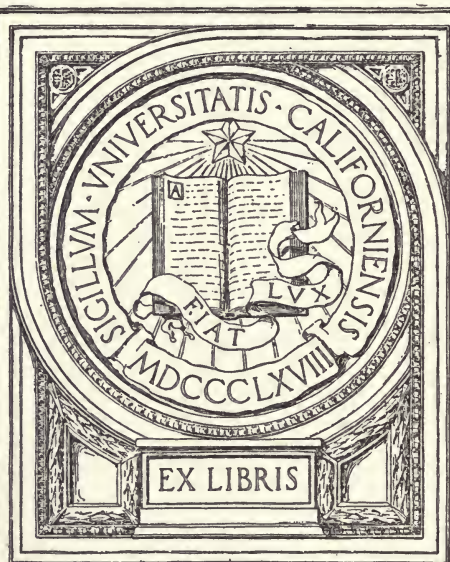


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REPORT of the PROCEEDINGS

OF THE

**Twenty-Third
Annual Convention**

**The American Mining
Congress**



DENVER, COLORADO

NOVEMBER 15 to 20

1920



Report of the Proceedings

OF THE

Twenty-Third Annual Convention

OF THE

American Mining Congress

DENVER, COLORADO

NOVEMBER 15-20, 1920

National Tax Conference

National Gold Conference

National Flotation Conference

National Oil-Shale Conference

National Standardization Conference

National Education and Public Service Conference

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PROCEEDINGS OF
THE AMERICAN MINING CONGRESS
Twenty-third Annual Session
DENVER, COLORADO

OPENING SESSION OF THE CONVENTION

MONDAY, NOVEMBER 15, 1920, 2.20 P. M.

CHAIRMAN THOMAS B. STEARNS: Gentlemen of the American Mining Congress: I have the great pleasure and honor of calling the session to order and beginning the elaborate, and we hope helpful, program which has been mapped out by your very competent Secretary. Twenty-three years ago there was born in the city of Denver a healthy infant, and those of us who lived here at the time cannot but take great pride in the history of this creation. All of those who have nurtured it in infancy, and who have cared for it in childhood and youth, must be gratified to see this organization in its present virile state of manhood. The accomplishments of the American Mining Congress are altogether too varied and too many for me to even attempt to recapitulate in a few remarks, and under the conditions I must seek refuge in print, and you will find in the issue of the *Daily Mining Record* of Denver a brief account of these accomplishments.

This session today, which we welcome on its return to Denver, is met to consider the many, or some of the many, vexatious and troublesome problems that devolve upon us, due to the reconstruction period. There exists today in the United States a disposition that never hesitates to attempt the solution of any problem, however great or difficult. But I, for one, as I know all of those present, have the greatest faith in the judgment, in the intelligence, and in the future of the United States of America. (Applause.)

I am going to ask Rev. A. H. C. Morse, in whose sanctuary we are meeting, to offer the invocation.

The Invocation

REV. A. H. C. MORSE: Our gracious Father, we look up to Thee at the opening of this Congress. We remember that the earth is the Lord's and the fullness thereof, the world and they that dwell therein; that in Thy wisdom Thou hast bestowed upon us gold and silver, and all the

treasures needed for our comfort and our good. We thank Thee for this wise provision. In our search for these things wilt Thou save us from greed, and in the finding of them wilt Thou preserve us also that we become not forgetful of Thee. We thank Thee for the necessities of toil; these are for the good of Thy people and are essential to progress, calling for wisdom and leadership on the part of those who project great industries, and fidelity on the part of those who execute them, and this is all but another evidence of the wise provisions Thou hast made for this world. We pray for wisdom to be given to those who sit in this Congress that they may be saved from selfishness; that wealth may be increased and the world made richer. We pray for Thy great Spirit to descend upon capital and labor, as we sometimes speak of these phases of organization; that those who project great industries may be governed by Divine Wisdom; that the laborer, who is Nature's nobleman, may be upright and true, and that a new spirit of fellowship may spring up between those who plan and those who execute these plans, and so wilt Thou save us from strife. We are not forgetful of those who are in the heart of the earth with pick and shovel. We pray for them and for their families; give them a real joy in their toil, and if sometime they return, weary in body, give them renewed courage and the satisfaction that comes from work well done, and thus may all people lose themselves in the thought of others, and thus far share the spirit of Him who revealed Thee to us, and to Thee alone shall be the praise forever and ever, for Thine is the kingdom and the glory. Amen.

CHAIRMAN STEARNS: I have the pleasure to present to you the Hon. Dewey C. Bailey, Mayor of the City of Denver. (Applause.)

Welcome to Denver

MAYOR BAILEY: Ladies and gentlemen, and delegates to the American Mining Congress: It is a great honor to Denver that the Mining Congress is holding its sessions in this city at this time. I hope that great good may come from your deliberations, and there is no doubt in my mind that great plans will be promulgated here which will be helpful to the whole inter-mountain mining country. As normal times return to this country, and prices and labor reach a point that can be relied upon, it seems to me that interest equal to that of some years ago should be taken in the mining industry of the West and of the Rocky Mountain region. Mining in this State was the greatest industry we had 25 years ago. Great things sprang from mining. This city was practically built by returns received from Colorado mines. I am sure that the plans made during this Mining Congress ensure great energy being put again into the mining industry of the West.

It is not my purpose to make an address. I am here merely to welcome the delegates to this Convention for the good people of Denver, and I hereby welcome all of them to this great city, with the hope that you will enjoy your stay here; that your work may be successful, and that when you leave for your homes you will feel as though you liked Denver, and that you will return again as soon as you can to visit us. (Applause.)

CHAIRMAN STEARNS: The next speaker, Mr. George E. Collins, is, I think, well known to most of you. We regard him as one of our mining headlights in the State, and I would say that locally he possesses an

excellent reputation. We have asked him, as a Colorado member of your organization, to say a word of welcome in behalf of the City and the State. (Applause.)

CHAIRMAN STEARNS: It becomes now my duty, and also your pleasure, to exchange presiding officers, and to present the president, Mr. Bulkeley Wells. (Applause.)

Appreciation From President Wilson

PRESIDENT BULKELEY WELLS: Mr. Chairman, delegates to the 23rd annual Convention, ladies and gentlemen: To another has been assigned the pleasant duty of responding to the words of welcome so graciously expressed. I simply wish at this time to express to all of you my personal appreciation of your attendance at this Convention. I have a telegram which I am sure you will be glad to hear, dated White House, today: "I wish to extend my greetings and best wishes to the twenty-third annual Convention of the American Mining Congress. The work of the Congress in co-operation with the Federal Government, with mining operators and other interests of our mineral resources has been a help of immense benefit. It provides an opportunity for discussion, education, and the dissemination of information, and cannot fail to be helpful in improving and advancing the mining industry."

(Signed) WOODROW WILSON.

(Applause.)

PRESIDENT WELLS: Wherever and whenever there is held a convention of the American Mining Congress, you will invariably find Mr. E. P. Mathewson of New York, who is the dean of such conventions; and to him, therefore, is naturally assigned the response in behalf of the American Mining Congress. (Applause.)

MR. MATHEWSON: Mr. Chairman, ladies and gentlemen: As I came in on the train this morning, a little late, I was fortunate enough to get a copy of the morning paper. I thought I would see just what was going to happen today at the Convention. I read with amazement that I had been selected to respond to the addresses of welcome on behalf of the American Mining Congress. That was the first intimation I had that I would be here this afternoon. However, I have some apologies to make, and I am glad to have the opportunity to make them.

My father was a prominent member of the Methodist Church, and he constrained me to attend that same church in my youth. I attended it as long as he compelled me. During those years of attendance I learned something about conversion. After I acquired years of responsibility I became connected with the smelting industry, particularly the copper smelting industry, and there I learned more about conversion and converting. At the last Convention of the American Mining Congress at St. Louis I was, unfortunately, the one discordant note in its harmony, so I want now to apologize, and say that since that time my eyes have been

opened, and I have been converted and now am with the gold conference, the gold standardization committee and the McFadden Bill, and everything else, and I am going to help you through. (Applause.) If our silver miners could get so much assistance and encouragement, why not gold miners? and let the fellows who use the gold pay the bill. (Applause.)

We have been told that the American Mining Congress was born in the city of Denver. It remained here for many years, and then on account of its increasing activities and the necessity of having headquarters at the seat of Government, it moved to Washington. Denver lost at that time one of its best citizens. I refer to Mr. Callbreath, who had to move to Washington, but I think he still votes here.

Growth of the Mining Congress

The Congress has done wonderful work during the last few years. Its work has doubled, trebled and quadrupled. People not acquainted with its workings would be surprised to know of all its activities. It is a necessity in the mining industry today. It seems strange that they selected me to speak on behalf of the American Mining Congress here this afternoon. I was a citizen of the State of Colorado when this Congress was born here, and when the meeting was called to welcome the new baby, I was in the smelting business, and my private opinion was that this Mining Congress was organized for the sole purpose of seeing that the smelting men didn't gouge the miners. (Laughter and applause.) Its activities, as I say, have widened; smelter men have been welcomed into the membership, and that is how I got in. I still stick to the smelting game, and do a little mining on the side. I have learned in the few years that I have been connected with the Congress that it is a good thing, and I know the welcome of Colorado is heartfelt. You have the best water that Denver can produce; you have the welcome of the Denver people—and that means the best there is in the world—and we are here to take what you have, so if there is any of that stuff the other fellow is referring to, we will see you quietly. (Laughter and applause.)

PRESIDENT WELLS: Having heard from the Atlantic Coast, we will now step lightly to the Pacific, and Judge John F. Davis will respond on behalf of the mining industry. (Applause.)

[Mr. Davis' remarks will be found on page 269 of the Proceedings.]

Organizing Resolutions Committees

SECRETARY CALLBREATH: I want to announce the plan for organizing the Committee on Resolutions. According to our by-laws, the delegation from each State represented in the Convention is entitled to name one member on the Committee on Resolutions. I will ask each of the delegations present to assemble and be ready to report at the meeting tomorrow evening at 8 o'clock, after having selected the name of that man who is to serve on the committee. This is an important duty. The Committee on Resolutions has the heavy work of the Convention to per-

form; it is by it that all resolutions shall be considered and acted upon, and I therefore urge on you that you make your selections carefully. If some one from each delegation will determine a place and time of meeting and make announcement on the bulletin board, then the other members will know where and when the meeting is to be held. I wish you would give this your special attention and be ready promptly to name your member on the committee at the opening of the session tomorrow evening.

PRESIDENT WELLS: I was fortunate to learn yesterday that Mr. Eugene Meyer, Jr., was in Denver in connection with Senator Calder's Committee on Reconstruction. Mr. Meyer was managing director of the War Finance Corporation, and I have asked him to say a few words to you regarding the work of the Corporation, more especially in relation to the export of American mineral products. (Applause.)

[Mr. Meyer's address will be found on page 430 of the Proceedings.]

PRESIDENT WELLS: The Secretary of the Interior has honored us by sending as his personal representative the Hon. Clay Tallman, commissioner of the General Land Office, who has proved himself a just and firm friend of the West. (Applause.)

Appreciation of Mining Congress in Washington

MR. TALLMAN: At the outset I think I should say a word along the line that I am sure the Secretary would say himself if he were here, and that is in compliment and congratulation of the American Mining Congress for the very excellent work it has done during a number of years and is now doing. We people in Washington come in contact with a good many organizations. There are all classes, kinds and descriptions designed to favor every possible species of economic, social, religious or other propaganda that anybody can think of; and we soon learned always to begin and search behind the scenes to see who is behind this organization, and what is the real purpose of its existence. But we have come to know Mr. Callbreath almost as an institution, almost as a part of Government; we know he is there, not in the furtherance of any particular branch of mining industry or any particular private interest—he is there for the mining industry as a whole. We know that he is not going to ask for anything he is not entitled to or ought not to have; we know that he is acting in good faith and representing in a proper way that great industry which is so important in the Western country. (Applause.)

What I shall attempt to confine myself to is a brief discussion of the Mineral Leasing Law of February 25, 1920—a new Act, far-reaching and important in its consequences.

[Mr. Tallman's paper will be found on page 377 of the Proceedings.]

PRESIDENT WELLS: As it is somewhat late, we will defer until another place on the program Dr. Cottrell's address, which was to have followed at this time, and the Convention will now stand adjourned until 8 o'clock this evening at this place.

SECOND GENERAL SESSION**MONDAY, NOVEMBER 15, 1920, 8 P. M.**

The president, Mr. Bulkeley Wells, presided.

CHAIRMAN WELLS: Not all of you know the kind of Governor we have in Colorado, so I will tell you a few things about him:

He was, first of all, a mining man, which, of course, fitted him through adversity to become an oil man and from that he progressed to being a governor; so you see what is to be gained by that orderly procedure. A few days before our recent election a strike was called in Colorado, evidently in the hope of gaining political advantage against Governor Shoup and the other candidates on his ticket. He took up the challenge, and in an open letter said, in effect: "If this costs me my election, it is of no importance; there shall be law and order in Colorado." (Applause.) And the interesting fact is that some 73,000 people who voted said he was right—more than those who said he was wrong. (Applause.)

Politics in Colorado

GOVERNOR O. H. SHOUP: Mr. Chairman, ladies and gentlemen: Mr. Wells did not explain to you that I was something else besides a mining and oil man. During this campaign, like most politicians, I found it was necessary to change my thoughts. The first time I ran as a business man and was elected as such. I knew that was a joke, and the people did before they voted for me, so the next time I ran as a farmer, and the farmers in Colorado get 60,000 more votes than the business men. So the next time—because I will keep on going—I shall run as a successful politician; and I ought to get it by acclamation.

Colorado is glad indeed to have you out here—your Mining Congress—because our mining business needs something. Sixty years ago Colorado was chiefly a mining State, and throughout its many developments in various gold and silver camps we produced a billion and a half dollars' worth of metal. As you know, we lead in the production of tungsten, and we have deposits of rare metals. Thirty or forty years ago mining was our chief business, but today the only profitable mines I know of that are left belong to Bulkeley Wells and George Taylor. A mining man is one who invests, as I understand it. I believe Mark Twain said, "A mine was a hole in the ground owned by a liar." But I certainly am impressed with the way the mining business has improved, especially to have conventions like this in the First Baptist Church of Denver. It is certainly a great thing over the early days in Cripple Creek, because the church I attended there is very far removed from this. They had a sign over the organ something like this: "Don't shoot the organist; he is doing his darndest." I do not see any such sign around here, although there are signs around the building.

We are glad indeed to have this Convention here, and hope that you

may learn something from us, and we won't sell you anything, because there is a ban on selling anything during this Convention; but we will take your address and visit you after you get home.

Resources of Colorado

But the mining business was the foundation of Colorado's greatness. You will be interested in knowing that after the money came from the mines, the men who got that money proceeded to develop the horticultural and the agricultural business, and today, these, with the live-stock interests, are worth a great many more times that of the mining interests. We produced last year in Colorado the largest crop of sugar beets grown in any State. That is no reflection on the mining men, because we are ninth in the production of gold, and Colorado could be second to none if we had transportation. We are twelfth in production of wheat, and you would hardly look upon Colorado as being a wheat-growing State, so our production along every line has been marked with development. We are glad to have you come back. We like to relate the history of our past, and we like to look forward with enthusiasm to what we may have in the future. We have yet in Colorado undeveloped resources of great value. You would be interested in knowing that in the shale deposits is stored more oil than produced in America since the opening of the first well in Pennsylvania, in 1858. We have set aside in this country vast resources that may be of permanent benefit to you, and so we are glad to have you come to Colorado and see our mountains and sunshine, see our people, get acquainted with us, and we will get acquainted with you, and by stimulus and united effort bring back conditions that will make mining in Colorado and elsewhere profitable. Until there are changes and remedies, we cannot mine in competition with foreign countries. We have tungsten, molybdenum and carnotite mines, and everything that every State can possibly have, so we are looking forward to expansion and growth in our mining industry.

I do not want to discourage you in regard to any of the different States, but I want to tell you that Colorado has the best people we know of; we have the finest city in America; we have the finest people in the city; and you all have heard about the Governor, and he admits it, so if this Convention will do you as much good as we hope it will, it certainly will be a Convention long to be remembered.

I am elected for two years, and I don't need to talk to you any longer, because I don't care. (Laughter and applause.)

President's Annual Address

CHAIRMAN WELLS: It now becomes my duty to inflict upon you the so-called President's annual address. It is really of more meaning to the actual members of the Mining Congress, but primarily it must be an address.

[Mr. Well's paper will be found on page 265 of the Proceedings.]

CHAIRMAN WELLS (continuing): We asked Governor Allen of Kansas to come here and address us on the subject of the Kansas Industrial Law. He has expressed great regret that engagements he could not break prevented his doing so, but he sent a telegram assuring me that he had sent us a man far better qualified to speak than he would be if present. He has supplemented that message with this one.

November 15, 1920.

JOHN T. BURNS, *The American Mining Congress,*
Denver, Colorado.

MY DEAR MR. BURNS:

Allow me to offer my best wishes for the success of the great congress you are about to hold. It meets at a time when we are in particular need of a constructive program for the stabilization of our industrial life. I am glad that Senator Smith of our State is to be with you for the purpose of presenting the principles which have been worked out in our Court of Industrial Relations. It seems to me that we have reached a period in America when a just Government must assume the same responsibility for the regulation of industrial strife that it has assumed for all other forms of strife. If there is any subject in this country too great for Government to solve with justice, then Government is a failure.

(Signed) HENRY J. ALLEN.

CHAIRMAN WELLS (continuing): Senator F. Dumont Smith, who drafted the Kansas Industrial Law, will now address you upon that subject.

[Mr. Smith's address will be found on page 403 of the Proceedings.]

CHAIRMAN WELLS: We have with us a man who has brought to us words of courage and comfort in these trying times; it is therefore with pleasure that I introduce to you Dr. Chas. A. Eaton, editor of *Leslie's Weekly*, to speak upon the subject of present and future relations between capital and labor.

Conditions as Viewed by the Editor of Leslie's

[Dr. Eaton's lengthy and humorous address included such topics as his personal contact with laboring men, what was done during the war, labor in the shipyards, the misunderstanding between capital and labor, human progress, the difference between America and Europe and Asia, politics, science applied to industry, racial diversity, tyranny of wealth and labor, necessity of leadership, propaganda, State socialism, and the need of capital and labor getting together.]

CHAIRMAN WELLS: The meeting will stand adjourned.

THIRD GENERAL SESSION**TUESDAY, NOVEMBER 16, 1920, 8 P. M.**

CHAIRMAN WELLS: The third general session of this Convention will now be in order. The first business is the announcement of members of the Resolutions Committee.

SECRETARY CALLBREATH: I will call the roll. The States named will please respond and give the name of their member selected as promptly as possible. (The roll was thereupon called.)

SECRETARY CALLBREATH (continuing): May I announce, Mr. President, that resolutions are to be presented to the Convention and submitted to the Committee on Resolutions without debate. Any persons having resolutions to offer will have opportunity at the beginning of each session, and I would urge those having resolutions to offer to do so at the earliest possible moment.

Will the Resolutions Committee meet at 9 o'clock in the morning, or perhaps 9.30, in the little room in which we had our lunch; I think it is parlor C.

CHAIRMAN WELLS: Are there any resolutions to be offered at this time? If not, we will proceed.

I regret to inform you that Congressman McFadden has been detained in New York, and will not be able to attend either this Convention or any of the subsequent sessions. Mr. Merritt has also been detained. He was to speak this evening, but his paper is here, and after the speakers present have addressed you, if you wish, I shall be glad to read his paper on 'Social Control of Industrial Warfare.'

Several Interesting Addresses Follow

Although the American Mining Congress may fairly claim to have mothered the U. S. Bureau of Mines in its infancy, yet the child has outgrown its parent, but considerably retains its early charge, so it is but natural for us to hear tonight from our first cousin, Dr. F. G. Cottrell, of the Bureau of Mines, who will now address you.

[Dr. Cottrell's paper will be found on page 365 of the Proceedings.]

THE CHAIRMAN: I believe we were all convinced last evening by Senator Smith of Kansas that much good can come out of that State. The next speaker was formerly attorney-general of Kansas, and is now general counsel of the National Lumber Manufacturers' Association. I have great pleasure in introducing to you General L. C. Boyle of Washington, who will speak to you on the subject of 'Industry and the Government.'

[An abstract of General Boyle's address appears on page 412 of the Proceedings.]

THE CHAIRMAN: The text of the address that was to be delivered by Mr. W. G. Merritt, attorney for the League for Industrial Rights, is here. It is entitled 'Social Control of Industrial Warfare.'

[Mr. Merritt's paper will be found on page 419 of the Proceedings.]

THE CHAIRMAN: I think the Secretary has some announcements to make.

Thereupon the Secretary announced the names of the Committee on Resolutions as under:

Resolutions Committee

Alaska.....	E. B. Gray
Arizona.....	J. E. Curry
California.....	W. J. Loring
Connecticut.....	H. J. Stander
Colorado.....	Horace F. Lunt
District of Columbia.....	Robt. G. Wilson
Idaho.....	Ravenal McBeth
Indiana.....	Philip Penna
Illinois.....	James Needham
Kansas.....	F. E. Doubleday
Massachusetts.....	H. P. Baker
Michigan.....	Leslie P. Barrett
Minnesota.....	Robert D. Longyear
Missouri.....	C. W. Wright
Montana.....	C. H. Clapp
Nebraska.....	C. H. Simmons
Nevada.....	Henry Rives
New Jersey.....	L. C. Bales
New Mexico.....	G. A. Caseman
New York.....	Robert Linton
Ohio.....	Frank E. Wells
Oklahoma.....	A. E. Dunlap
Oregon.....	Edward Boyce
Pennsylvania.....	Edwin W. Parker
Philippine Islands.....	Arthur F. Fischer
South Dakota.....	William S. Elder
Texas.....	S. H. Warrell
Utah.....	Walter Fitch
Washington.....	J. M. Elmer
West Virginia.....	George Wolfe
Wisconsin.....	Eugene F. Yahr
Wyoming.....	H. C. Marchant

THE CHAIRMAN: There being no further business, this General Session will stand adjourned until 2 o'clock tomorrow afternoon.

FOURTH GENERAL SESSION

WEDNESDAY, NOVEMBER 17, 1920, 2 P. M.

PRESIDENT BUCKELEY WELLS: The fourth general session will now be in order. The presiding officer of the afternoon needs no introduction to members of the Mining Congress. Mr. Carl Scholz is a former president and a present director, and has always been a faithful and a hard worker for the Congress. It is a real pleasure and a privilege to have him here to preside over this session.

MR. SCHOLZ: The first order of business will be announcements by the Secretary.

SECRETARY CALLBREATH: We have some resolutions to be introduced and presented.

(The Secretary read resolutions No. 1 to 7, inclusive.)

CHAIRMAN SCHOLZ: Are there any more resolutions to be offered? If not, we will proceed with the regular program. Colorado in general, and Denver particularly, has always been famous for its blue sky, and for the benefit of the ladies who are here, we have here with us a speaker who will tell the other side—Mr. A. G. MacKenzie of Salt Lake City—who will tell us what he means by controlling blue-sky legislation.

Blue-Sky Legislation

MR. MACKENZIE: The members of the Committee on blue-sky legislation are not agreed on some of the points considered. We are presenting, therefore, two short reports, the first one, which is signed by Sidney Norman of Spokane, and myself, as follows:

"We have given much time to the study of the blue-sky question, with particular attention to the results following the enactment of laws on the subject in the Western States. Our conclusion is that in general such legislation has failed in its purpose to protect the ignorant and unwary, and has in many instances seriously impeded legitimate development of mines and other natural resources. It is a noteworthy fact that most blue-sky laws operate to the prejudice of the State home citizens, while leaving an open door, through the United States mails, to residents of other States.

"Development is the only infallible way to prove a mining prospect; no man can say with certainty that a surficial showing does or does not mean the existence of a mine. Development requires capital, and in almost every case where a prospect has been converted into a mine, the cost has been met through small contributions from the many. Large corporations do not engage in prospecting; they leave that to the small investor, led by the small promoter. It is therefore essential that such forces of capital be not closed through unduly restrictive legislation.

"Although proponents of blue-sky laws always emphasize their desire to treat all industries alike, it is evident that they always have in mind corporations formed to develop natural resources, although these are not invariably the ones most in need of regulation. The situation, however, must be accepted as it exists, and in our judgment calls for affirmative action by representatives of the mining industry.

"We believe that the American Mining Congress should view squarely the virtues and shortcomings of mining, and to aid in their correction—

"This Committee recognizes that unscrupulous promoters have frequently used mining corporations as a means to defraud, and that this practice is still more or less prevalent in non-mining communities. It is conceivable that such people desire and need a measure of protection, and naturally turn to blue-sky legislation. Undoubtedly there is much justification for the sour disapproval with which mining securities—good as well as bad—are viewed in many places, and this Committee believes it is up to the mining man, through the national organization, to declare unequivocally for any proposal that will help legitimate mine promotion.

Investors Should Investigate Prospects

"In the Western mining States themselves blue-sky laws are not necessary, and undoubtedly at times work hardships on reputable men and legitimate propositions. Any competent person in the West can easily learn the truth about a project in his own State, and no law will save the incompetent from his own folly. Moreover, it has been abundantly demonstrated that local blue-sky laws do not stop the operation of the crook. He merely has to lie low while the law is new, and presently, after the blue-sky officials have settled themselves comfortably, you find him doing business in the same old way, except that now he has the document from the State to lend plausibility to his misrepresentations.

"We believe that blue-sky legislation should attempt nothing more than the enactment of rigid laws against fraud and misrepresentation; the establishment of agencies easy of access, where the investor can obtain reliable information or file his complaints; and prompt prosecution and punishment of the dishonest. Drastic legislation, establishing commissions or bureaus, with power arbitrarily to approve or disapprove securities, should be opposed.

Federal Legislation Desirable

"We recommend that the Mining Congress favor desirable Federal legislation on this subject, and, in connection therewith, the repeal of all State legislation that conflicts with or parallels such Federal laws. Our idea of such a Federal statute is that it shall provide for authenticity of each corporation in its originating State through some designated Federal representative, and that upon filing the required information under oath the corporation shall receive a license permitting it to solicit capital in any part of the United States. Such legislation would be doubly beneficial by reducing fraud and opening a maximum field of capital for investment in legitimate enterprises.

"We have not undertaken more than the general outline of the plan, leaving details for further attention. We believe that with the aid of existent Federal agencies, such as the Post Office and the Department of Justice, a law based on the broad plan indicated can be satisfactorily worked out; and we also believe that the American Mining Congress should endorse the plan as a constructive movement to better the industry. We have prepared a resolution in conformity with the foregoing, which will be presented to the Convention."

The following report is by Messrs. M. B. Tomblin of Colorado and Robert I. Kerr of California, members of the Committee:

Prime Object of Blue-Sky Laws

"The object of all honestly conceived blue-sky legislation is primarily, if not wholly, for the purpose of protecting the unformed and credulous investor, who admittedly does not possess the business intelligence to protect himself. To this extent it is class legislation; and it must be recognized that whatever regulatory laws are enacted to protect such investor, might to a greater or lesser extent hamper and restrict legitimate enterprises. To fail to take into consideration these basic principles in enacting blue-sky legislation must inevitably result in confusion and the restriction of legitimate enterprise.

"We favor sane and reasonably regulatory State laws to protect the weak and credulous, but believe:

"First, that such legislation should undertake nothing more than rigid laws for the prevention of fraud and misrepresentation.

"Second, the designation of some agency, preferably some office already established, where complaints can be filed, and in case of violation prosecution is compulsory.

"We are opposed to the creation of a Federal bureau empowered to license or authorize the sale or transfer of securities, believing that all such legislation, if effective, must necessarily be cumbersome and restrictive, and furthermore would more or less conflict with State regulatory laws now in force." (Applause.)

CHAIRMAN SCHOLZ: The next item on the program is an address by Judge E. C. Finney, member of the United States Board of Appeals, Interior Department, representing the Secretary of the Interior.

MR. FINNEY: The subject assigned to me is the administration or interpretation of the United States mining laws. It is a pretty large subject, and I cannot cover it in 15 minutes. It has many phases. One of them is the matter of administration where we have conflicts or contests between two or more persons claiming the same mine or land.

I do not think that the American Mining Congress is particularly interested in that phase of the administration of the law. I take it that you are more so concerned in the general administration of the law, those phases with which the rank and file have to deal, and those which are

ex parte in their nature, which have liberal views for encouraging development. I might start this by saying that I believe in a liberal administration of the mining law. It occurred to me that some of you might be interested in knowing briefly how these laws are administered by the Interior Department, particularly in view of the resolution just introduced in this Congress, urging that the Interior Department be retained, in order that it might administer those laws.

Four Interesting Addresses Follow

[Mr. Finney's paper will be found on page 358 of the Proceedings.]

CHAIRMAN SCHOLZ: The next item on the program is one on which opinions largely differ. I find that at taxpaying time we have two classes of people: those who like to pay taxes and those that do not. The former usually have none to pay; the latter are those that earn money. I take pleasure in presenting Mr. James G. Fitch, who will address you on the subject of 'State Taxation of Metal Mines.'

[Mr. Fitch's paper will be found on page 348 of the Proceedings.]

CHAIRMAN SCHOLZ: We have with us a man who is telling us something strange and new, and that is the mining of coal without powder, and I take pleasure in introducing to you Mr. D. Vance Sickman.

[Mr. Sickman's paper will be found on page 334 of the Proceedings.]

CHAIRMAN SCHOLZ: Before proceeding to the last item on the program, the Secretary has some announcements to make.

(Announcements by Mr. Burns; also reading resolutions later marked No. 10, introduced by the Gold Committee; also reading of resolution later marked No. 11, introduced by H. H. Schwartz.)

CHAIRMAN SCHOLZ: We will now call on Dr. A. L. Murray of the U. S. Bureau of Mines, Washington, D. C., to give us the concluding address on industrial medicine and health conservation.

DR. MURRAY: The title of the paper I am presenting is: 'The Application of Industrial Medicine and Health Conservation in the Development of Mine Labor Efficiency.'

[Dr. Murray's paper will be found on page 323 of the Proceedings.]

CHAIRMAN SCHOLZ: This concludes our program. Mr. MacKenzie has a resolution he would like to present.

A Co-operative Prospecting Scheme

MR. MACKENZIE: I am sorry I haven't with me some notes on this. This is the idea of the co-operative prospecting scheme, which, of course, is not new. In this document you will find a resolution of the Salt Lake Commercial Club favoring a movement in the interest of the small prospector, and to develop a financial organization along the lines of the old prospector's grubstake, and particularly along the lines suggested in the

plan of the Associated States Development Co., which plan has been investigated by the mining division of the Salt Lake Commercial Club and recommended by it to the board of governors of the club. This is simply a continuation of the co-operative plan of grubstaking. You have had it here in Colorado, of course, and in all the Western mining States. These people have formed a parent company, which controls the operation of what they call their local companies. They have established so far seven or eight of the local companies; I am speaking in general terms, because I am not in any way associated with them. The prospector or the claimholder brings his proposition to the local company, which investigates it on the ground and makes its recommendation to the parent company, which, in turn, decides whether the property shall be taken up and developed sufficiently to determine whether it is a mine or not. The parent company, instead of selling stock, sells what it calls "grubstake contracts," by which each investor agrees to put in a certain sum monthly for a period of ten years, and he participates in proportion to the amount of his subscription. As I recall it now, the parent company, in addition to directing the management, retains 10% of the proceeds of the "grubstake contracts" to cover the maintenance of the parent company's offices and the necessary overhead and general expense.

CHAIRMAN SCHOLZ: The session now stands adjourned.

FIFTH GENERAL SESSION

NOVEMBER 17, 1920, 8 P. M.

Mr. Thomas T. Brewster of St. Louis presided.

THE CHAIRMAN: The conference will be in order. Are there any resolutions to present?

MR. CALLBREATH: There are a few resolutions: Shall I present them?

THE CHAIRMAN: If you will, please.

(Thereupon the Secretary read the resolution presented by the Tax Conference Committee, as follows):

THE CHAIRMAN: Under the rules and order of business, the resolutions are received and referred to the Committee on Resolutions without debate.

Are there any further communications? (No response.) The first speaker of the evening will be the Hon. Robert N. Miller, recently solicitor of the Internal Revenue Department, who desires to discuss the necessity of the taxpayer taking firm action in order to secure proper adjudication of excise.

HON. ROBERT N. MILLER: I entered the U. S. Treasury as a war-time helper about the time when the 1917 tax returns were being filed. Ten months ago I went back to my own business, and I have no connection with the Government at all now. During my service I, like all the other fellows who were charged with trying to straighten out that terrific war-time tangle, the taxes, worked not only every day, but practically every night. That was true not only of our department, but it was true in many of the departments, even in the City of Washington, which had previously gained a well-deserved reputation as the "City of Magnificent Delays." (Laughter.) In war-time there was a vast amount of real work done there.

The Tax Problem

When we went there and saw the problem that these taxes presented, getting an unprecedented amount of money out of the country's industries and the irregularities of the tax law, our hearts almost failed us. I felt very much like an old Kentucky colored man I know about: His boss saw him with his head all tied up and his arm in a sling, and asked him what was the matter. He said that he went hunting the day before and there was snow on the ground, and without knowing it some snow had got in the end of the gun. He went on, "I saw a rabbit and I aimed the gun at him, and, do you know, boss, the minute I pulled that trigger I know'd I'd done wrong." (Laughter.)

I believe nearly every man that went to Washington to try to help out on the taxes after he had been there a week wished somebody else had that job; after he was there a month he was sure of it. Yet somebody had to do that work.

It is perhaps worth while to speak briefly about your taxes. Somewhere in Washington there is a small group of men, maybe two or three, who have a file of papers that represent your particular tax return. They are either working on it, or they are working hard on somebody else's so as to get to yours. They may be concluding, right now, that you owe \$500,000 more in taxes for the past year, which you have not paid. That is a very unhappy kind of thing to say on a pleasant occasion like this, and yet it is true; and it is a part of the situation that makes necessary this resolution which has just been adopted. If they reach such a conclusion, they will not assess you at once, of course; they will give you a hearing—and it will be a real hearing—if you want it; and if you require an appeal, you can have that to men who are higher up, men who have great responsibilities and are willing to take a little more.

Millions of Tax Returns

If you were to enter a part of the great buildings of the Bureau of Internal Revenue right now, where millions of tax returns have to be gone over, and were able to find the right place, you could observe the very auditor who is working on your return. In your conference with this man, who has charge of your tax case, he would try to get your ideas, and he would show you his views of the law as applied to your case, and you would probably not like his ideas. In nine cases out of ten, however, that

man will listen with interest to your side, and with a fairly open mind. There is perhaps one auditor in ten who no matter how hard he has been worked, still thinks he knows it all, but if you run into that man you can always go to his boss and at least get a hearing from him.

The Bureau is trying hard to solve this great problem, and still, in spite of that very honest endeavor, war taxes have been oppressively heavy, and final determination of tax liability has been intolerably delayed. We all know that.

Tax on the Wasting Industries

Those war taxes, heavy as they were on the whole of industry, laid an unusually heavy hand on wasting industries—such as mining—treating them as though they involved no more risk than the ordinary, stay-at-home, sit-down-at-the-desk kind of industry. These laws were severe, yet these were the best that the best men available could devise considering the emergency, yet in spite of the best attempts of the Bureau of Internal Revenue, the laws are responsible for real hardship. The terrific yield they demanded—the big percentage of the earnings of the country—emphasized the injustices. The inflexibility of the law did not give the Commissioner—did not give anybody—the right just to be “fair.” They had to follow the law. This made it impossible to collect 11 billions of dollars of taxes in 2½ years, more money than had been collected from internal revenue in the whole history of the United States before, and still make it easy or light, or even tolerable. The wonder is, as we look back on those things, that it could be done at all without actually destroying business.

But the war is over. The crying, the immediate present need, as that resolution declares, of every business of whatever kind right now is to find out, once and for all, what its taxes are today. The suspense in some cases is terrible, destructive of opportunity and fatal to successful operations. These delayed audits make it difficult for the banks of the country to be sure of the net worth of any business, since it is possible for them to issue an additional assessment, changing an apparently comfortable surplus into a deficit. It is rather a desperate situation. The Bureau of Internal Revenue, I am perfectly satisfied, knows that, and indeed the Bureau knows it, in some ways, better than the individual taxpayers do, because at Washington they see every day new instances of hardship. The Bureau cannot help it. Congressional action is necessary and ought to be taken as an emergency provision to clear this matter now while it is needed. Your own efficient and alert Tax Division, long before I knew anything about what it was doing, saw that clearly and have been working on it, and this resolution presented here tonight is the result of many weeks of work on their part. I do not believe that any business man who reads it can fail to be interested in seeing that work go ahead. To my mind there are two things that ought to be done right away by Congress:

How the Confusion Could be Cleared Up

First—Provide the Commissioner of Internal Revenue with sufficient funds to pay salaries to attract and hold an adequate number of men

capable of dealing with these difficult questions with confidence and self-reliance. Decisive and broad-minded action cannot be secured in any business without paying for it. Men who have the knowledge and experience to carry such responsibility do not have to hunt for jobs; such men are pursued by people who want to employ them. There are men in that Department who rank favorably in ability with the ablest accountants and technical men in the United States. In the legal department there are lawyers of unusual ability. These men must pass upon questions involving millions of dollars. Many of them are underpaid. The best of them are constantly receiving offers, based upon their experience and their administrative ability, in multiples of what they earn now. Sooner or later they leave the service; a lot have already done it. They ought to be paid enough to make them stay. But what are two or three dozen such good men when there are millions of returns to audit every year? Some of the single returns, in the Consolidated Section, involve more than a hundred corporations, each with its own peculiar theoretical problems. One able, experienced man can do the work of five inexperienced men, and keep them profitably at work when they are not otherwise employed. Some taxpayers ask me why beginners won't do just as well. The fact is that in the Government service nobody has the courage to make rulings in the taxpayer's favor, except the man who knows what he is doing.

Second—Some method must be provided—and your Tax Conference has suggested one in the resolution just brought up here—by which you and other taxpayers may get a prompt and final determination, closing forever the tax liability for the year in question, as it cannot be closed under the present law unless actual fraud or misfeasance is shown to have been committed. The plan is to give this power of final closing (with the taxpayer's consent) to a special emergency body of able men, with compensation for the limited period of their service—one year—in a sum commensurate to the responsibility.

Training of Auditors

If, during your visit to the Bureau, you came across the auditor who had charge of your case, or the head of that division, or the head of the great Income Tax Department, and you were to say to him, "Why don't you work faster and finish up for good this mass of old cases?" he would say that about a year ago the Bureau saw this great need, and especially planned to have enough well-equipped auditors in the Consolidated Return Section. They would not be any good, even if they started as pretty good accountants, until they had four or five months' training. The auditor would also tell you how they started on that program and worked about a month, and then they didn't have money enough to go ahead with it. That is the kind of thing that we, as business men, have to correct, because we are on both sides. We are taxpayers, and we, taken together, compose the Government that is collecting these taxes. Congress can and will solve these difficulties if the necessary support is given.

Finally, I want to say that I have appreciated very much what I have learned from the able and broad-minded men with whom I have had the

good fortune to come in contact during the few days I have been here. I thank you for the privilege of addressing you, who are connected with an industry which, in spite of the hazards, has managed to pay between 9% and 10% of the total amount of taxes paid the Government by all other corporations put together. (Applause.)

THE CHAIRMAN: I take pleasure in introducing Mr. George Wolfe, secretary of the Winding Gulf Operators' Association of West Virginia, who will address you on 'A Survey of the Conditions of Operation and Production in the So-Called Open-Shop Districts.'

[Mr. Wolfe's paper appears on page 315 of the Proceedings.]

THE CHAIRMAN: We heard last night of the small beginnings and the great growth of the U. S. Bureau of Mines. We have with us a gentleman who was largely instrumental in building the solid foundation upon which that great superstructure has been raised. Dr. E. W. Parker, now director of the Anthracite Bureau of Information, will tell us what happened to the anthracite industry in 1920.

[Dr. Parker's address appears on page 303 of the Proceedings.]

MR. CARL SCHOLZ: Your speakers' committee had arranged to have Governor Cornwall of West Virginia address you on this subject, but, due to his occupation in fighting strikes and riots under conditions similar to those which invoked the injunction we are about to discuss, he was prevented from coming. Mr. Wolfe has ably told you what the Winding Gulf Operators' Association has done, and the Governor wanted to tell you what steps he had taken in opposing the aggressive action of the miners' organization in the territory tributary to the Norfolk & Western.

The United Mine Workers

Mr. Wolfe and Mr. Parker have covered, to a large extent, my own ideas when discussing the closed-shop problem. But, referring to this injunction, it may be necessary to go back to the early history of the miners' movement, which began at the Chicago meeting in 1898, at which a collective contract was made for the States of Pennsylvania, Indiana, Illinois and Ohio. The United Mine Workers had gradually extended their activities, and for many years have cast their eye on West Virginia. By degrees they entered the Kanawha, Northern and Fairmont districts, but so far have not been successful in the region of the Norfolk & Western. The position that the Norfolk & Western operators took to the Union was well-founded. They saw the oppressive measures that the miners' organization had adopted in the Kanawha district, and they felt that their men did not care to join them. Mr. Wolfe has set forth the argument that 85% of the miners are well-meaning men, and the remainder are trouble-makers.

I see in this audience several men who were on the other side of the fence at one time, and who are now on the operators' side. They did not come to our side except as a matter of principle.

Union Dues and the Check-Off

The closed shop is a subject with which everybody is more or less familiar, but not many know to what extent the miners carry it. I am not going to burden you with it now, because you are to hear it from one of the ablest men we have today. Besides, the bill and answer in the injunction suit, which I referred to, will be published in the Proceedings, but I would like to call attention to it because I know you will find it interesting and instructive. I only want to say now that the 'check-off' is a subject on which many are not informed. The check-off is the means that the miners' organization has used to force the employers to collect union dues from the membership at large. In other words, no man can be employed in a mine where the closed shop prevails unless he pays the check-off; it is compulsory upon him, and he must pay it or quit. In a mine that I operate in Illinois our rates were \$6.50 per man last month, and this, for the number of men employed, amounts to approximately \$50,000 per annum. You can see, therefore, why the miners should seek to establish the check-off system. Coal mining is the only industry in which the employer collects from the members for the organization. Ostensibly it is a voluntary contribution, but as a matter of fact it is compulsory to the last degree. That all men are not members of the union, and have no desire to become so, is well known to the operators who come in close contact with them.

Although the Labor candidate for West Virginia was very popular at the last election, and caused the population at large some concern—it was confidently expected that he would be elected—yet, when the election returns came in, the very communities that furnished the largest number of delegates to his meetings returned few votes in his favor. This shows that West Virginia is not controlled by class votes.

Inasmuch as this bill is to be published, I will not say anything more, except to thank you for the kind hearing you have given me. (Applause.)

The Fuel Administration

THE CHAIRMAN: The next speaker on our list requires no introduction to coal men. During the early part of the war there was a wonderful piece of machinery built up known as the Fuel Administration. Its gears, and some parts of the machine were very heavy, and for some peculiar reason the machinery ran backwards. Upon overhauling and final investigation it was found that the design was faulty, in view of the fact that there was no master pinion to drive the gears. Therefore, Dr. Garfield got Mr. J. D. A. Morrow, then general secretary of the National Coal Association, and now its executive vice-president. During the war Mr. Morrow performed a wonderful service in pointing out the condition and making a great map of the general coal situation so that coal could be mobilized and moved right along. Since that time, and recently in the recent difficulties in the East, Mr. Morrow has performed similar service. Mr. Morrow will speak to you on 'The General Coal Situation.'

[Mr. Morrow's address appears on page 436 of the Proceedings.]

ANNUAL MEMBERS' MEETING AND ELECTION OF OFFICERS

Members of the American Mining Congress assembled at 9.30 o'clock Thursday morning, November 18, 1920, in the Magnolia room of the Albany Hotel, President Wells in the chair.

After calling the meeting to order, the President called for the financial report of the Secretary, which was read by Mr. Callbreath, together with the report of the auditor, which was accepted and approved.

Election of Nominating Committee

PRESIDENT WELLS: The next order of business is the election of a nominating committee. The chair will receive in nomination five names to constitute a nominating committee to select names for your consideration for the offices of directors vacant at this time. The following Committee on Nominations of Directors was elected: E. P. Mathewson, A. G. Mackenzie, Edwin Higgins, A. Cressy Morrison, P. H. Penna and George L. Nye.

MR. GEORGE L. NYE: I should like to withdraw, as it will be impossible for me to serve. That will leave five names, and I move that nominations be closed, and the Secretary be authorized to cast a ballot for the other five. (Motion unanimously carried.)

PRESIDENT WELLS: The Nominating Committee may at once proceed to select names to offer to this meeting, five in number, for the vacancies on the Board of Directors.

SECRETARY CALLBREATH: Perhaps it would be well to state to the Committee that those retiring as directors are Walter Douglas, Samuel A. Taylor, L. A. Friedman, Charles S. Keith and Carl Scholz.

PRESIDENT WELLS: The Secretary wishes to present to you gentlemen some matters relating to possible revision or readjustment of initiation fee and annual dues.

Mining Congress Finance

SECRETARY CALLBREATH: The question of the support of the work of the American Mining Congress is something which appeals to all of us who are interested in the work, and those others who have signified their interest by becoming members. When the American Mining Congress first established its headquarters in this city, in 1906, the membership dues were \$2 per year, the admission fee being \$5 at that time. We had on the membership roll approximately 200 men under obligation to pay us \$2 per year, which would have netted a total sum of \$400, and not more than half of those then on the list ever did pay the \$2. It was seen at once that it was necessary to have more substantial support than could possibly come from a \$2 membership, and therefore a meeting of the

members was called in this city, at which the vote, with one exception, was unanimous, to increase the membership dues from \$2 to \$10 per year. At that time no special service was being rendered. It was proposed to carry on, as far as might be possible, the original aspiration of the Mining Congress, to seek Federal aid for the mining industry. At that time it was believed we could get this by virtue of the vast importance of the mining industry, but later we found that we were asked "if you have grown so important without governmental aid, why do you need governmental aid?" We had then to demonstrate to Congress that it was the need of the mining industry for the benefit of the country, and that its growth had not reached its proper proportions, and it needed governmental aid to solve its problems. At that time no publications of any kind went to the members except the proceedings of the annual conventions. As time has gone on we have established the Mining Congress 'Journal' as a medium through which we could tell the story of official Washington to our members. That has grown to a point where it is thought by some of our members to be of some value. And we expect, incidentally, to increase its usefulness in your behalf. We have a difficult factor to meet which you gentlemen may not quite understand, and that is, we had to keep entirely out of the field of technical publications. It would have been easy to have filled our 'Journal' with technical articles, but in doing that

The Congress 'Journal'

we were invading the field of mining journals, and we wanted to keep entirely out of that field. We have tried to keep absolutely out of the field of the American Institute of Mining Engineers and other technical organizations. It is our desire to occupy a separate field entirely our own, not only as to our journal, but as to all our work. The 'Journal' has been given without any additional charge than that embodied in the \$10 fee. More recently we have established a news service, by which we gather important news relating to the mining industry, and send out a weekly bulletin. These publications have gotten to the point that the actual cost of the printing and postage we furnish to our members is in excess of the \$10 annual dues. In other words, as it stands today, our members are a liability and not an asset financially. They are a great asset with reference to our standing before the world and the influence that we may exert, but from a financial standpoint they are a liability. Some months ago, after we established this weekly news service, which, as you understand, is duplicated on the mimeograph and is more or less expensive, I had prepared a letter to send to our members which I first submitted to Mr. Wells. He put it in his portfolio for proper attention. It reached him just before he went to the mine at Telluride, and, leaving it there, the shafthouse caught fire, and when they came back not only the shafthouse had burned, with the copy of my letter—which was a special loss—but the wind swept down the valley with such force that you couldn't find a particle of ash on the spot which once contained this building. I want to say right here if I could have my own wishes followed, with all respect to any other president of the organization, I should make Bulkeley Wells president of

the American Mining Congress for life. (Applause.) No man could have been more useful, more helpful, more ready always to meet the responsibilities of his office, more ready always to seek help on the outside, without inspiration, advice or suggestion from the home office, to reach out and build up the organization. You know from the statement that I have read, showing the support of this organization to have grown from five, six or seven thousand a year to one hundred and fifty thousand a year, there is somebody who has had to do with it besides the secretary. I don't give the president the credit for all of that, but I do give him credit for most masterly and magnificent work in behalf of the Congress.

Membership of the American Mining Congress

I feel that we want a large increase in our membership; we ought to have a membership of 5000 instead of approximately 2500. We ought to have a great increase of our personal membership, and I think as well that the membership ought to pay a little larger dues; just what that should be I do not know. I leave it to you to say what you think ought to be done. But I think those memberships at least ought to be made self-supporting. We should have an increased membership, and it is up to you to assist and help in getting others to join the organization, because we know there are 10,000 or 15,000 people in this country who might well profit by the work of the Mining Congress. To the extent that we increase our membership, our influence in Washington is made that much stronger. Somebody has said that we were lobbying in Washington. You know the term lobbyist is considered more or less discreditable. I do not believe that there is any reason why members of Congress should not be approached upon a matter in which any citizen is interested; but I want to say, even with that view of it, the American Mining Congress does not lobby. When the members of Congress and Senators want any information about the mining industry we offer to prepare it for them. Some members of Congress have learned that when they want some information about the mining industry, about any phase of it, if they will apply to our office we will immediately get busy and find it for them. We have not yet been able to create that agency through which we can gather all this information. We have a Bureau of Mining Economics. We have spent considerable money on it, and need to spend more, but we do not undertake to gather the statistics that are collected by the Bureau of Mines, the Geological Survey, the Department of Commerce or the Census Bureau; those agencies are open to us at any time, so we can find all the statistics they have gathered. But there are gaps in between; there are statements of a different character; there are statements that do not seem to dovetail; and when a member of Congress seeks information and finds that the departments have prepared their statistics from different angles he is confused and does not know what to do.

Information Procured When Desired

The Mining Congress is trying to put itself in position with members of Congress so that they will realize we are there to serve them—to give

them any information they may want, and by virtue of that, tie up the mining industry with the members of Congress. One thing we try to do above all others is to preserve the reputation of the Mining Congress for absolute fairness, for broad, impartial treatment of questions relating to the mining industry; that we are impersonal, that we do not represent any one agency or any one interest; that we are working for the broad industry as a whole; and because of that reputation, I believe we have been able to exercise a greater influence than would otherwise be possible.

Our office simply tells Congress the facts. They have yet to make up their minds. Should there be a difference of opinion based on all the facts, and after that if we find that a member of Congress is undecided in his mind, some of you gentlemen know how we have appealed to you to take this matter up direct. We present the facts, and then when you come in and ask that a certain thing be done they have the facts which justify your request. So, gentlemen, we feel anxious there shall be a large increase in our membership; we want everybody interested in mining upon a broad and impersonal plane to be tied up with the Mining Congress so that we may have your influence.

Higher Dues and Revised By-Laws

That brings us to the question of whether or not our dues should be advanced, and I think, Mr. President, there are other things in our by-laws that ought to be amended. Our by-laws were drawn for conditions which do not exactly harmonize with the present situation. I make this talk with the idea in mind, Mr. President, of making a motion that there shall be a committee appointed, perhaps of three, and I hope somewhere near our office, so we can advise with them, who shall take up the question of the revision of the by-laws, which may be submitted back to our members for approval or rejection. I therefore move that a committee shall be appointed for the purpose of revising or drafting a form of proposed revision of the by-laws to be submitted to the membership. I thank you, gentlemen, for listening to me. (Applause.)

PRESIDENT WELLS: Mr. Callbreath, is this in your thought, that this committee also deal with the matter of annual dues?

SECRETARY CALLBREATH: Yes, the by-laws provide for annual dues, and therefore no change can be made without their amendment.

PRESIDENT WELLS: Well, you really need a report from that committee, shall we say with respect to the dues at least, at the general session tomorrow morning in order to have action by the members.

SECRETARY CALLBREATH: No, we have no power here to amend the by-laws. While we have proxies enough to constitute a quorum to act on other things that submission will have to be by letter direct to every member, so every member will have an opportunity to vote.

PRESIDENT WELLS: How will you have that committee appointed?

SECRETARY CALLBREATH: By the Chair.

PRESIDENT WELLS: Then your motion is that the Chair appoint a committee of three to confer upon and report to the directors upon the revision of the by-laws, with a view to their submission to the members for approval or rejection.

The motion was unanimously carried.

PRESIDENT WELLS: Is the Nominating Committee ready to report?

New Directors Elected

MR. E. P. MATHEWSON: We, the undersigned, your Committee on Nominations, beg respectfully to submit the following names as our unanimous choice for directors of the American Mining Congress for the forthcoming term:

James A. Douglas, metal mining, Arizona;
Robert Linton, metal mining, New York;
W. J. Loring, metal mining, California;
Carl Scholz, coal mining, West Virginia, and
Hugh Shirke, coal mining, Indiana.

Motion was made, seconded and unanimously carried that the Secretary be authorized to cast the unanimous ballot for the names proposed by the Nominating Committee to fill vacancies on the Board of Directors.

SECRETARY CALLBREATH: Mr. President, in accordance with your resolution, I have cast the unanimous ballot of the members present for the election of director for the term of three years as follows: James A. Douglas, Robert Linton, W. J. Loring, Carl Scholz and Hugh Shirke.

PRESIDENT WELLS: The Secretary having cast the ballot presenting the unanimous vote of this meeting for the names as read, these gentlemen are declared elected directors of the Mining Congress.

Gentlemen, I am very sincerely appreciative of the applause which you offered in response to Mr. Callbreath's kindly tender of this office, but it seems to me it is a little harsh to inflict a life sentence upon me, even at Mr. Callbreath's suggestion, as a penalty for burning one letter from him. My desk at present is entirely buried under letters from Callbreath and Burns, and there will be a great conflagration when this meeting is over.

The meeting thereupon adjourned.

ANNUAL BANQUET

NOVEMBER 18, 1920

PRESIDENT WELLS: Ladies and Gentlemen: I have a message from Marion, Ohio. (Applause.) This is worth-while:

Wire From President-elect Harding

"My dear Mr. Wells: I have to thank you for your invitation to the 23rd Annual Convention of the American Mining Congress, and express my regrets that it will be impossible for me to accept.

"My regrets are the more keen because your meeting will bring together a body of men with which I am anxious to take counsel in outlining the policies of the next administration.

"I am aware of the difficulties that confront the mining industry of the country, and would be glad of the opportunity to familiarize myself with some of the details.

"It is my hope and belief we will presently be brought to realize that the tendency to reaction and industrial depression is only momentary.

"Not only is our country sound and secure, but it is the world's mainstay and hope. We have been through a trying period in which the national policy and aspiration have been misinterpreted and misjudged.

"We have now had a convincing demonstration of the real attitude of the American people, and it will not fail to reassure both our own people and the rest of the world, which so greatly needs our steadfast support and aid.

"A mighty effort will be required of us to meet the demands that a recovering world will impose.

"In no direction will these demands be more pressing than in supplying those necessities of life and reconstruction that must come from the richness of American mines.

"With wisdom and deliberation such as we hope to secure by dint of enlisting the aid of such expert authorities as your own organization represents, I believe we shall place our country and its industries once more on the high road of prosperity and success. To that end you may be assured that every energy and effort of the new administration will be directed.

"Please be good enough to convey to the Congress and all its members the assurance of my pleasure in receiving your invitation; and of my wish to serve you, in common with every worthy American interest.

"Most sincerely yours,

"WARREN G. HARDING."

(Applause.)

Presentation to the Secretary

PRESIDENT WELLS (continuing): Members of the American Mining Congress: It has been my privilege to serve as your president for the past two years. If I have accomplished a little in strengthening and enlarging our organization, it has been due, 99%, to the sincere, never-failing co-operation of the active organization at Washington; and at the head and directing that organization is Mr. Callbreath. As a slight expression of my personal appreciation of his loyalty through all these years, and more particularly during the last two years, I have the greatest pleasure in handing him this little souvenir.

MR. CALLBREATH: Mr. President, Ladies and Gentlemen: This is indeed a great surprise. To have had the loyal support of such a president as Bulkeley Wells is enough reward for any man, I don't care who he may be. To have had the loyal support of the splendid men who have been associated with Bulkeley Wells as president of the American Mining Congress is enough reward for any man. But I surely appreciate this wonderful token, this elegant Shriners' pin, with a diamond center. I shall wear it with most sincere pleasure, and recall all of the pleasant relations which have existed between the Secretary's office and the President of this organization, which, under his leadership, has made strides during these two years which the fourteen years before that we were not able to make. Following that leadership, I feel that the American Mining Congress has grown so steadily that it can now stand and say that it is today one of the most influential organizations in the United States for the up-building of its industries, for the protection of its men and women, and for the betterment of all conditions in all society of the United States. (Applause.) I sincerely desire to express my sincere appreciation of this gift, which comes to me in a very surprising but touching way.

Something has been said here about reconstruction. Something is said, as it occurs to me, that in view of the fact that this country has gone upon a prohibition basis—I am reminded somewhat of the statement made concerning Bishop Wilmer of Alabama, who for many years was quite an inveterate smoker. His parishioners told him that it was not quite becoming for a Bishop of a church to be seen smoking upon the streets, so for a long time he went along, apparently, without smoking. One day he appeared upon the streets smoking an elegant cigar, and somebody said, "Why, Bishop, I thought you quit smoking?" "No, no, I just quit lying."

The American Mining Congress may be somewhat lax or slow in expressing this appreciation, but it always in the end does so.

Life Membership Presented to D. W. Brunton

I am thinking of a man who had ordered a carload of lumber, and the people from whom it was ordered telegraphed back to him that this car of lumber would be shipped as soon as he had paid for the previous car. His wire was in reply: "Cancel the order; I can't wait so long." The by-laws of the American Mining Congress permit our Board of Directors

each year to select one man as an honorary member of the Mining Congress. Thus far in our history three records of that kind have been made, and the last that was made is the one to whom I want to present tonight this certificate of membership, Mr. D. W. Brunton. I take great pleasure in presenting to him this certificate of honorary life membership to the American Mining Congress. (Applause.)

CHAIRMAN WELLS: This is important: Biologists, geologists, and even mining engineers are all agreed that a dog to attain the true canine prestige, and to realize that he is a dog, must have at least one flea, and so it is with a banquet, it must have one toastmaster. I take pleasure in introducing Mr. Thomas B. Stearns. (Applause.)

MR. STEARNS: Ladies and Gentlemen: In my early youth, many years ago, sitting at the knee of my Sunday-school teacher, I was taught one of the many old Biblical sayings: "The wicked flee when no man pursueth." This is the first time in my life that I have been referred to as a parasite, but I am quite willing to be anything in connection with this wonderful organization to whose success our president has contributed so much. (Applause.)

Adulation of Water

At first I thought this toast was to be to water, and this is really what your president intended to say when he rose to his feet: "The purest and best of all things that God created is water." I have noticed it tonight; I have seen it glisten in tiny tear-drops on the sleeping lids of infancy; I have seen it trickle down the blushing cheeks of youth, and going in rushing torrents down the wrinkled cheeks of age; I have seen it in tiny dew-drops on the blades of grass and the leaves of trees; I have seen it trickle down the mountainsides in tiny rivulets, and so on; but tonight we have seen water circulating from wall to wall, and your president bids you godspeed, and drink deep and drink long.

The first speaker of the evening is a gentleman whom we, in Colorado, call a friend. He has done yeoman work for this State during the last several years in Washington, and we are going to ask you to listen to Senator Charles S. Thomas. (Applause.)

SENATOR THOMAS: I was first notified that my subject was to be 'Industrial Dishonesty,' on the 17th; then I was informed that I was expected to discuss 'Industrial Honesty,' on the 18th. However, whether considered from the first or second standpoint, the topic is a broad one.

Industrial honesty is a very necessary element in the industrial world, and, like a great many necessary elements, it is sometimes more conspicuous for its scarcity than for its abundance, and its absence is not peculiar to any section of the social and economic world.

Current Industrial Dishonesty

We learn from investigations in the City of New York that the leaders of the labor unions on the one side, and a combination of contractors and

material men upon the other, were engaged in levying tribute, by way of blackmail, upon the building interests of that great city; and about the time our amazement subsides we are confronted with a report of an investigating committee, carried on in the City of Washington, which informs us of the widespread corruption, fraud and robbery which has characterized the activities and the developments of the Shipping Board from the time of its inception to the present. We scarcely digest that piece of startling information before our eyes encounter descriptions of a train robbery in the City of Omaha, resulting in much loss, concocted and conducted by boys, the oldest of whom has scarcely yet reached his majority. We hear of strikes for higher wages and for shorter hours on the one hand, and of stock dividends to avoid the payment of income taxes upon the other. There is, therefore, this interplay of dishonesty all throughout society, and those who seem to be the most virtuous are those who, in the last analysis, are perhaps only those who have not yet had an opportunity to apply their particular calling.

This condition is certainly a very unfortunate one. I used to think that all men were more or less dishonest, and I think I can say, and still keep within the truth, that except this enlightened, distinguished and virtuous audience, every man and woman in the United States gives some leeway to his inclination and his interest when he swears to his assessment returns.

Conditions in 1862 and 1921

This brief reference to some of the disclosures of the very recent past is inclined to make pessimists of us all, and cause us to wonder whether the old rugged, incorruptible virtues of our ancestors have not disappeared from their degenerate progeny, and whether we are not headed straight for industrial destruction. I am not disposed to accept that conclusion, especially when recalling some of the chronicles of the accounts, and reading of similar conditions during the Civil War, and the period of reconstruction immediately succeeding. That has been an interesting, if not a pleasant task of mine, and I have derived a sort of a melancholy pleasure in discovering that there were just about as many thieves and scoundrels and profiteers and combines then as now, the only difference being that the developments of that time had not reached that period of evolution which at present characterize these wholesale methods, but a difference is simply in degree, and not in kind. I flatter myself, therefore, that as time passes perhaps we will ourselves return to the old ways, when the shell-shock of the last great war shall have subsided, and the old and homely virtues of every-day life will re-assert themselves and we become once more a safe and a sane Republic.

But I am somewhat perturbed, ladies and gentlemen, by the constant growth of the tendency of this generation to saddle all of its troubles, and all of its disappointments, and all of its aspirations, upon the broad shoulders of poor old Uncle Sam. In the early days of the Republic, and even up to a period of twenty-five or thirty years ago, the individualism of the American always asserted itself. He depended upon himself and

took the loss and shouldered the blame for his failures; but with the growth of that spirit which seeks appropriations from the Government, and its partnership in the various pursuits of man, have come a deterioration of individuality in America, and a broadening of the activities of the Government, and its participation in nearly all the pursuits, as well as the conduct, of men. The result is that the responsibilities of community life in our cities and in our States are largely disappearing. They are shifted to Washington, and the Capital of the nation is becoming more and more the county-seat of every county in the United States. Today, if a man fails in business, he is apt to blame his Government for it. We have, therefore, more statutes regulatory in character, and applying to all of the relations of man to man, than are beneficial or desirable. Penalties have multiplied until men must become students these days to keep from becoming criminals, and what perhaps is worse, the departments of Government, under their rules and regulations are now regulating us all, and the courts are enforcing these regulations by sending us to jail when we even unintentionally disregard them.

What may Come in the Future

We have passed the 18th Amendment. This is the most conspicuous illustration of the transfer of the State police powers to the nation. The investiture of the Nation with such a supervisory control was never dreamed of by the founders of our Government. I am not complaining. I am glad the saloon is gone forever, but the attempted enforcement by Federal authority of rules and regulations regarding the subject of prohibition is converting 50% of the people into detectives and inspectors and the other 50% into liars and hypocrites. (Applause.) And when we shall give you the 20th Amendment, that will deprive you of the use of tobacco, cigars and coffee, then this 50% who are now the victims may, in turn, become inspectors, and everybody will be an employe of the Government for the enforcement of the law. (Applause.)

We have in the City of Washington, according to a recent statement in the Detroit newspaper, 125 lobbies, one of which has my friend here as its head. These represent many interests, some of them industrial, some of them political, and many of them racial. Every one is there to get what it can out of the Treasury of the United States, without regard to the welfare of the whole, except as an abstract proposition, and without regard to the apparently equally important demands of the others. Now, fancy 125 separate lobby associations marching in solid phalanx against the Congress of the United States and its Treasury. Talk about industrial honesty, it may exist in such an atmosphere, but the independence of your Representative and Senator becomes impossible. He must have both ears to the ground most of the time, and his eyes at the key-hole all of the time. He will be influenced in legislation, not by the popular welfare, not from the standpoint of the Republic, but in proportion as the interests which are brought to bear upon him have political power. Your representative system is therefore today on trial as it never was before and the time is rapidly coming when, if this pressure is continued and

increased, your representatives will become merely delegates to register the will of what they think is the strongest political influence of the particular moment. And then what becomes of the interest of the United States? That is today a minus quantity in national legislation. No one in either house longer stands for the interest of America as against the States and the districts, and consequently the people instinctively turn to the President, who has become the great representative of the United States, that political entity to which we all owe allegiance; because, and only because, he is not subjected to these influences, and presumably stands for the ideal for which he was chosen, the interest and the welfare of this great Republic.

Individualism and Paternalism

I have spoken about the effect of these conditions upon individualism, and individualism is the foundation of American progress. Lord Goshen once declared that it might be affirmed that the confidence of the individual in himself and the respect of the Government for national liberty constituted the foundation of the growth of peoples, the wealth of communities and the greatness of nations. Individualism cannot thrive in an atmosphere of paternalism, and paternalism is the inevitable outcome of this constantly growing tendency to place all our burdens, our woes, our misfortunes and our vocations upon the Government of the United States. I think, therefore, that industrial honesty should turn itself to the promotion of individualism, of independence, and of personal and corporate responsibility. The other course encourages a diffusion and division of the people into as many classes and organizations as there are races and interests. This is demoralizing; for without unity there can be neither strength nor nationalism, and nationalism is an absolute essential to an avoidance of the terrible consequences of these revolutionary theories and demands which today constitutes the most sinister dangers of the future. If one part of the people pull in one direction, another in another direction, and another in a third, the cohesive force of nationalism is destroyed and leadership disappears. And it is an eternal truth in history that the collapse of every civilization has been preceded by the collapse of its leadership. The thing needed in America, locally and nationally, is independence and capable leadership, which comes, if at all, through the encouragement of individuality and a recognition of the duties that every citizen owes to his country, that such duties are not only a part of every man's business, but paramount to his occupation, whatever it may be. Now, you cannot love your country as you should and at the same time demand and compete with others for its special favors and privileges.

I am satisfied my fifteen minutes have elapsed. You know that a Senator has no terminal facilities when it comes to talking. Yet I must recognize the gathering frowns upon the pleasant countenance of my genial friend as intimating that my time is up. (Applause.)

MR. STEARNS: Ladies and gentlemen, I am now going to call upon an ex-president of the Congress. The gentlemen can differentiate by hard

and bitter experience between moonshine and coal. There is a difference between these two things; one warms the inner man; the other, the outer. Each produces the distillate, which, if pursued to the bitter end, is fatal, and each lights the weary way of humanity. I am going to call upon Mr. Carl Scholz.

Moonshining and Mining

MR. SCHOLZ: Mr. Toastmaster, ladies and gentlemen: Inasmuch as I have attended a meeting of the directors of the American Mining Congress today, and it was my pleasure to nominate its next president in the person of Mr. W. J. Loring, I want to testify to the unreliability of your toastmaster. As you all know, on July first of the past year the legitimate sale of liquor ceased in many States of this country. To you in Denver, of course, this meant nothing, because you had gone dry many years before and have been dry ever since. However, it cast gloom over many of the people who did not expect to be able to get another supply. There is, however, a small family of moonshiners in West Virginia and Kentucky who viewed this day with much pleasure, because they saw an increase in the number of customers for their wares. Mining men are always pioneers in the line of civilization. The miner goes to the front first and discovers the mine, and the others follow him. Therefore, it is the opportunity and the part of the mining engineer, more so than any other, to find the people as they were and as they are. Recently, my business has taken me to the very remote sections of West Virginia, where the moonshiners are in their glory. The story of the moonshiner and the revenue officer is well known to you. Many books have been written about the moonshiner, and their histories are closely connected with the Hatfields and the McCoys, who lived in the remote recesses of the Allegheny Mountains. You have something to learn from these moonshiners, and I think Mr. Stearns had a story in mind in calling me to the Chair, one I related to him the other day.

My remarks are not going to be as lengthy as those of Senator Thomas, because I could not possibly occupy thirty minutes, but this is interesting, nevertheless. In the development of a new mine I noticed that on the brightest days we had the least men available for work, and I naturally inquired where they were. I soon found out that all our men had small garden patches on the steep hillsides, which they had to attend to. They were growing corn, which they expected to harvest this fall. These moonshiners in days gone by were trained to convert their corn into a product that could be more easily transported than metal, because the mountains are so rugged and rough they cannot very well get over them, and therefore they invented the process of moonshining. As a result, we had to make an order that no man would be allowed to drink on the premises. Shortly thereafter our camp one night was invaded by a number of men bringing with them many boxes and suitcases, and four men with pistols who said: "We are here to sell, you are here to buy—\$2 a quart," and the result was the sale of 16 quarts in 15 minutes.

The New President of the American Mining Congress

Mr. Toastmaster, I apologize for telling this story again, and I will now surrender to the real president of the American Mining Congress.

MR. STEARNS: Ladies and gentlemen, Mr. Loring is to preside over the destinies of the Congress, and I think it well that you all be introduced, and that you hear a word from him now.

MR. LORING: Mr. Toastmaster, members of the American Mining Congress, ladies and gentlemen: It gives me great pleasure to be selected as the guiding spirit of the American Mining Congress for the next year, and I trust that it may be my pleasure to follow with success in the steps of my predecessor, Mr. Bulkeley Wells. If I can do as well as he has done I shall be delighted, and I trust at the end of 12 months hence I shall be received as cordially as he has been received tonight.

I am a long way from home, you must understand—I came from California; came here just as an ordinary visitor to the American Mining Congress, and apparently they have landed me. I am going to do my best, and I shall expect all of the members of the American Mining Congress to assist me the same as they have my predecessor.

A Queer Affair in California

Now, to divert just a moment: I have heard something about moonshine. In California they talk about Jackass brandy. If there are any Californians here they will understand what that is. I read in an evening paper not long ago where a man traveling from the country found a five-gallon demijohn of this brandy, and he proceeded to take some of it away. It went to his head, and by the time he arrived in town he was pretty well off his head, and the police grabbed him and put him in jail; and a reporter stated that the last he saw of this man he was sitting on his bunk trying to wag his ears.

Now, ladies and gentlemen, I am not going to take up 15 minutes of your time, or 30 minutes of your time talking to you, but I think that I will probably learn how to talk and know what to talk about within the next 12 months, and if you will pardon me, I will thank you very kindly for receiving me as cordially as you have.

MR. STEARNS: Ladies and gentlemen, I am now going to call on a true son of the Golden West. We have here a gentleman who exemplifies the advantages of the education of a mining engineer. There is probably no education that fits a man for the general struggles of life than that. The gentleman I am going to introduce has been a mining engineer, but is now the Governor of Nevada. He is a distinguished member of the American Mining Congress—the Hon. Emmett D. Boyle.

Presentation to Retiring President

GOVERNOR BOYLE: Mr. Chairman, ladies and gentlemen: In advance of any remarks I may make in accordance with the set program, I am going to request our friend, Bulkeley Wells, ex-president of the Amer-

ican Mining Congress, to stand up. I have been accorded the privilege of presenting, on behalf of this association, a slight testimonial of its appreciation and affection for 'Buck' Wells. In recognition of the services that he has rendered humanity, as well as to the American Mining Congress, we have decided to supplant his Ingersoll-Rand watch with something that will be more in keeping with the elegance of the gentleman who is to wear it. This is a Denver Rock Drill watch, and it goes to him to remind him that there is such a thing as time, that element which has touched him so lightly in the glad and joyous years in which he has lived. So I say that on your behalf, and attempting in my humble way to voice some measure, in some slight measure, the heartfelt sentiments of affection and appreciation which we all have for 'Buck' Wells, I present to him the substitute for the ancient and venerable Ingersoll-Rand in the presence of everyone in this assembly. (Laughter.)

MR. WELLS: Mr. Toastmaster and gentlemen: I don't know whether the ladies contributed to this at all—we have no lady stockholders in the Denver Rock Drill Co., I am sorry to say. It has been my pleasure to do a little work—and it is hard nowadays to do any work—but I have found men in the American Mining Congress who apparently and professedly were glad to work with me, and I promise you that I have been glad and happy and always shall be to work with the members of the American Mining Congress. I thank you from my heart.

MR. STEARNS: All I can say to the representatives of the ancient Rand, after the remarks of Governor Boyle, is, "Watch and Wait." I am now going to call on another distinguished man of California, who, for six years was State Geologist of Colorado, and a gentleman who has been very prominent in all the mining activities of this country; also who, among the many witnesses, was brought into this remarkable Minerals Separation program which seems to have created so much excitement during this session. I present to you Mr. T. A. Rickard of the *Mining and Scientific Press* of San Francisco.

Some Jokes Told by an Editor

MR. RICKARD: Mr. Chairman, ladies and gentlemen: It is a pleasure to be introduced by such a toastmaster. As you will have observed, he is a man of most excellent courtesy and most unflinching tact; in fact, he is a good deal like the Irish butler, who butted into the bathroom without knocking at the door, and found the lady of the house in the bath; whereupon, he retreated and said: "Excuse me, Sir." The "excuse me" stood for courtesy, and the "Sir" for tact. (Laughter.)

I have known Mr. Stearns for nearly 35 years. On one occasion I had the honor of being introduced at a gathering of this sort, and I was presented as a much more distinguished and a much better known man—Tex Rickard. It happened in Louisiana, where I was the guest of James Douglas. And the first evening there while we were dining he said to me: "We are going to have a meeting in the town, and I hope you will come." I said: "Certainly," and as the dinner progressed he said he would like

to have me speak. I said: "Well, I will try to do that." I was introduced to the chairman, and he very stupidly, of course, introduced me about as follows: "Ladies and gentlemen, I have great pleasure in introducing to you Mr. Tex Rickard, who will now address you;" whereupon I stood up and explained to the audience that only recently my boy had come back from school and had asked his mother and myself whether by any chance we were related to Tex Rickard; and when I said we were not, he was visibly disappointed. Well, my little talk went on, and the lights went out, and the chairman told me to talk until the lights went on. When the lights came on I sat down, and I said to a representative of the Red Cross there, a lady: "Very funny, my introduction as 'Tex' Rickard." "Oh, is it; who is he?" "Well," I said, "he is a prizefighter," whereupon she said, "I think you would do that very well also."

The chairman has referred to the flotation process and to an examination before the Federal Trade Commission, and to some testimony I have given before that Commission; that reminds me of the man who went through the third degree. The police commissioner had given instructions and had left the room, and when he came back he said: "Did you do it?" "Oh, yes; we badgered him without limit." "And what did he do?" "Well, he became kind of drowsy and said, 'Yes, my dear, you are perfectly all right.'"

Praise for the Secretary

The toastmaster has been good enough to refer to my association with the State of Colorado, and I am proud of it, and I always shall be. There is another association between this American Mining Congress and the State of Colorado upon which I would like to dwell before I sit down. This Congress was cradled in Colorado, and the hand that rocked that cradle was that of J. F. Callbreath. To his initiative, perseverance, persistence and sincerity this Congress has become great. Therefore, gentlemen, I am taking the opportunity as a speaker of proposing long health and happiness to Mr. Callbreath.

MR. STEARNS: It is plain that those who have attended this Congress, coming from long distances, have shown their enthusiasm and their loyalty, but I want to say that there is present from Fairbanks, in Alaska, a man who walked 175 miles to attend this session of the American Mining Congress in Denver, so I will ask Mr. Gray to say a word to you.

MR. GRAY: Mr. Chairman, ladies and gentlemen: There is one thing I will say, and that is, in the next five or ten years Alaska will come forward and be a great factor in the mining industry. We have the biggest goldfields in the United States. We have good mines there, and they are going to be opened, and Alaska will ask for the golden jubilee Convention. I thank you one and all.

MR. STEARNS: One of the shining lights of the engineering and metallurgical profession in this country, and a man who has lived in different parts of the United States—coming to us originally from Canada—

one who is familiar with the ways and expressions of all the French-Canadians, and who got his main metallurgical education in our sister city of Pueblo, Colo., is Mr. E. P. Mathewson. While I am unable to relate some of the French-Canadian dialect anecdotes, I will call upon him to tell some.

Typically Mathewsonian

MR. MATHEWSON: Mr. Toastmaster, ladies and gentlemen: I am really too full for utterance. We have been besieged with water-bottles all evening; they have been passed around to all the tables; flowers have been showered upon us; we have heard all kinds of lovely music; and we have heard our past president sing. I thought I would be able to tell you a story tonight, but our toastmaster has taken all the pep out of me, and I don't know what to say. If you will bear with me, I will relate one short Scotch story. (Thereupon Mr. Mathewson told a typically Scotch yarn.

MR. STEARNS: The next speaker is a gentleman from the East, a man who occupies a very prominent position in the railroad world. He has a message that he intends delivering to us tomorrow morning at some length, but he has kindly consented to say a few words tonight: Mr. W. G. Bierd, president of the Chicago & Alton Railroad.

MR. BIERD: Mr. Toastmaster, ladies and gentlemen: Listening to Senator Thomas' remarks, I was impressed with the suggestion that today we all look to our Government either to correct or improve any part or all of our ills. That is about the beginning, and perhaps the reason for my being in Denver. It is an exceptional pleasure for me to be in Denver tonight and to meet many old friends. I made my home in the Rocky Mountains and on the Western Plains when a young lad for 15 years. Today is my first visit, or rather return, to Denver in 22 years. My duties have called me East and South and into two foreign countries, but I have never forgotten my early days, my Western friends, and I have never ceased to know or to desire to return West. While I have made several trips over and through these mountains since, but not in Denver.

Government Control of Railroads

I can say nothing more than that I bring to you of the West and to members of this Mining Congress a message from another branch of industry—the railroads. We have been incarcerated, but unfortunately have been released on our good behavior. Some of you in the mining business are a little more fortunate; you barely escaped the same fate that we did. Take the advice of the Senator, and let us not lodge any more of our complaints or ask for relief from any of our ills from the Government. It is a poor doctor, and will give little relief. I thank you. (Applause.)

MR. STEARNS: We love to honor those of our members who have come from long distances, and have from the Philippines a delegate—Mr. Fischer.

[Mr. Fischer thereupon made some general remarks upon the variety of news published in the United States concerning the Philippines and concluded by saying he probably would have a few interesting things to say on the next morning.]

MR. STEARNS: I want to present Governor Brooks of Wyoming.

GOVERNOR BROOKS: I certainly appreciate the fact that I am here to say a few words about the oil industry, particularly of your sister State, Wyoming.

Oil Industry of Wyoming

I am glad that this Mining Congress saw fit to take in the oil industry. Some of the people here from the East, and some from the West, thought that the oil industry in the Western country was new; as a matter of fact, oil was discovered in these Rocky Mountain regions 87 years ago, long before Colonel Drake brought in his first discovery well in Pennsylvania. Fifty-four years ago the first oil well was drilled in Wyoming. The oil from that well was widely used as a lubricant. Twenty-five years ago—and I am saying this for the benefit of some refining men here—that well 25 years ago produced in Wyoming 3000 bbls. of oil that year, which sold for \$7 a barrel. I want to call their attention to that fact, because we would like to see that price again. Eight years ago, owing to the discovery of some big wells in Salt Creek, the production of Wyoming oil jumped to 2,000,000 bbls. for that year, but the price dropped to 50 cents a barrel, and Wyoming only received \$1,000,000 for its oil. Our production of oil this year [1920] will exceed 17,000,000 bbls., bringing over \$50,000,000. In Wyoming we have 43 producing oil-fields, yielding something like 60,000 bbls. a day. We have 12 gas-fields, yielding 700,000,000 cu. ft. of gas daily. We have 10 refineries; and in the little town of Casper we have one treating 36,000 bbls. of crude oil per day, nearly ready to open a new 8-in. pipe-line from Salt Creek that will enable it to handle 50,000 bbls., making it one of the largest refineries in the world. In addition, they re-run 6000 bbls. They have paraffin wax plants and lubricating oil equipment without a superior. We have the Standard Oil Co. there. That re-run oil comes from the Midwest company's plant. The Standard Oil came in there, and this re-run oil comes into the pipe-lines at Casper and goes into the oil-refining process at the Midwest plant. That oil, which only a few years ago was used solely for fuel purposes—a sort of a waste product—is now taken over to the Standard Oil plant, and there they take

Proposed Extensions of Refineries

that re-run oil and get 50% more out of it. The company is to spend \$10,000,000 more at Casper in doubling the capacity of its present plant, which is to be used exclusively for re-run oil. Casper today is producing 650,000 gals. of gasoline daily. With these enlargements completed it will produce 1,000,000 gals. of gasoline, which will make it the largest gasoline manufacturing center in the world. At retail prices, that gasoline would cost about \$130,000,000 a year. I feel it is fortunate that the Amer-

ican Mining Congress has taken in the oil industry. You can do many things for it, and it can make many things for you. The influence that you have at Washington can be exercised to aid the oil industry. In Wyoming our wells last a little longer than they do in some other States. In that Salt Creek field one well that came in 26 months ago makes 5000 bbls. today, exactly as much as it did then; another, 500 ft. distant, came in with 38 bbls, and is making twice as much as it did 16 months ago. Down in Oklahoma, Kansas and Texas you have great production, but it does not hold up. In the Salt Creek field we have probably the biggest known oil-field in the world, and it is different from those in Kansas and Oklahoma. Down there all the land was owned by small farmers. The land was leased by oil companies, who were so anxious that they drilled as many wells as quickly as they possibly could. They developed that field so rapidly that much of the oil was wasted. In the Salt Creek conditions are different. There the ground is largely under Government control, and its development can only be done under the Federal leasing

Conservation During Construction of Works

system. I believe in reasonable conservation as exemplified and made possible by Theodore Roosevelt. I advocate conservation that means sensible development. From the Salt Creek field there are now 5 pipe-lines, which, within 30 days, can bring 50,000 bbls. of oil per day into Casper. What is the use of drilling a lot of additional wells before that oil can be transported? What is the use of building a lot of additional pipe-lines and refineries before that oil can be economically used? Let us not waste one bit of these great natural gifts. Let us develop it sensibly; let us hope that the Government will see that the drilling of that great field is economically performed; let us hope that that oil will come in and not be wasted.

MR. STEARNS: I think it is only fair, since oil has had its innings, to say that Denver is very thankful to Wyoming—and we indorse every figure and everything that Governor Brooks has said—that coal ought to have a word to say, because on coal we have depended these many years, and I am going to ask Mr. Brewster to say something about coal.

MR. T. T. BREWSTER: Mr. Toastmaster: When I was notified that I would be called on to speak I was told to make it humorous, and since then I have been making a solemn effort to think of something funny to say.

Co-operation Between Coal and Metal Mines

You have identified me as a representative of the bituminous coal industry, and suggested I could tell something of experiences in Washington. It is true that certain people down there have done, or tried to do, some funny things to the coal business during the past few years, but a narrative thereof might be misconstrued as ridicule. It is coming out all right, so let it pass. In carrying out certain allotted duties, it has developed upon

me to try to get all the coal operators to think of their problems, to identify and classify the elements of their business, and to account for their operations in the same way, because most of the misunderstanding in this world comes from the failure to think and talk about the same thing at the same time in the same way. Since I have been here I have been impressed that there are many problems that the soft-coal man and the hard-rock man have in common, and through the medium of this great institution, the American Mining Congress, I hope we can bring to all a realization of the many things we have in common, and in looking at this singing list I see here a little sentiment with which I will conclude my remarks: "Let's get together; work together; play together; pull together."

MR. STEARNS: Mr. Loring was so modest that I am going to ask Governor Boyle to say a word to you about Mr. Loring, who is to be your president for the ensuing year.

Something About the New President

GOVERNOR BOYLE: From California comes the next president of the American Mining Congress. Happily for me, it has been my fortune to know not only the coming president, but the past president, as individuals who have visited my home and who have been intimate friends. Mr. Loring comes to you something of a stranger, because he is of a modest and a retiring sort of disposition, but he is a man who has sailed the seven seas, who has mined on the three Continents—as some one said—and who has in his make-up all of these qualities that ought to continue the excellent progress attained by the American Mining Congress under the presidency of its distinguished retiring leader. He comes to you as an international mining engineer who will lead the ship of the American Mining Congress into a safe harbor. [Governor Boyle then expounded the virtues of Mr. Loring at considerable length, receiving applause.]

The meeting thereupon adjourned.

SIXTH GENERAL SESSION

FRIDAY MORNING, NOVEMBER 19, 1920.

CHAIRMAN WELLS: The sixth general session will now be in order.

Three Interesting Addresses on Labor

The first address is by Mr. Arthur Nottman, on the subject of 'Conditions of Operation and Production in Open-Shop Districts in Arizona.'

[Mr. Nottman's paper appears on page 294 of the Proceedings.]

CHAIRMAN WELLS: The next address is by Mr. Charles A. Chase, manager of the Liberty Bell mine, Telluride, Colo.

[Mr. Chase's paper appears on page 302 of the Proceedings.]

CHAIRMAN WELLS: The next speaker is Mr. L. Ward Bannister of Denver, whose address is entitled 'Denver and the Open Shop.'

[Mr. Bannister's address will be found on page 443 of the Proceedings.]

CHAIRMAN WELLS: We are now privileged to listen to the Hon. W. G. Bierd, president of the Chicago & Alton Railway, whose subject is 'The Relation of Industry to Industry.'

[Mr. Bierd's address, which covered the obligation of one line of industry to another, was a general review, dealing with such points as association and prosperity of allied industries, oppression and unrest, the American standard of living, labor and its organizations, world policy of humanity, the obligation of one business to another, politics, governmental control, and that nothing un-American be permitted to thrive in America.]

CHAIRMAN WELLS: This general session will now stand adjourned until 2 o'clock.

SIXTH GENERAL SESSION

FRIDAY AFTERNOON, NOVEMBER 19, 1920.

CHAIRMAN WELLS: The session will be in order. Mr. Fletcher Hamilton of San Francisco will speak to you on the gold-mining industry. (Applause.)

[Mr. Hamilton's paper appears on page 620 of the Proceedings, among those of the Gold Conference.]

PRESIDENT WELLS: Mr. Arthur F. Fischer, who is Chief of Forestry and a delegate of the Philippine Government, will speak to us on mining in the Philippines. (Applause.)

MR. FISCHER: Upon receiving a telegram from General McIntyre, Chief of the Bureau of Insular Affairs, asking me to represent the Department of Agriculture and Natural Resource, I came here with the intention of learning something that will be useful in the Philippines, particularly now that the Government is working on a new mining law. I am sure the Government of the Philippine Islands would be more than pleased to have suggestions from the Mining Congress along this line.

Gold, Iron, Coal, and Oil Prospects

In mining we have not done much, because of the lack of a complete geological survey. Mining is being carried on sporadically as a consequence and also because of lack of capital. Practically all development has been done by local capital.

Gold mining has received the greatest attention, and several lode mines have been operating continuously for a number of years, and paying dividends. Placer mines are also being developed, and dredges are working in the Paracale and Mambulao fields along the east coast of Luzon. Hydraulic mining of placers was started, but was suspended, due to lack of capital. Gold is found in the sands of all the streams, and sporadic prospecting has been done; and I feel certain that should real exploration be done and a geological survey made of the islands, the Philippines will develop into a mining country.

Iron is one of our largest undeveloped natural resources. Iron smelting and foundry operations have been carried on for many years in a small way. The ore is picked up in the stream bed near charcoal furnace, reduced, and cast into pans and plow points. The iron deposits of the province of Suriago, consisting of whole mountain ranges, offer great promise for development. Part of the iron deposits in southern Luzon were acquired by the Japanese, and some iron ore was shipped to Japan; but owing to faulty title, the property is in the courts.

We have been dependent upon Japan for our coal. During the war, coal reached \$30 gold per ton; and we had to pay the price. This was a blessing in disguise, however, as we began to develop our own lignite field,

both governmentally and privately, on the Islands of Bataan, Cebu and Mindanao.

Oil occurs from Luzon to Mindanao, and exploration by both American and foreign interests has been carried on. No large wells have been sunk, but shallow wells have been put down and oil baled. Since coming to the United States I have been reading considerably about the motor-fuel problem, and it would be well to make a comparative study of the cost of producing motor-fuel and fuel-alcohol. In the Philippines, the nipa palm is the cheapest source of alcohol in the world. In Borneo the British are beginning to develop their alcohol resources from their immense nipa areas. Other countries have investigated this palm and are preparing to plant it. Cassava is also another cheap source of alcohol, and with the immense areas of cheap fertile land available and comparatively cheap labor—with a production in fuel-alcohol of approximately two tons or over per acre per year—it would pay to make a comparative study.

Copper deposits occur in various parts of the islands. The old Man-cayan field in Luzon has been worked since ancient times, but the development of this field is due to lack of transportation. Other metallic minerals exist.

Many commercial deposits of non-metallic minerals exist, and their development is just a question of transportation and capital.

Geography and Ethnology of the Philippines

The ignorance of the average American is very apparent concerning some geographical points in the Philippines. The Islands are 120,000 sq. miles in area (about the size of the State of New Mexico), comprising about 3000 islands, eight of which constitute the major portion of the Territory. About 12% of this entire area is under cultivation, supporting a population of 10,500,000 people. Drawing a semi-circle, with Manila at the focus, with a radius of 2500 miles, it would take in nearly 800,000,000 people, or half the world's population. The American has not taken commercial advantage of the Philippines as he should. The English, Japanese and other nations are keenly alive to this market and in development of its natural resources. A statement was made in Washington that with the increase in our population and the increase in our food supply in the United States, we would consume everything we raised in 25 years. Why not build for the future in placing our capital where it is needed and helping develop a practically virgin country which will have the best of relations with the United States? How about the mining industry? Have you taken stock? Has your Mining Congress a foreign extension committee?

PRESIDENT WELLS: It has not.

Mining Congress Should Study Foreign Countries

MR. FISCHER: This leads me to a suggestion to your Congress: The appointment of a foreign extension committee to study the mineral resources of foreign countries, co-operating with the Departments of Com-

merce, Interior, State and other Governmental agencies in Washington—the Bureau of Mines and Geological Survey have already, I understand, compiled certain information along this line—this committee to keep in touch with all departments, and that the American mining industry has equal opportunity with other nations, or the open-door policy. Apply your arguments in the open and closed-shop papers presented to the world's affairs. (Applause.)

PRESIDENT WELLS: Governor Boyle had expected to speak to you, probably on the subject of gold, but he has been obliged to leave for Nevada. Mr. James Lord, president of the Mining Department of the American Federation of Labor, came here to attend this convention and to address you. On Monday his father died, and he was called East, but he left with me some hastily-prepared notes and an address which is rather too long to read to you; but because I have known Mr. Lord for a good many years, and because I was instrumental in getting him to come here to talk to us, I will ask your indulgence while I read to you a part of his address, because it indicates his attitude, and a very satisfactory one, as I view it.

[Mr. Lord's address will be found on page 279 of the Proceedings.]

PRESIDENT WELLS: I thank you for your courtesy in letting me read that to you, but I thought it was only fair to Mr. Lord to make his views known to you, to that extent, at least.

We are now ready to hear the presentation of the reports of the Resolutions Committee.

Report of Resolutions Committee

(The Chairman of the Resolutions Committee read the resolution No. 1, presented by Bulkeley Wells.)

PRESIDENT WELLS: What is your pleasure with respect to these resolutions, gentlemen? Will you pass upon them individually as read, and then accept them collectively as the report of the Resolutions Committee, or how will you proceed?

SENATOR MACBETH: Mr Chairman, I move that the report of the Resolutions Committee be accepted, unless there is an objection by some member present to a particular resolution. In that way we will expedite matters. If there is any member that objects to any resolution read, he can get up and make his objection, and if there is no objection, we will consider the resolution adopted.

A MEMBER: I second the motion.

PRESIDENT WELLS: As I understand it, the motion is to the effect that the report of the Resolutions Committee be accepted, except such objection as may be raised at the time by anyone who does not concur in the approval of the resolution as read. Is that the effect of it, Senator Macbeth?

SENATOR MACBETH: Yes, sir.

PRESIDENT WELLS: It has been duly moved and seconded. Those in favor signify by saying aye. (Chorus of ayes.) Contrary, no. (No response.) It was so ordered, and unless there is objection, it will be understood that the resolutions as read are approved under this motion. They must be read now. If there is no objection, they will be accepted. Read them all.

(Thereupon President Wells read resolution No. 2, introduced by himself; also resolutions 3 to 7, inclusive.)

PRESIDENT WELLS: You understand, gentlemen, these resolutions have been passed and approved by the Committee on Resolutions. I am not reading in each instance that attached writing.

Reading resolution No. 8, as follows:

First Blue-Sky Resolution Rejected

Introduced by Sidney Norman and A. G. MacKenzie of the Committee on Blue Sky Legislation.

"WHEREAS, blue-sky laws in more than 30 States of the Union have largely failed to protect the public against dishonest promoters, and have at the same time made it increasingly difficult to obtain capital for legitimate enterprises; now, therefore, be it

"RESOLVED, by the Twenty-third Annual Convention of the American Mining Congress, at Denver, Colorado, November 15-19, 1920, That we favor a Federal blue-sky law instead of varied State enactments, and that we call upon the officers of this organization to take the initial steps to such end; that we endorse the report of the Committee on Blue-Sky Legislation as presented by the chairman of the committee to this convention and recommend that the suggestions of said committee as to the nature of such Federal legislation be followed as closely as may be possible."

A MEMBER: Just one moment. I think that was rejected, was it not?

PRESIDENT WELLS: That is quite right.

THE MEMBER: Isn't there another one attached to it which was approved?

PRESIDENT WELLS: No, that is the report of the committee attached to that.

THE SECRETARY: Yes, that is the substance of the report of the committee.

PRESIDENT WELLS: I am sorry about that. I thought that these were all approved resolutions.

[Reading Resolution No. 9, as follows:]

Second Blue-Sky Resolution

Introduced by M. B. Tomblin, and Robert I. Kerr.

"In accordance with the above, the undersigned members of your committee on blue-sky legislation most respectfully submit this following resolution:

Be it resolved, by the Delegates to the twenty-third Annual Convention of The American Mining Congress, held at Denver, Colo., November 15-19, 1920, That we are opposed to all proposed enactments now pending in Congress providing for so-called 'blue-sky' legislation, and that it is the sense of this Convention that State regulatory measures now in force in the several States are sufficient in form, with slight modification, to meet all requirements."

MR. MACKENZIE: Mr. President, I wish to be heard on that resolution briefly: For about five years, at the instance of this organization, I have been investigating blue-sky legislation. I say this so you will understand my remarks are based on more than casual observation. Any one who will give a small part of the investigation I have given to this subject will know, as I do, that blue-sky legislation never can be made effective to regulate the sale of securities without regulating the use of the mails for that purpose. Without restrictions on the use of the mails, I can drive a four-horse team through any State blue-sky law in America.

Thirty State Blue-Sky Laws

With reference to the action of the Resolutions Committee, I am not going to propose Federal legislation, but I do wish to oppose the resolution which has been approved by the Committee. We have something over thirty State blue-sky laws in this country; no two of them are identical, and most of them are bad. They operate distinctly to the disadvantage of the man who tries to raise capital in his home State. Some of them have provisions whereby an eastern railroad, or public utility, or mortgage bond enterprise, or other foreign corporation that goes before the commission is asked no questions; but when men walk in from the hills with a mining proposition, or bring up a local or individual proposition, they have to tell more than they know about it and half the time they don't get by then. That is what State blue-sky laws are doing—they are operating against the man who is trying to do business and raise capital at home.

I wish to call your attention to the language of this resolution, and its effect:

"It is the sense of this convention that State regulatory measures now in force in the several States are sufficient in form, with slight modification, to meet all requirements."

Just realize what that means: It means that the American Mining Congress is placing its stamp of approval on existing State blue-sky laws, and if you had read those laws carefully there would not be a man

in this convention that would give his approval to them. Don't understand me as defending the unworthy promoter. I wouldn't be understood as saying that, but I do say that some of the existing blue-sky laws are among the worst things mine development has to contend with today. For that reason, I am firmly opposed to this resolution, and I move that it be laid on the table.

MR. GEORGE L. NYE: Mr. Chairman, I desire to second that motion.

SENATOR MACBETH. Some years ago, when the Hon. J. H. Richards was president of this association, a careful investigation was made of the necessity for a blue-sky law in the several States. A committee of this organization gave much study to the question for a number of months, and then sent to the several legislatures of the Western States—and I imagine throughout the United States—a carefully drawn blue-sky bill. This bill was adopted by most of these States. We have it in Idaho. We have found it, Mr. President, to be very excellent, and we feel further, on the subject, that we want no more government interference in our State affairs—we want the States to manage their own affairs. That is one of the reasons, and I might say the main reason, why the committee on resolutions unanimously turned down what is known as the MacKenzie-Norman bill and favored the bill that we now have before us.

Satisfactory Law in California

MR. JOHN F. DAVIS: I am not a member of the Resolutions Committee, but I have had some experience with blue-sky legislation, and with the administration of the law that we have in California. There is one phase of this subject that has been suggested here at all today, which I think ought to be emphasized. Before I speak of it, let me say, however, that if you expect to make people cautious by legislation, if you expect to prevent that certain class of men from making false investments, and do it by legislation; why, you are taking useless steps. The theory is all right, to protect, as far as we can, people against being robbed by wildcat promoters, but what is going to be the method? That is the whole proposition. There isn't any particular discussion needed as to whether or not we are against wildcatting, whether or not we would like to put in jail a man who will rob another. We are all in favor of that. The question is what is the most effective method?

As Mr. Macbeth has said, the legislation by the various States on this subject was initiated by this very body. I don't know what the blue-sky law is in Colorado; I am not sure what it is in Idaho; but I do know that we have one of the best laws of that kind on the statute books in the State of California. It was one of Senator Hiram Johnson's (then governor) measures. All kinds of objections were made against it at the time it was put through; and yet the very men who opposed it, men who were afraid that it would prevent legitimate capital coming into the country, and all that sort of thing, are back of it today. It does not work to the disadvantage of getting capital invested in a fair project. It has worked well. There is not a single objection to it in any quarter, except on the part of wildcatters; and of course they have no standing in

court. I do not know of this dire need of laws of this kind in certain States. If there is, probably the same experience that has made effective laws in the States where they are effective, will amend ineffective laws in those States where they are thus far ineffective, and will bring on laws of that kind where there are none. We do not need to regulate the whole world at once. We have enough problems in Washington without taking up the outer fringe of a subject like this, where there is no overwhelming demand on the part of any community or of the country for it.

Result of a National Blue-Sky Law

But there is another feature: If you take this and pass under the guise of a blue-sky law or anything of that kind a bill which is going to keep in Washington a great big army of employes, you will have this situation confront you: Every time you want a permit, instead of being able to go to your State Capitol, you will have to go to Washington, or employ a Washington attorney, to take up the matter, in addition to anything else that you have to do at home. When you think of the blue-sky law that was planned at the last session of Congress—and I remember Mr. Callbreath sending circulars all over the country to call our attention to its character—what would it have done to legitimate enterprises if it had been passed? I think you will agree that we should wait to see if there is an urgent necessity for a Federal law before we turn our backs on these efficient State laws. I think we ought to stand by the report of the committee. (Applause.)

PRESIDENT WELLS: A motion has been made, and duly seconded, that resolution No. 9 be tabled. All those in favor of the motion will signify by saying aye. (Chorus of ayes.) Contrary minded no. (Chorus of noes.) The motion is lost.

MR. MACKENZIE: I have another motion.

PRESIDENT WELLS: All right.

MR. MACKENZIE: I am sorry that took so much time. This discussion got entirely away from my previous motion, and I am going to make another one. I prefaced my remarks by saying that the committee had rejected the idea of the Federal law. I do not urge that. I move that the latter part of this resolution, following the word "legislation," on line five, be stricken out.

PRESIDENT WELLS: Just what words do you mean?

MR. MACKENZIE: Where it says, "That it is the sense of this Convention that State regulatory measures now in force in the several States are sufficient in form, with slight modification, to meet all the requirements."

Now, can I get a second to that for the purpose of making some remarks?

MR. GEORGE L. NYE: I second it.

MR. MacKENZIE: That will be considered as an endorsement of existing State blue-sky laws by the American Mining Congress. Go ahead and kill your Federal bill, but do not send that voice to Congress.

MR. KERR: I signed the minority report of that committee, and I would like to have the report read in full, and I would like to have Mr. MacKenzie read the entire resolution. It provides that we are opposed to blue-sky legislation now pending before Congress. California has an ideal law, as Judge Davis said, and we are perfectly satisfied. I stand by the report of the committee.

PRESIDENT WELLS: What is it you want read?

MR. KERR: The entire minority report, that signed by Mr. Tomblin and myself.

PRESIDENT WELLS: I have it--"In accordance with the above, the undersigned members of your committee on blue-sky legislation, most respectfully submit the following resolution:--"

MR. KERR: It probably has been detached from the resolutions, for some reason, Mr. Chairman.

PRESIDENT WELLS: This seems to be all there is to it:

"Be it resolved by the Delegates to the twenty-third Annual Convention of the American Mining Congress, held at Denver, Colo., November 15-19, 1920, that we are opposed to all proposed enactments now pending in Congress providing for so-called 'blue-sky' legislation, and that it is the sense of this Convention that State regulatory measures now in force in the several States are sufficient in form, with slight modification, to meet all requirements."

This is all that I have, Mr. Kerr.

MR. KERR: There was another sheet.

MR. McBETH: Let us have the question on Mr. MacKenzie's motion.

PRESIDENT WELLS: Was there a second?

MR. NYE: Yes.

PRESIDENT WELLS: You understand the motion is to strike out all after the word "legislation." Those in favor, signify by saying aye. (Chorus of ayes.) Contrary minded no. (Chorus of noes.) The motion is lost again.

MR. MacKENZIE: I call for a division.

Vote on Resolution 9

PRESIDENT WELLS: All right. Those in favor of the motion made by Mr. MacKenzie, please stand. (16 members arise.) Now those opposed to the motion to strike out the latter part, will please rise. (14

members arise.) The motion is carried. The resolution is amended by the elimination of all following the word "legislation" in the fifth line. Is there any further discussion of this resolution? (No response.)

[Reading resolution No. 10.]

PRESIDENT WELLS: Any discussion? (No response.)

[Reading resolutions Nos. 11 to 24, inclusive.]

MR. NYE: I sent a resolution, as I thought, for presentation to this body in the regular manner. Owing to the fact that I was in attendance at another conference, I was unable to attend the regular meeting of the Resolutions Committee, and I entrusted it to someone else, and he in turn thought it had reached the proper channels; but inasmuch as it has not been presented here today, I guess it was mislaid, and I therefore ask the consent of this body that this resolution be considered with the other resolutions, and incorporated therein.

PRESIDENT WELLS: What is your pleasure, gentlemen?

A MEMBER: Let us hear the resolution.

Armenian Affairs

MR. NYE: "WHEREAS, among the Christian peoples of the Near East a most intolerable situation was brought about by the World War and taken advantage of by the Turkish fanaticism and cruelty and which situation still continues, and

WHEREAS, the Armenian nation in particular has demonstrated by innumerable acts of heroism, its unflinching support of Christian principles and civilization, and

WHEREAS, the Near East Relief taking over the work formerly done by the American Red Cross has been chartered by the Congress of the United States, and is energetically doing all possible with the resources at its command to care for the countless thousands of orphans, and rescue from Turkish slaver many thousands of Christian girls, and in short, carry on the best ideals of America;

Resolved, that the American Mining Congress in annual convention assembled do hereby endorse the efforts and principles of the Near East Relief in their great work and recommend that all members and chapters give aid by

First—Assisting the Near East Relief workers in their efforts wherever they may be;

Second—Accepting the responsibility for the support of an orphan Near East child whenever possible;

Third—Assist the educational program of the Near East Relief by publishing Near East Relief stories in trade publications."

I move the adoption of the resolution. I do not desire to speak to the resolution unless there is opposition, in which case I do desire to be heard.

MR. LORING: That resolution was presented and unanimously rejected. I don't know how it happened to be left out of the report.

MR. NYE: Mr. Loring, I was advised by the Secretary that it had not been presented by the committee.

SECRETARY CALLBREATH: I found that resolution after the resolutions had gone in. In some way I overlooked it, and there was no record that it had been considered by the committee.

A MEMBER: I was a member of the committee, and it was read and discussed, and rejected.

A MEMBER: It came before the Resolutions Committee, and was unanimously rejected.

MR. NYE: Mr. President, I desire to offer the resolution, and if I can get a second, will discuss it.

MR. MACKENZIE: I will second the motion for the purpose of discussion.

MR. NYE: Mr. President, I do not desire to take up any great length of time of this Convention, but why this body of men, which includes within its fraternity, if not within its actual membership, such a man as Herbert C. Hoover, could reject a resolution endorsing the humanitarian work of the Near East Relief committee is something I cannot understand. This resolution may not mean anything to you, but it means something to these people over there, and to those men and women who are giving their time to rescuing these people. Certainly, the least that this body can do is to recognize and endorse that work, and do it unanimously and now.

PRESIDENT WELLS: Does anybody else desire to be heard? (No response.) The motion is, then, upon the adoption of this resolution, as read by Mr. Nye and seconded by Mr. Mackenzie.

MR. NYE: Mr. Chairman, I will ask for a rising vote.

PRESIDENT WELLS: I will be glad to have it. Those in favor of the motion will stand. (21 members arise.) Those opposed to the resolution will rise. (3 members arise.) The motion is carried, and the resolution is adopted and becomes a part of the report.

Your previous vote having been upon the adoption of the report of the Resolutions Committee, I will entertain a motion covering the adoption of these 25 resolutions.

MR. FRANKLIN: I move that the Convention adopt the resolutions as read.

PRESIDENT WELLS: The 25 resolutions?

MR. FRANKLIN: The 25 resolutions:

PRESIDENT WELLS: The 25 resolutions, excepting No. 8. Those

in favor of the motion to adopt these resolutions will signify by saying aye. (Chorus of ayes.) Contrary minded, no. (No response.) It is so ordered.

RESOLUTIONS

(1) Urging That The War Finance Corporation Resume Activities

WHEREAS, The sharp contraction during the past few weeks in domestic demand for American products has been so acute as to bring about a serious business situation and as to threaten even more unfortunate conditions, in agriculture and the commercial business, and the mining industry, and

WHEREAS, The European market has in the past under ordinary world conditions served in large measure as an outlet for the American producer, and

WHEREAS, Europe, although desperately in need of American raw material and food products today, both for the purpose of feeding and clothing its population and of giving them employment, is unable to do a large volume of business with the American producer by reason of the need on the part of the European buyer for long-term credits, and

WHEREAS, The War Finance Corporation, for the purpose of meeting the world emergency, was vested by Congress in March, 1919, with the power (which has not yet expired), either out of funds heretofore appropriated by Congress or out of funds to be obtained from the public by the sale of its bonds, to make advances on good security to American exporters and American banks to assist in the sale and exportation on credits up to five years in duration, and

WHEREAS, The War Finance Corporation did, up to May 10th. 1920, demonstrate its usefulness to the country by assisting in the exportation of American products on credits or from six months to five years, and

WHEREAS, The Secretary of the Treasury, in May, 1920, caused said Corporation to suspend such exercise of its powers in the preservation and stimulus of American export trade, although such powers still exist under the law, so that said Corporation is today inactive at a time when the American people have the most urgent need for its activity, and

WHEREAS, This meeting of the American Mining Congress, in Denver, Colo., November 15, 1920, is informed that said Corporation could resume the exercise of its said functions with reference to export trade if the Secretary of the Treasury would consent thereto; now, therefore, be it

Resolved, That this meeting does hereby most earnestly urge upon the Secretary of the Treasury that he now cause the War Finance Corporation to resume the exercise of its powers under Section Twenty-one of the War Finance Corporation Act to make advances in aid of the exportation of American products until such time as its said power in that behalf shall have expired under the law, or until the present dire emergency shall have passed; and further

Resolved, That the chairman of this meeting be and he is hereby authorized and requested to forward these resolutions to the Secretary of the Treasury, and a copy to Honorable William M. Calder, chairman of the Senate Committee on Reconstruction and Production.

(2) The Public's Interest In Patents of Invention

WHEREAS, Patents on inventions represent a monopoly granted fundamentally in the public's interests; and

WHEREAS, In the case of similar monopolies such as public franchises it long ago became evident that some form of public administrative machinery such as public service commissions was necessary to function in a way between the issuing of franchises and final appeal to the courts; and

WHEREAS, The necessity for somewhat similar general supervision of monopolistic elements in other lines of business has more recently been generally organized, as for instance, through the creation of the Federal Trade Commission; and

WHEREAS, The extension of these same principles to the study and guidance of public policy with regard to the interpretation and control of patent rights appears to have distinctly lagged behind that of other technical aspects of trade and industry; and

WHEREAS, a broad, intelligent and equitable public policy with regard to patents of invention is of vital importance to the whole mining and mineral industry; now, therefore, be it

Resolved, That The American Mining Congress appoint a committee on patents of invention to co-operate with the proper governmental bureaus and committees of other business and technical organizations in working out methods for insuring to the patentee, to industry, and to the public more comprehensive and adequate guidance of public education and policy in the interpretation of patent rights.

(3) **Protesting Against Abolition of Interior Department**

WHEREAS, more than one-half of the acreage of the United States west of a north and south line drawn through the eastern border of Colorado is now owned by the Federal Government; and

WHEREAS, The enactment of the Public Lands Leasing Bill creates a continued responsibility upon the Federal Government in handling the public lands of the West; and

WHEREAS, This vast expanse of territory contains more than 3,000,000,000 tons of coal, untold oil reserves, oil shale deposits of unmeasured value, water power measured in productive force many times greater in value than its oil, oil shale and coal reserves combined, and immense deposits of phosphate and other minerals, and

WHEREAS, The administration of these vast resources will require an increasing service from that department which is charged with the work of supervising the development of the Rocky Mountain and Pacific Coast Western States, namely, the Department of the Interior; and

WHEREAS, A proposal has been made looking to the discontinuance of the Interior Department and the creation in its stead of a Department of Public Works; now, therefore, be it

Resolved, That The American Mining Congress in its twenty-third annual session assembled in Denver, Colorado, November 15-19, inclusive, enters its protest against the abolition of the Interior Department and urges that the Interior Department shall be continued for the above weighty duties and as that department through which the mining industry of the United States shall function in Federal affairs.

(4) **Division of Mines and Geology**

WHEREAS, The importance of the mining industry of the United States has been better appreciated during the days of the war when it was realized that the production of minerals was essential to the carrying on of the nation's contests in the great world war; and

WHEREAS, The relative importance of mining is shown by the fact that during the year 1919 the railroads of the country received from the transportation of mining products approximately \$576,000,000 while from the transportation of manufactured products the total amount paid to the railroads was approximately \$168,000,000; and

WHEREAS, Those two activities of the Federal Government which have rendered most specific service to the mining industry are the United States Bureau of Mines and the United States Geological Survey, and

WHEREAS, It is desired that these agencies with such other agencies as render service to the mining industry shall be co-ordinated in a more effective way than is possible through the present organization of the Interior Department; and

WHEREAS, Senate Bill No. 4369, known as the Henderson Bill, provides for the creation of a Division of Mines and Geology within the Interior Department under an Assistant Secretary of the Interior to be appointed for that specific purpose by the President; now, therefore, be it

Resolved, That the American Mining Congress in twenty-third annual session assembled at Denver, Colo., November 15-19 inclusive, hereby expresses its approval of the principles contained in the Henderson Bill and urges the enactment by Congress of a bill embodying the principles therein contained.

(5) Bureau of Public Works

WHEREAS, The enormous burden of taxation which must be met by the industry of the nation requires greater economy in the conduct of governmental affairs, the abolition of all useless expenditures, the highest efficiency in every governmental agency, and the prevention of all duplication in every governmental agency, and the prevention of all duplication of service and expenditure; and

WHEREAS, The engineering and construction services of the Government are now lodged in various bureaus of the several departments; now, therefore, be it

Resolved, That the American Mining Congress in twenty-third annual session assembled in Denver, Colo., November 15-19, inclusive, hereby expresses its belief that a Bureau of Public Works should be created under the direction of which, so far as feasible, all engineering and construction features of the government service should be consolidated to the end that greater economy, higher efficiency, and more effective service shall be rendered, and all duplication of effort shall be prevented.

(6) Oil-Shale Experimental Station

WHEREAS, For the past several years the domestic production of petroleum has been insufficient to satisfy the domestic requirements of the United States, and;

WHEREAS, The deficit between domestic production and consumption of petroleum is estimated to be more than 100,000,000 barrels for the year 1920, making it necessary to import enormous quantities of oil from Mexico and to draw continually on our rapidly waning stocks of petroleum, and

WHEREAS, The present rate of increase of consumption of petroleum in the United States makes it appear that in the near future the nation will be largely dependent on foreign sources for its petroleum supplies, a condition which will place the nation in a dangerous position in time of war and tend to a loss of commercial supremacy in time of peace, and

WHEREAS, The nation's enormous deposits of oil shales represent a resource which, when properly developed, will give the nation a practically inexhaustible domestic source of petroleum, and

WHEREAS, The commercial development of these oil shales can be immeasurably facilitated by properly conducted scientific research, and

WHEREAS, The United States Bureau of Mines, a federal agency properly qualified to conduct such investigations, has requested of the Congress of the United States an appropriation for the construction, equipment and operation of an experimental station for such investigations, therefore be it

Resolved, That this, the twenty-third annual convention of the American Mining Congress does hereby approve of the plans of the U. S. Bureau of Mines for investigations on oil shale and further urges upon the Congress of the United States the necessity of favorably considering the appropriation requested.

(7) Opposing Federal Control of Bituminous Coal Industry

WHEREAS, For the past eleven months in certain sections of the United States, there has existed a shortage of bituminous coal, and

WHEREAS, It has been charged that certain tonnage of bituminous coal in certain sections of the United States has been sold by the producers at excessive and exorbitant figures, and

WHEREAS, Today in the minds of certain of our lawmakers exists a strong belief that government supervision and control of the bituminous coal industry is of earnest consideration, therefore, be it

Resolved, That the fuel supply problem, in so far as bituminous coal is concerned, is one of transportation and that the recent evils of coal speculation were the result of such transportation shortage, and should not be charged against the coal producers who were helpless in this emergency, and be it further

Resolved, That we feel that no condition exists in the bituminous coal industry, at this time, calling for federal control of the bituminous coal mines of our country, such as has been advocated by Senator Calder of the Senate Committee on Reconstruction and that, if the industry is left alone that the present co-operation between transportation, producers and labor will continue, and the present high tonnage production will be maintained which will necessarily clear away certain evils heretofore complained of.

(8) This Resolution, on Blue-Sky Legislation Was Rejected

(9) Against Pending Blue-Sky Legislation

Be It Resolved, by the delegates to the twenty-third annual convention of The American Mining Congress, held in Denver, Colo., November 15 to 19, 1920, that we are opposed to all proposed enactments now pending in Congress providing for so-called "Blue-Sky" legislation.

(10) The McFadden Bill

WHEREAS, The Government of the United States is justly committed to the gold standard; and

WHEREAS, The maintenance of a healthy gold mining industry is absolutely essential to the maintenance of a gold standard; and

WHEREAS, The gold mining industry of the United States is in deplor-

able straits, having almost ceased to function, and it is necessary to apply immediate measure for relief; and

WHEREAS, The McFadden Bill, H. R. 13201, offers the best present solution of the problem;

Resolved, That The American Mining Congress, in convention assembled, heartily endorses the McFadden Bill, and pledges its support to the measure, and urges a like support on the part of all our citizens who have at heart the maintenance of the gold standard and the common welfare of the country.

(11) Proposal to Amend Oil-Shale Section of Leasing Law

WHEREAS, in various parts of the West, particularly in the States of Utah, Colorado, and Wyoming, there exist bedded deposits of sandstone, limestone, and other rocks impregnated with bituminous or similar organic matter in solid or semi-solid form which may be utilized commercially and which are not oil shales, and

WHEREAS, No provision for prospecting, developing, or leasing such deposits is made under the existing laws; therefore, be it

Resolved, That The American Mining Congress recommend to the Congress of the United States that Section 21 of the Act of February 25, 1920 (Public 146), known as the Oil Shale Section of the Leasing Law, be amended so as to include all lands containing valuable deposits of bituminous or similar organic material in solid or semi-solid form.

(12) Bi-Partisan Tax Board

WHEREAS, The immediate need of the present moment is a definite fixing of the past tax liability for each taxpayer, especially for the war years, 1917, 1918, and 1919, and this need is emphasized by the present unstable business conditions; and

WHEREAS, This need for prompt final tax determination for the war years is so vital as to require immediate provision for final settlement of all unsettled cases for the years 1917, 1918, 1919;

Resolved, That The American Mining Congress recommend to the Federal Congress the enactment of a statute authorizing the President to appoint, by and with the consent of the Senate, a bi-partisan board of ten men, composed of lawyers, accountants, engineers and business men, who will sit for a period of one year, to pass upon and settle the cases of taxation arising during or consequent upon the war-time period of 1917 to 1919, both inclusive. The powers of such board to be of the broadest character; to summon witnesses, to compel the production of books and papers, to determine questions of fact and law, and to make assessments under both the general terms of the statutes and those special remedial provisions embodied in Section 210 of the Revenue Act of 1917 and Sections 327 and 328 of the Revenue Act of 1918.

The board to be given power to compromise taxes in cases where the need arises, and should be given a power which is not now provided for in our statutes, namely, to postpone the payment of taxes for reasonable periods, or to provide for their payment in installments where the board deems it necessary in order to prevent undue hardship on the taxpayer, requiring, of course, adequate security from the taxpayers to safeguard the interests of the revenue.

We strongly urge that the board shall be an independent body separate and apart from the Bureau of Internal Revenue and the Treasury Department.

The board should have authority to remand the case to the Bureau of

Internal Revenue, with instructions how to close it, or on the other hand to summarily dispose of the case and determine the final assessment.

If, however, a determination and assessment is made in the case of any taxpayer and an agreement in writing signed by the taxpayer and the board that such determination and assessment shall be final and conclusive, then (except upon a showing of fraud, malfeasance or misrepresentation of fact materially affecting the determination or assessment thus made) the statute shall provide that the case shall not be reopened or the determination and assessment modified by any officer, employee or agent of the United States, and no suit, action or assessment shall be entertained by any court of the United States.

The board to be a large board, one composed of ten members since the work it will perform may be divided into three or four general classes. The full board should not be required to sit in every case; three members should constitute a sufficient quorum to hear and determine the case, although more members may sit on complicated or important cases. The decision in each case should be subject to the written approval of a majority of the board, including those members who sat on the case.

The board shall have the power to refuse to hear any appeals that they may deem frivolous or vexatious. It shall prescribe rules and regulations for its procedure and the hearing of cases. Proper recourse to the courts to lie from any decision of the board, by any taxpayer dissatisfied with the decision of the board.

A sufficient appropriation should be made to compensate adequately the members of the board and to enable the board to employ an adequate staff of clerks and assistants. In addition it should have power to call upon the Bureau of Internal Revenue for such auditing or other assistance as it might require in any particular case.

We believe the energetic impartial operation of such a board, clothed with broad and ample powers suggested, would result in the settlement of practically all the cases of war taxation within a year, and leave the Department free to carry on its current work. The expeditious settlement and assessments accomplished through the medium of such a board would save in interest alone many times the appropriation needed therefor.

(13) Urging Repeal of War and Excess Profits Taxes

WHEREAS, The burdens created by the Excess War Profits Tax Law have become an excessive burden upon business and a deterrent to investment and the undertakings of new business enterprises; now, therefore, be it

Resolved, That we most earnestly urge upon Congress the immediate repeal of the War Profits and Excess Profits Taxes.

(14) Deduction and Depletion

WHEREAS, The Department of Internal Revenue, having under the 1909 Tax Law contended that the net proceeds of mines constituted profits and were all taxable without any deduction for depletion, basing such contention on the general practice of the mining industry at that time, and having succeeded in establishing that view in the courts; be it

Resolved, That it is the sense of this Congress that the rule now adopted by the Bureau of Internal Revenue in ascertaining the invested capital of mining corporations by which a deduction is made from profits for each unit of minerals removed since the commencement of mining operations down to the year 1916, regardless of actual conditions, actual facts and valuations of the mining property, is inconsistent and unfair; and it is further

Resolved, That this Congress take steps to present its reasons to the Bureau of Internal Revenue supporting an abrogation of such rule.

(15) Tariff On Metals and Minerals

Be It Resolved, By the American Mining Congress in Twenty-third Annual Convention assembled, that we favor the imposition at the earliest possible date of such United States custom duties or tariffs on metals, minerals, and metalliferous and mineral products, presented for entry into the United States from foreign countries as shall be sufficient to enable United States producers of like or similar metals, minerals, and metalliferous and mineral products, to meet such foreign competition and continue to maintain American standards of wages and living conditions.

(16) Revision of Freight Rates On Ores

PRESENTED BY CALIFORNIA METAL & MINERAL PRODUCERS' ASSOCIATION.
 COLORADO CHAPTER, AMERICAN MINING CONGRESS.
 COLORADO METAL MINING ASSOCIATION.
 IDAHO MINING ASSOCIATION.
 MONTANA MINING ASSOCIATION.
 NEVADA MINE OPERATORS' ASSOCIATION.
 NEW MEXICO CHAPTER, AMERICAN MINING CONGRESS.
 UTAH CHAPTER, AMERICAN MINING CONGRESS.
 WASHINGTON STATE METAL MINING ASSOCIATION.

WHEREAS, The continued production of metals and consequently the employment of large numbers of men as well as the profitable operations of the ore-carrying railroads are all dependent, to a very large extent, upon reasonable and living freight rates; and

WHEREAS, Due to the peculiar character of the rate structure under which the ores are moved, the rate advances of June 25, 1918, and of August 26, 1920, have resulted in placing an undue proportion of the burden of furnishing additional revenue to the carriers upon the metal mining, smelting and refining business; therefore, be it

Resolved, That in the opinion of this Congress immediate steps should be taken by the carriers and ore producers and shippers, jointly, to secure such readjustment and revision of the present ore rates as will permit of the continued operation of the metal mines and, at the same time, will give to the carrier a just and reasonable compensation for the services rendered by it.

(17) Approving Mining Congress Stand On Minerals Separation

WHEREAS, On November 12, 1918, the Federal Trade Commission commenced a proceeding against the Minerals Separation North American Corporation; and

WHEREAS, The American Mining Congress has lent its assistance in developing and presenting evidence in connection with this proceeding; now therefore, be it

Resolved, By The American Mining Congress in Convention assembled, with members and representatives present from every mining State in the Union;

That The American Mining Congress hereby indorses and commends the proceeding of the Federal Trade Commission against the Minerals Separation North American Corporation, and indorses and approves the action of the officers and counsel of The American Mining Congress in supporting the Commission's proceeding; and be it further

Resolved, That The American Mining Congress hereby pledges the assistance of its officers, its counsel, its chapters, and its members to assist the Federal Trade Commission in this proceeding.

(18) War Minerals Relief Appropriations

Be It Resolved, That The American Mining Congress urge the retention in *statu quo* of the appropriation provided in Section 5, of the Act of March 2, 1919 (40th U. S. Statutes, page 1272), until such time as further congressional legislation be enacted and the claimants under this said Act of March 2, 1919, shall have received the relief intended to be granted thereunder, and that the Executive Committee of the Board of Directors of The American Mining Congress are empowered to take such action in this behalf as they deem necessary and proper.

(19) Right of Appeal for War Mineral Claimants

WHEREAS, In Section 5 of the Act of March 2, 1919 (40th Statutes, page 1272), provision was made to pay producers of chrome, tungsten, manganese and pyrites net losses suffered by them in an effort to comply with the requests or demands of the Governmental agencies mentioned therein to produce the said minerals required by the exigencies of the war and appropriating the sum of \$8,500,000 therefor; and

WHEREAS, Under the constructions which have been placed upon this law, many claimants thereunder protest that they have not received the relief this law was intended to administer; and

WHEREAS, The present administration of this Act is approaching completion; therefore, be it

Resolved, That the American Mining Congress urges the immediate passage of H. R. 13091 by the House of Representatives, which bill has already been passed by the Senate, and been favorably recommended to the House by unanimous report of the Committee on Mines and Mining, and accords to claimants who have not received adequate awards under this Act the right of appeal to the Court of Claims from the decision of the Secretary of the Interior.

(20) Urging Passage of Timberlake Bill

Be it Resolved, That the American Mining Congress favors the speedy passage of the Timberlake Bill (H. R. 4437) for the protection of tungsten and its products, which has passed the House, and is now pending upon the calendar of the Senate, with a favorable report from the Senate Finance Committee.

(21) To Prevent Dumping

Be It Resolved, That the American Mining Congress support legislation to prevent the dumping of the products of foreign mineral industries on the shores of this country at prices so far below the cost of domestic production as to make competition of domestic mineral industries impossible.

(22) Better Information on Mines and Quarries

Resolved, By the American Mining Congress in convention assembled, that we favor and will co-operate with such joint action by the Federal Congress, the Bureau of the Census and such other governmental agencies as may beneficially participate therein to the end that more informative data than those now available be collected, compiled and published by the national Government, and that if found necessary to accomplish this result, a special census of mines and quarries be authorized and made.

(23) For Reduction in Freight and Price Charges

Be It Resolved, That in order to bring about a return to normal conditions as rapidly as possible, it is the judgment and request of the American Mining Congress that the manufacturers and sellers of mining supplies and equipment reduce prices, and public carriers reduce freight charges in accord with the present economic trend, to the end that the mining industry may resume its normal activity.

(24) Resolution of Appreciation

Thanks were given to the City of Denver and State of Colorado, their respective officials, the press, and all others who assisted in facilitating the business of the Convention of the American Mining Congress.

(25) Armenian Relief

As appears on page 51.

The next order of business is a discussion of plans for the twenty-fourth Annual Convention. It should be understood in advance that this is a mere discussion, as the assignment of the place for the next annual meeting is left to the directors; but discussion at this time and presentation as to the advantages of their cities is in order.

A MEMBER: I would like to offer a resolution.

[Reading resolution that the next convention be located in some city east of the Mississippi River easily accessible to all points, and recommending Atlantic City, N. J.; Chicago, Ill., and Pittsburgh, Pa.]

PRESIDENT WELLS: I think that should be in the form of a discussion, instead of a resolution.

THE MEMBER: The resolution is merely to get it before the Convention, the idea being that some of these cities offer more advantages.

PRESIDENT WELLS: You have already accomplished your purpose.

ASSISTANT SECRETARY BURNS: We have had three invitations, as stated, one from Atlantic City, and we have a number of invitations which are too long to read. I might state that I visited Atlantic City, after receiving these invitations from the Atlantic City Publicity Bureau, the Chamber of Commerce of Atlantic City, and the Atlantic City Hotel Men's Association. I find that there is a very fine exposition building on the pier, with something like 68,000 ft. of space, advantageously located, with plenty of hotel accommodations, and they have promised not to increase their hotel rates.

End of Sixth Session

PRESIDENT WELLS: Is there any other business to be presented? If not, I want personally to thank you for the loyal support that you have given me, for the friendly feeling that I have been able to experience in calling upon many of you at various times to help the work of the Congress, and to thank you in particular for so cheerfully coming here to

Denver, because I really had a good deal to do with having the Convention here this year, as other places, I might say, were rather slow about guaranteeing anything in the way of expense funds, and so on, coming here where a number of us were at home and could put the thing through. I do appreciate very cordially that so many of you have come here.

And now I turn you over, and with you this gavel, to the new president, Mr. Loring, and I beg you to support him even more loyally than you have me, and to accept from me the assurance that Mr. Loring will carry you just as far as you elect. (Applause.)

MR. W. J. LORING: Mr. Buckeley Wells, ladies and gentlemen: I am not going to make a long speech. The hour is getting late. I will simply say that it will be my endeavor to do the best that is in me, and at the same time follow in the successful footsteps of my predecessor. I am going to ask all members of the American Mining Congress to assist me in my endeavor to do as well, if not better, than Mr. Buckeley Wells has done. I wish to thank you for your confidence, and I shall put my heart into the work, and with your assistance, I think we can go forward rapidly. I think you. (Applause.)

GOLD CONFERENCE

American Mining Congress

TUESDAY, NOVEMBER 16, 1920

Mr. H. N. LAWRIE, economist for the American Mining Congress, presided.

CHAIRMAN LAWRIE: Ladies and gentlemen: An able address

Binding our Financial Wounds

was delivered last night on the subject of binding up the wounds of the war. The maintenance of a normal gold production in this country is a very essential part of any program to bind up our financial wounds, and thus safeguard a return to normal financial conditions. For five years the economic pressure has been operating to retard gold production, and no remedy has been applied. We have yet to go through a period which, according to the opinions of many economists, may be ten years and may even extend further, before the dollar of 1914 will have regained its purchasing power, in terms of commodities. With that in view, we are approaching a period where the economic stress will probably not be any less for over the next five-year period than that which has been sustained by the gold-mining industry during the period of 1915 to 1920.

How Price of Gold was Fixed

Some people have asked whether the price of gold is fixed, and there seems to be an indistinct idea as to why that should be. Briefly, there are 480 grains of gold in an ounce, and by United States statute there are 23.22 grains of fine (pure) gold in the standard dollar. Dividing the number of grains in an ounce by the number of grains in a dollar, the quotient obtained is 20.6718 dollars, the price of the fine gold ounce. There is no question that the price of gold has been arbitrarily fixed by the Government. Also there is no question because of the fact that the price of gold is fixed, gold does not respond to the law of supply and demand; nor does it take on the market conditions that prevail with regard to the production of and consumption of any other commodity.

It is my purpose to review briefly the exact loss, based upon the production of new gold in the United States during the past five years, due to the depreciated purchasing power of the dollar, assuming that had gold been free to respond to the law of supply and demand it would have risen at least to the level of other commodities in the country. That is a fair assumption, because the industrial arts are consuming more than

is extracted from the mines. Naturally, had the gold throughout the world been free to respond to the law of supply and demand, it would probably have been at still higher level than all other commodities.

[Mr. Lawrie then showed and explained two charts that he had prepared, which will be found on page 615 of the Proceedings, under the head of 'The Industrial Gold Consumers' Subsidy.']

CHAIRMAN LAWRIE: You will be particularly interested in listening to the review of Mr. George E. Collins of Colorado, entitled 'The Condition of the Gold Producer in Colorado.'

[Mr. Collins' paper will be found on page 625 of the Proceedings.]

MR. PERKINS: Are not bankers buying gold in England at \$28 an ounce at the present rate of exchange and making a large profit?

MR. COLLINS: No, I do not think so. I will ask the Chairman to answer that question, because it needs a rather involved explanation.

Premium for Gold in England

CHAIRMAN LAWRIE: I cannot figure that at all. The exchange premium is based already upon the discount and sterling exchange. The price paid for gold in London is a direct accounting of the exchange discount. If a man had American dollars and paid 117 shillings [\$28 normal exchange] an ounce for gold in London, brought it to New York, and sold it for dollars, the transaction would wipe itself out because he would have to pay transportation costs and insurance.

MR. PERKINS: That is practically \$5 on the other side.

CHAIRMAN LAWRIE: No, it is not five dollars; it is not dollars; it is still pounds when you are using it on the other side.

MR. PERKINS: The pound is worth five dollars.

CHAIRMAN LAWRIE: No, I should say not. I do not see how you base American dollars in London for pounds on the basis of the par exchange. You cannot buy a pound sterling at \$3.35 and expect to get \$5 for it. When you make a transfer from sterling to dollars, you come back to the point of origin.

MR. H. W. SEAMAN: You can buy all you want in the United States Treasury for \$20.67 an ounce, notwithstanding it costs \$30 to \$35 to produce it.

CHAIRMAN LAWRIE: Not at five dollars; it is a pound still.

MR. PERKINS: That is the point I make.

CHAIRMAN LAWRIE: Mr. Milnor Roberts, Dean of the College of Mines, University of Washington, who has had an extended experience with gold-mining conditions in Alaska, has prepared an interesting view of those conditions, but he is unable himself to attend. Mr. Horace F.

Lunt, the State Commissioner of Mines of Colorado, will present Mr. Roberts' paper at this time.

Alaska and Oregon

MR. LUNT: Mr. Chairman, ladies and gentlemen: The title of Mr. Roberts' paper is 'Gold Mining Conditions in Alaska.'

[Mr. Roberts' paper will be found on page 632 of the Proceedings.]

CHAIRMAN LAWRIE: Gold-mining conditions in Oregon probably vary from those elsewhere, and Mr. H. M. Parks, Director of the Oregon Bureau of Mines and Geology, will give us a brief review of the present conditions in that State.

[Mr. Parks' paper will be found on page 645 of the Proceedings.]

CHAIRMAN LAWRIE: I have received a resolution adopted by the Chamber of Mines and Oil of Los Angeles, Cal. It is a direct endorsement, and as it is brief I will read and put it into the record:

"WHEREAS, the production of gold in the United States is steadily declining because the margin between the cost of production and the fixed price of gold is being absorbed by high costs of labor and supplies, and,

"WHEREAS, gold mining has ceased to be profitable in many cases, and this fact has discouraged prospecting and exploration and has even compelled many properties to close down, which may be expected to result in permanent injury to such properties, and

"WHEREAS, the gold standard has been and will be further imperiled unless action is taken to stimulate the production of gold,

"NOW, THEREFORE, BE IT RESOLVED, that the Chamber of Mines and Oil, representing the mining industry of the Southwest, indorses the McFadden Gold bill (H. R. 13201) and urges upon the Congress of the United States that it enact this legislation which provides for the protection of the monetary gold reserve by maintenance of the normal gold production of the United States, and creates the machinery by which the consumer of commodity gold in manufactures and the arts may pay an excise covering the cost of its production,

"AND BE IT FURTHER RESOLVED, that the duly authorized delegates of the Chamber of Mines and Oil to the National Gold Conference of the American Mining Congress Convention at Denver, Colo., November 15-20, 1920, be instructed to present this resolution, advising the Conference of its adoption."

Views of Another Economist

CHAIRMAN LAWRIE (continuing): Here is a letter that was written by Prof. Carl C. Plehn, head of the Department of Economics, University of California. Many of you will recall having listened to an interesting address by him before the Gold Conference at Reno, Nev., in September, 1918. He regrets that he cannot be with us on this occa-

sion, but this is his statement: "I wish I could convey to the Convention one thought: Gold money is sound money. None other is sound. By fostering this sentiment your Convention can do the country a great service."

Committee Suggested

In order to facilitate the business of the Gold Conference, it may be well to appoint a committee for the consideration of whatever matters this Gold Conference may want to recommend to the general convention for adoption, and to draft the same. If the gentlemen will be kind enough to serve, I would like to appoint Messrs. H. W. Seaman, W. J. Loring, and E. P. Mathewson. It is a subject we should debate at some length after listening to this address, as to what action this Convention may take which will more facilitate the consideration of this relief legislation; and then again the formulation of it is another matter requiring some little detail. At the last Convention we had a similar committee, and it reported back to the Gold Conference. The action was confirmed there, and the resolution was turned over to the General Resolutions Committee of the Convention of the whole and received its endorsement there, so I presume that the machinery will be the same this year as last.

No other speakers being available at this moment, we will adjourn until the afternoon session.

The meeting convened at 2 o'clock on November 16, 1920, Mr. E. P. Mathewson presiding.

CHAIRMAN MATHEWSON: The meeting will come to order. We are expecting Governor Emmett Boyle of Nevada to speak this afternoon. In the meantime, Mr. B. C. Yates, representing the gold industry of South Dakota, will give us a talk.

Mining in South Dakota

MR. YATES: Ladies and gentlemen: The subject assigned to me reads like this: 'What Failure Means to South Dakota.' In the first place, I want to say that I am not going to tell you what failure means to South Dakota, because I do not believe that the gold miner has ever admitted failure. Perhaps the best way to show what failure means to obtain an increased price of gold in South Dakota is to present the true conditions of that State with the more apparent reason for those conditions. Briefly stated, the gold-mining industry of the Black Hills of South Dakota is in a state of disintegration, not because the mines are becoming exhausted, but because the price obtained for the gold when extracted does not pay the cost of production. The Black Hills do not comprise a large area—about 100 miles square—and the gold-producing section is only a small part of this area. Four years ago there were from 10 to 12 producing mines; now there are only two operating. I speak from knowledge in one case; and I think I speak also with correct-

ness with regard to the other, that it is operating simply to keep its organization intact, hoping that in the near future conditions may change or will change so that it can receive some profit from operations.

Prospecting is at a standstill, and only two or three mines in the development stage show any signs of activity. The population of the two largest mining towns of the Hills—Lead and Deadwood—has decreased from 12,045 in 1910 to 7,415 in 1920, and the population of Lawrence County, which is the principal mining section of the Hills, has 6,666 less people in 1920 than in 1910.

[Mr. Yates' paper will be found on page 639 of the Proceedings.]

MR. SEAMAN: Mr. Chairman, I wonder if it is not in order at this time to present the resolution that has been prepared for the consideration of this body, so that it may or may not be presented to the general Resolutions Committee. With your permission I will read the resolution.

CHAIRMAN MATHEWSON: Just read the resolution. There is no action to be taken by the meeting.

Resolution Endorsing McFadden Bill

MR. SEAMAN: In the preparation of this short resolution, we aimed at brevity, for the reason that everybody knows what the McFadden Bill is, rather than an extended discussion of the present conditions:

"WHEREAS, the gold-mining industry of the United States is in deplorable straits, having almost ceased to function, and it is necessary to apply immediate measures for relief; and

"WHEREAS, the McFadden Bill (H. R. 13201), offers the best present solution to the problem;

"RESOLVED, that the American Mining Congress, in congress assembled, heartily endorses the McFadden Bill, and pledges its support to the measure, and urges a like support on the part of all our citizens who have at heart the maintenance of the gold standard and the common welfare of the country."

CHAIRMAN MATHEWSON: It is not often that the mining engineer becomes prominent in politics. He is usually too busy looking after his employer's interest to take an active part in that business. Within recent years, mining engineers have been forced to take part in politics, because they have found that those engaged in every other industry have taken an active part in politics, and why should the engineer, particularly the mining engineer, take a back seat? So, of late we have had a few instances of successful mining engineers becoming successful politically. We have with us today one of the most successful mining engineers in this country. He has also shown that mining engineers can be a success in political matters, and I am going to call on Governor Boyle of Nevada to tell us something about the gold question, which he has studied deeply, and of which he can speak feelingly. (Applause.)

Views of an Engineer and State Governor

GOVERNOR BOYLE: Ladies and gentlemen: This is a totally unexpected pleasure upon my part. I arrived a few minutes ago on the train, and was rather under the impression that I might be given the privilege of speaking from the floor and that perhaps would not be called to the pulpit. At a matter of fact, I would prefer, if it met with the pleasure of this audience, to be permitted to speak at greater length on the gold question later on.

I have had the good or bad fortune to be connected with many of the enterprises which had for their purposes the relief of the gold-miners' situation, and I have come to view the thing from a good many different angles. I have seen it likewise from the standpoint of a public official, during the period in which I was a member of the Gold Production Committee of the United States Treasury, formed immediately following the armistice. I might say also that I have come to this conclusion, that the possibility of making an address to a group of gold miners which will meet their entire approval of such group is a difficult task. I find that the conversion of men who are already convinced in their minds that a gold subsidy, gold premium or bonus, does not call for any special form of ingenuity. I have discovered, however, that the whole question of gold is so intimately related, and is so inter-related with the question of finance and the question of credit, as to call at this time for a period of propaganda. We have, happily, passed from the consideration of the problem from the bankers' standpoint. We have, I believe, a case where the economists of the country generally, wedded to the theory of the so-called quantity theory of money, may easily enough influence the better sentiments of the Nation as a whole to the point where, unless the gold miner can indicate his rights in absolutely unanswerable fashion to sell that portion of his product, which is not used for monetary purposes, on a commercial basis, that the bankers have the better of the argument.

Bankers to be Converted

This is not a pleasant thing to say, but it is nevertheless true. We are called upon, not to convert ourselves to something that we already believe; but rather to convert bankers to the proposition, or theory, that certain alterations in the former habit of gold in the markets of the world may be made without affecting credits; and in consideration of the proposition from that standpoint we must look at it through the banker's eyes, and from the standpoint of the man who is at once the public book-keeper and a man who is at the same time the custodian of the credit of the Nation. We cannot charge him with bad faith to the gold industry when we consider his responsibility. He has found innumerable instances where things that appeared upon their face to be innocent in the extreme, have had serious effects upon the national credit, on international relations, and on domestic customs. I would say that were this gathering to devote itself henceforth to the assimilation of the sort of facts that would help to disprove the theory that the alterations of the functions of gold would have no effect upon credit, we might present a

better and more united front to the opposition, which will inevitably be found in any enterprise that touches upon the delicate question of credits. With that in mind, and with your permission, I would like, for the present, to hear what may be said, and if in the course of the discussions it appears possible for me to introduce anything of a nature that might be used as a suitable and legitimate argument in the presentation of our problems to the custodian of the Nation's credit, I would like the privilege of appearing before you a second time. I thank you very much.

CHAIRMAN LAWRIE: There is in the audience one of those unrepentant sinners; we want to give him a chance to be heard; perhaps we can convert him, and I am going to call upon Mr. T. A. Rickard, of San Francisco, a cosmopolitan gentleman, a mining engineer, now retired from the profession, but permanent in the literature of the profession, to give us a few words from his point of view, and see if we cannot bring him to the means of grace.

Views of a Journalist and Engineer

MR. RICKARD: Mr. Chairman and gentlemen: I am not a sinner; I am only an ignorant man; and I am not a cosmopolitan; I am an American. I approach this point of the subject from the viewpoint that concerns all of us. Naturally I was much interested in listening to Governor Boyle. I was reminded of an occasion at the beginning of this year when at a similar Convention at Seattle we discussed this question of aiding the gold-mining industry by some form of legislation. Governor Boyle was the hero of the occasion; he was the big man of that convention—I say that sincerely—he carried the Convention with him as he can carry most conventions when he wants to. Just now he did not seem to be particularly anxious; he seemed to have taken a little of a more intellectual attitude on the subject, and I sympathize with him; and that is exactly my position. I am here as one of us; we are all actually interested in gold mining; we want to see it assisted; and I venture to say to you as a technical man, a scientific man, it is a good thing if we can ventilate some of the apparent difficulties that are arising from the study of this subject. If I make any suggestions this afternoon, it is in the hope that such a man as Governor Boyle will be exactly the one who will clarify my doubts in the course of this Convention. I have no desire to speak again, and I am delighted to think that he will, and that we will then be able to hear some of the troubles that come before us. At Seattle, we were practically unanimous in our sympathies with the Governor and his friend, Mr. Fletcher Hamilton of California; I felt in harmony with them. At the end of that Convention we were addressed by Mr. Frank Vanderlip, who made a good appearance. He spoke well and courteously, although 99% of the audience were hostile to his view; but as I listened to him, as able a financier as he is, and an authority on the subject, I felt that he did not know much about it. I honestly believe it is a subject of such complexity, owing to its international aspects, that not many of us know much about it, and I am among those who know less about it; and I am here to learn, and that is why I am going to pro-

pound one or two questions. Mr. Vanderlip, as you will recall, made the statement that if we were to increase our gold production, it would have a bad effect; in fact, it would delay the deflation so necessary, because by the Federal Reserve Act the increase of, say \$50,000,000, in the production of gold, would authorize just that proportionate amount more paper.

Gold Production and Paper Money

Of course, that argument seems to me trivial. Supposing we increased our gold production \$50,000,000, the amount of paper legally issuable would only be \$125,000,000, and that is only a small sum of money for the United States. In all these matters we need some perspective.

This morning I felt some sympathy for the gentleman from Central City, a place where I used to live, and whose plight at this moment I regret. I had keen sympathy with my friend Mr. Collins when he dwelt upon the gold-mining industry of Colorado, a State with which I used to be officially connected; and when this gentleman from Central City asked that question I felt like smiling, but I still felt he was doing right in asking this question. What he asked indicated what he thought, and I have no doubt a great many others think likewise. He thought that Great Britain is paying a premium on gold. I have no doubt that many of you some time or other have thought, "Well, if Great Britain is paying a premium on gold, Uncle Sam can do it, and we ought to be protected and cared for and assisted; this is a great industry, and if one country does it, we are rich and we can do it." Of course, that is absolutely nonsense. Great Britain is not paying any premium. All that Great Britain did after the close of the war was to remove the embargo on the free-trading gold on the export and import gold. As soon as that embargo was raised, the artificial prop was removed from the pound sterling, and it went to the discount where it properly belonged, in consequence of the shifting of financial credit. When a man in South Africa sells his gold, he is only getting a premium in a sense that he sells it for a depreciated currency in terms of gold, and he gets his 128 shillings. As long as he buys his machinery and supplies and pays for it in shillings, of course he has the advantage of that; but as soon as he begins to trade outside he finds that it will take the whole of the 128 shillings to buy an ounce of gold, or the equivalent in American exchange. If you were

How the Premium Works in Other Countries

mining in Italy—there are gold mines in Italy, or there used to be in northern Italy—you would get an enormous premium for your gold because the lira is only worth four cents; consequently your gold would be worth more than it is in London and about five times what it is worth in New York. So long as your business activities were confined to Italy you would receive the benefit of it, and it would be a benefit because the cost of other things, including your labor, in Italy, has gone up as much relatively as the cost of gold. If you were mining in Germany, you would have an enormous premium. This premium is simply a difference in exchange, and when people talk about the British gold suprem-

acy, why, it is rather pathetic. Of course, in Great Britain, and countries under the British flag, they are producing a great part of the gold of the world, but the power of their supremacy is measured by the fact that the pound sterling is worth only \$3.50 of United States money. Supremacy! Why, the United States dollar today is supreme as it never was in history. That argument is ridiculous; and, moreover, you have to remember that whether the gold is produced under the British flag or any other flag, the fact of gold being produced in a country does not mean that it remains in the country of its origin. The gold produced at Johannesburg, and the great mining regions of South Africa, is coming here. If we produce \$50,000,000 worth more of gold tomorrow, where it would go depends upon the tide of commerce. I hope Governor Boyle will correct some of the deficiency of my knowledge to present this aspect of the case. It is one of the problems that confronts us, and I hope he will make it clearer.

For the rest, gentlemen, I will only suggest this, that during the war we learned to think nationally. We have also begun, in a measure, to think internationally. Sometimes we would like to cease thinking internationally, and we would like to forget some of the other fellow's troubles, feeling that we have enough to engage in; but I would submit to you, and to those who are better versed in these matters—to my friend, Mr. Lawrie, whose scholarly statements this morning I listened to with deep respect—that that is a question, which is, essentially, an international question, and that is what makes it so very popular. I believe I refused to be called a sinner; I even would not accept the idea that I need conversion. I may be a doubting Thomas.

MR. SEAMAN: Mr. Rickard, I would like to ask—you seem to have a special knowledge of the South African situation—isn't it a fact that Great Britain did encourage her gold miners by forcing the sales of materials they used? For instance, manufacturers were forced to sell cyanide at 12 cents, while we were paying 30 to 35 cents.

MR. RICKARD: At the beginning of the war Great Britain took steps to prevent the collapse of gold mining in South Africa, and did see to it that shipments of cyanide were made available for the mines.

MR. SEAMAN: Didn't they also take care of their miners, who otherwise would have gone to war; and didn't they keep them at home, where as we didn't take that precaution?

MR. RICKARD: I really don't know; I wasn't here.

CHAIRMAN MATHEWSON: You have heard from a sinner, and you have heard something about the doubting Thomas; there may be a few more doubting Thomases in the place, and we would like to hear from them. We haven't any more speakers on the regular program; but we want to have a good discussion on this question.

MR. TAYLOR: Mr. Chairman, I am not a doubting Thomas; I don't want to be put in that class, but I might ask a question: The principal

opposition to the McFadden Bill seems to come from the banker. I don't know enough about credit, but I think that we all know this: that during the war every bank—every national bank—has doubled its divi-

Profits in Banking

dends. I know of two banks that I have a lot to do with have doubled theirs, and have added considerably to their surplus. The Federal Reserve Bank, last year, I think, made \$100,000,000. and I have heard several good business men say recently that it was only a question of a few years until the Federal Reserve owned all the money in the United States; that they were making it all. Now, as long as a banker has got a pretty good thing, and the gold miner has lost pretty much his all—the banks are using what gold he still produces, keep it in the Federal Reserve, refuse to let us have it in circulation, and issue paper dollars—as long as they are making 100% more than they ever did, isn't it possible that they may, not intentionally, but unintentionally, influence the banker to advise us to let the gold standard alone? (Applause.)

CHAIRMAN MATHEWSON: Is there any banker here present who could offer us a little suggestion on this point?

Bankers not Unanimous

In regard to this matter, I inquired of some bankers in New York City and St. Louis, and I do not find a unanimity of opinion on this subject. One said we had too much gold; another said we did not have gold enough. Now, if they are not agreed, although they are making so much money on it, there is room for the miner to doubt whether they are right in their contention; but I do not think all banks, by any means, all of the bankers, are in favor or, rather, against the McFadden Bill. This Bill, as I recollect it, has been twice recommended by the American Bankers' Association for endorsement, and once turned down. I have been given to understand that there is some little personal feeling in the matter; that it is not all a question of right, but there is a little personal animosity between some of the gentlemen on the bankers' committee and the gentlemen who are backing the Bill, so that we do not get at the truth of the matter from the Bankers' Association. We want to get enlightenment, however, and I am going to ask Governor Boyle a little later to enlighten us on this topic.

Are there any more of those present who want to ask questions, or to offer any suggestions on the question?

The Secretary Concisely Explains the Bankers' Position

MR. CALLBREATH: Mr. Chairman and gentlemen: It seems that there is a good deal of misapprehension about the attitude of the bankers of America upon this character of legislation. As your Chairman has just said, two separate national meetings of the American Bankers' Association have passed a resolution unquestionably favoring the aid of the Federal Government in the stimulation of the gold-mining industry. Both of these annual meetings of the Association recognized the fact

that gold was the basis of our credit, and that we could not have too much gold. They recognized, as we recognize, that this country, having one-third of the world's gold supply, maintains its currency at par. England, having the next amount of the great nations, comes nearer maintaining its currency at par than the other countries; and just in proportion to the amount of gold which the foreign countries own, just in that proportion is their credit and currency depreciated in value. Therefore, they recognize that there should be some proper aid given by the Federal Government for the stimulation of gold production. After those two annual meetings had passed that resolution, then consideration was focused upon the McFadden Bill in its present form, at that time the theory of aid not having been developed. The matter was then referred to the legislative committee of the American Bankers' Association, and it reported in favor of the Bill in its present form. One of the departments of the Association voted unanimously for it. It is not to be wondered at that there are many doubting Thomases among the bankers. The banker is a conservative; he does not loan his money to you unless he is absolutely sure that he can get it back again, and he does not take very many chances. His business is to be conservative; and when there is a question in his mind, even a remote possibility, that there might be something in this thing that was revolutionary, rather than undertaking to study out the question—and it is not an easy question to understand—he says, "Well, we will just let well enough alone;" and upon that basis there has been some opposition. Even with that conservative feeling upon the part of the bankers, their Association, through its legislative committee, approved the enactment of the Bill. Thereafter there was a flutter: A few people upon the inside objected to this procedure; men, whom I fear, had not given the study to the subject that they ought to have given it before acting; or, perhaps as your chairman has intimated, were controlled by a personal resentment of some sort, and I would rather not bring out that point, although I am thoroughly familiar with the facts—a committee was appointed which undertook to bring in a reverse report. That was brought before the last session of the Association, and it was known that the question was to be considered by them.

Truth of the Bankers' Reports

We want to know how the bankers of the Nation were acquainted with the fact that the McFadden Bill was to be considered at that meeting. This adverse report of this special committee was brought before the Association a week ago [early in November, 1920] in Washington, and presented to the Convention; but it was not approved; on the contrary, the answer and reply to that report given by Congressman McFadden was referred to that report to another committee upon policy, and therefore, instead of the bankers going upon record as opposed to this bill, they went on record as refusing to approve an adverse report. So it seems to me we have every reason to believe that the bankers of the Nation are thoroughly imbued with the idea that the gold reserve of this Nation must be maintained, that our supremacy in the world's finance and industry

are based upon that gold reserve, and therefore every effort should be made to sustain that gold reserve. I believe that in the end, the American Bankers' Association and all of its members, with the exception of a few people who cannot be convinced of everything, will be our best aid in securing the enactment of the McFadden Bill at the coming session of Congress. I thank you.

MR. COLLINS: I would like to ask a question arising from Mr. Rickard's remarks. He truly said that the American dollar was now dominant in the finance of the world: I believe that is true; is it, however, true that our paper dollar is everywhere at par?

GOVERNOR BOYLE: Yes, and above par.

MR. COLLINS: Everywhere?

GOVERNOR BOYLE: Yes.

MR. COLLINS: I was informed that about six months after the armistice—on authority that I believe to be absolute, and which I will be glad to give in confidence to Governor Boyle—that the American dollar was at a discount, fluctuating between 20 and 25% in China, which was the reason for the shipment of considerable amounts of gold to China at that time. Supposing that the American dollar is everywhere always at par, why do we have to export such large quantities of gold all the time?

Gold Preferred to Paper Dollars

It is obvious the reason is, that gold is preferred to our paper dollars in the countries where we are shipping gold, particularly to South America and the Orient. I believe it is entirely true that the American paper dollar stands far ahead of the paper of any other nation; that is naturally to be expected. The next nation in credit is Great Britain, and I believe it to be true, as I stated this morning, that the reason for that was that Great Britain was able, by the use of the constant flow of gold from her possessions, to maintain her credit. Whenever the British credit dropped—that is perhaps not so now, but up to a year ago when British exchange dropped—large shipments of gold were made over here, which helped. All other nations are much behind for the same reason, because they have not the gold in case of need to aid their exchange; but taking the world as a whole, it has issued quantities of paper money which is out of all reasonable proportion to the gold backing that they have. Generally speaking, the exchange of those nations in the international market is proportionate to the percentage of gold backing that each nation possesses. I have referred to British exchange: The entire difference between British, and say German exchange, does not depend on the amount of gold that is available to send in case of need; part of it is due to greater confidence in British stability as compared with Germany. The difference between English and French exchange today, the main part of it, cannot be attributed to anything else except the fact that when the British need to pay their balances here [in America] they can do more than can the French.

A VOICE: As a farmer, I am glad I am here.

CHAIRMAN MATHEWSON: Name, please?

A VOICE: I am a stranger here, but some of my friends have been careful to send me a lot of financial literature which I have looked over, and would like to ask a question. It seems to me that all the gold that has ever been in the United States has been three billion dollars, and all our paper money, our bonds, and our credit is based on that gold; but I have not found out how much we have shipped of that three billions. It must be a lot, because we cannot do business in a great nation like this on three billions. If we have gold to that amount, and issue about seventy-five billion dollars, what is the value of the gold dollar?

MR. LAWRIE: Mr. Chairman, I might be able to answer that more directly by citing the gold cover that is given by the Federal Reserve Bank, which is 46.6 cents of gold to every Federal Reserve note in circulation. The Federal Reserve Act holds that a 40% gold cover was proper, so that leaves a surplus of 6.6% of gold at the present time back of the Federal Reserve note for every dollar.

GOVERNOR BOYLE: There are two or three matters that apparently may be well to consider by this Conference in relation to the functions of the gold reserve. The gold reserve of this country is established by law. The Federal Reserve Act requires that it must be maintained at 40%. The whole question of the gold reserve is a psychological one.

Gold Reserve Against Notes in England

The Bank of England, without any restrictions whatever, and the other two banks of issue in England, have, by agreement, maintained a gold reserve that has fluctuated between 54%—they have permitted the gold reserve to go as low as 30%. The gold reserve, in effect, is this: It means that a sufficient amount of gold must be held in some reservoir to permit of the redemption in specie of any outstanding demand—paper of banks of issue, or of the Government. Under those circumstances, the experience of any community determines what the gold reserve ought to be. If it is found that people who have demand-paper, demand gold in place of paper, then a 70% gold reserve is necessary; that is, if all the people who have demand-paper, demand gold. Then a 70% gold reserve is necessary in order to maintain the parity of the paper in circulation. On the other hand, as institutions have become old and well known, and have had certain governmental backing, such as that supplied to the Bank of England since 1694—I believe it was first chartered—a lesser amount of gold serves to satisfy the requirements of a satisfactory gold reserve back of notes of issue.

Gold Essential During War

One of the points I hope to bring out is the idea that the gold reserve essentially needed in time of war, essentially needed in times of peace when the credit of the nation is affected by adverse trade balances, is a

matter that depends almost entirely on national and international trade. It may be interesting to know that many of the South American countries have no gold standard, issue no gold-secured paper, and do not have to issue it, because they don't require it; but those countries whose adverse trade balances must maintain their exchange paper on the parity of the knowledge possessed by everyone with whom they deal, then they must have gold in the amount of the face of the paper; so the whole question of the gold reserve is a psychological one. I think, if I recall correctly, that in Austria, all banking agencies, and notes of issue agencies, are able to maintain their exchange paper on a parity of 16% gold production reserve, or gold reserve. In France, the gold reserve was maintained at about 40%, or a little over 30%. It may be an interesting fact to know that the gold back of the United States Federal Reserve notes, at the time of the outbreak of the war, was 98½% of the total issue; and the question of how much gold must stand back of those notes is a matter that is related directly to the amount of confidence which the public, domestic and international, has come to repose in the credit of the issuing country, or the issuing institution.

Three Distinct Views Held by Bankers

As a fact, the argument against the expansion of our gold industries in the United States and in the world is not ill-founded. I tell you this with no expectations of applause. It is one of those points that must be employed in our consideration of this proposition, if we are going with it properly before the bankers. I have found that there are three separate and distinct classes among banks. Those who believe firmly in the proposition of continually adding to the gold reserve; those who do not believe in adding to the gold reserve and who confine their convictions in the utterances of the economists; and those who say that the final settling upon the increased gold supply of the world is the one cause for the increased prices which prevailed from 1890 until 1915, during which period a careful analysis indicated that commodity prices generally had risen 48%. The third group—a small one—after eliminating all of the causes that might have contributed to high prices, determined that the quantity of money in circulation, bearing no longer on the amount of business transacted, had something to do, if it was not entirely the controlling factor, with the purchasing price of that money. Going further in their analysis they found that the world produced during the last 430 years, or thereabouts, approximately \$16,500,000,000 of gold, and in the last 30 years of that period about \$8,000,000,000 of gold. In other words, during the last 30 years we have produced half of the gold extracted in the last 4½ centuries. These bankers are not going to be waived aside by any processes of passion and class argument. The firm conviction of the second group of bankers—who depend upon the utterances of economists, who dwell upon the so-called quantity theory of money—is that their views have to be met by the type of argument which takes into account the historical effects of alterations of standards and domestic credits. Those men may be reached by argument.

Purchase Power of the Dollar

We had the pleasure in Seattle of listening to Mr. Vanderlip. He stated that as a result of what he termed the unwarranted expansion of the currency by the acts of the Federal Reserve Board over the period of the war, the dollar had been reduced in purchasing power to the point where it was only 40 cents. Mr. Vanderlip failed to state that bankers loaned that money—that 40 cents—on excellent security, while the war prevailed; and that those bankers, in the expectation of a return to normalcy, were more anxious to see inflation carried on by whatever means might be devised in order that the 40-cent dollar, which they were to receive in payment for their 40-cent loans, would have a normal 100-cent value. There are bankers of that type who are going to oppose anything that impedes in the slightest degree the rapid depletion of the currency, or the rapid decrease in the volume of the currency, known as deflation; but I would say that we need not consider them.

The middle class of banker—who is from Missouri—can be approached by certain forms of argument, which, it seems to me, might be considered by the mining industry as a whole. There are no more complex problems in the world, perhaps, than the problem involved in modern mining and metallurgy; and it is reasonable to assume that the equally complex problems of domestic and international finance are capable of being grasped by the mining engineer.

My plea here is not one against the McFadden Bill—I have been in favor of it since the start—but rather that we begin to approach the use of propaganda on its legitimate and fair-thinking opponent. in such a manner as will reflect real credit on the intelligence of the mining industry. With that in mind, I wish you would hold yourself in the frame of mind that permits you to see his side of the problem. He has his own theory. He has been required, as commerce had advanced and as the business of the world has become more complex, to find ways and means for expanding currency much more rapidly than he could have had he maintained a standard gold cover. I do not believe that our case should be presented in any other terms than in those terms which go to the very bottom of the major function of gold, that being the maintenance and support of domestic and foreign and international credit. I believe that you have an opportunity—and a golden one here—to step in and present a real economic argument and convert your legitimate opponents among the bankers. (Applause.)

World's Gold and Debts

MR. SEAMAN: Mr. Chairman, I just want to call attention briefly to what seems to be more of a neglected side of this question: It has been suggested that the gold problem should be considered from the international standpoint, which I believe is really the controlling one in this matter. What is the total stock of gold in the world available for the payments of debts? What is the amount of indebtedness in the world that is predicated upon that gold stock? From that standpoint I believe that we should ask the United States, its Senate, its people, to consider

the gold problem as one of a square deal. We have loaned to the nations of Europe nearly \$10,000,000,000, every dollar of which is re-payable to us in gold coin of the present standard of weight and fineness. Our Government sublimely sits by and sees a waste of hundreds of millions of dollars in the lack of operations of the gold mines, which is a national calamity. Our Government should help the gold miner, and we should take the necessary measures to urge it to do so.

MR. VOORHEIS: I would like to ask Mr. Lawrie a question: I believe that all of the gold produced now in the United States is used in the arts. Is that correct?

MR. LAWRIE: More than that.

MR. VOORHEIS: More than that? The people who use this gold in the arts buy it from the Government, do they not?

MR. LAWRIE: Yes.

MR. VOORHEIS: How do they pay for it?

MR. LAWRIE: They pay for it in gold certificates.

Gold Used in the Arts

MR. VOORHEIS: Would it not be possible for the Director of the Mint, or could we not have some law passed prohibiting the sale of gold for the arts? (Applause.) If such a law could be passed, and the gold that is in the country be put into bullion bars and stored to redeem the currency, then those who use the gold for arts would have to buy it from the producer and pay the price that was asked. Would that be logical? Could that be done?

MR. LAWRIE: The situation is this: The Secretary of the Treasury has full power at any time to regulate the sale of gold bars, but it has been found that the best means to protect the gold coin in circulation is that sales should be made as far as possible to the industrial consumers.

MR. VOORHEIS: And they pay \$20.67 an ounce for refined gold?

MR. LAWRIE: Yes. Of course other gold will come into the market, and the benefit to the producer would be much lessened by virtue of the larger volume of gold to satisfy industrial requirements; therefore, the disadvantage of giving the profit to those people who have been hoarding gold—that problem is met with—and they are not entitled to that consideration. In England there is a law to prohibit the destruction of gold coin; here we have none. Mr. McFadden has introduced a bill in Congress for that purpose. As you will recall, a great deal of destruction was carried on in the past, and there is no reason why there should not be such a law in order to protect gold bars or gold coin from being destroyed.

MR. VOORHEIS: If the Government would guard all gold coin and put it into bars, would there be any destruction of coinage?

GOVERNOR BOYLE: Use only gold notes.

MR. VOORHEIS: The gold notes would be redeemable in gold and they could use gold bars for that purpose.

Gold Certificates

MR. LAWRIE: Of course, gold certificates for an equal amount of gold bullion back of them. Gold certificates are nothing more nor less than a receipt for that amount of gold, so that the gold reserve is there for the purpose of redeeming those certificates; and the balance of the gold reserve in the Federal Reserve fund is practically all consumed now, under the restrictions of the Federal Reserve Act against the deposit liability and against Federal Reserve notes and other forms of currency in circulation; that is, there is very little free gold to be dealt with in any way in the United States without releasing it by deflation.

MR. VOORHEIS: If the producers of gold in this country did not deposit their money with the Mint and receive paper for it, where would the Government get any gold?

MR. LAWRIE: They are getting gold, of course, as Mr. Rickard has pointed out. I would like to call your attention to the fact that our export trade is now seriously threatened by the fact that the recent shipments of gold from Great Britain and France have had a tendency to weaken their purchasing power in our market. It has been debated whether those foreign debts should be made payable immediately. It seems reasonable, if our export trade is to be hampered in any way, to extend the interest payments over a greater period of time, so that they will not lose this gold and thereby weaken their purchasing power. If \$10,000,000 is received in New York, and it has a marked effect on the money market, whether it is psychological question more than a real one, I believe is a debatable point. Probably it is largely psychological; but in any event it has an expensive effect on the money market, and a great many of these critics who complain of the small amounts of gold, I think, are greatly in error.

MR. MYERS: Isn't it a fact that manufacturers in England have to go outside of that country to buy the gold which they use for manufacturing purposes, jewelry and so forth, and that the law regulates all gold?

MR. LAWRIE: There are restrictions upon the exportation of gold by the gold producers in South Africa; it is all by certificates, but there is a certain amount of gold in any nation, and it is more or less out of sight. It has a mobility, both in the arts and in the mint, and from the mint back into the arts. It is almost impossible to regulate the destruc-

Destruction of Gold Coin

tion of gold coin, although there is a law against it in Great Britain, and I believe also in France. The United States Mint has made no detailed estimate of such destruction since 1883. It did make some yearly estimates before that time, and accounted for \$3,500,000 per annum as a regular statement. There has been a great deal more gold coin destroyed than that; dentists and small manufacturers have destroyed it. We

exported gold to England for industrial consumption during 1919, and we exported gold to France. \$14,500,000 of that \$80,000,000 was gold exported specifically for manufacturing purposes, so that on the other hand the French manufacturer is paying this exchange difference plus the cost of transporting. He is paying three francs, in addition to the sumptuary tax of \$3.60 an ounce for the privilege of manufacturing at all; and it is levied on the metal content of the article of jewelry.

MR. COLLINS: I would like to submit to this committee of this Conference, to be considered in a preliminary way, a resolution with a view to submission, or otherwise, to the Resolution Committee of the American Mining Congress:

"WHEREAS, the gold producers of the United States are in urgent need of assistance to maintain their properties and organizations in such condition as shall permit them to maintain production in the event that the Congress of the United States shall, through the McFadden Bill, or other means, provide assistance such as shall enable them to operate, and,

"WHEREAS, the opposition by certain interests to the McFadden Bill suggests the possibility that this sound and well-considered measure may be delayed in passing through Congress,

"THEREFORE, BE IT RESOLVED, that the directors of the American Mining Congress immediately take such measures as may be necessary in the event of the failure of the passage through the forthcoming short session of Congress of the McFadden Bill, to organize the gold producers of the United States and Alaska for the following purposes:

(a) To deposit the gold produced by them in the mines, and demand coined gold in exchange therefor.

(b) In the case of gold ore sold to smelting companies to arrange for the equivalent of gold content to be deposited in the Mints, withdrawn as coined by the smelting company, and delivered to the producer in settlement for the ore.

(c) To place such gold in circulation by using it in liquidation of payrolls, in payment of supplies and so forth.

(d) To arrange with local bankers in gold-producing localities to furnish gold in all withdrawals to an amount equivalent to deposits of gold made locally with them.

(e) To provide for companies where local banks are unwilling to adopt this course, by the organization of a central gold bank, with branches in various mining camps, organized under the State banking laws.

(f) To conduct concerted propaganda in favor of the use of gold and silver certificates, in preference to Federal Reserve notes."

Mr. Chairman, I suggest that if it meets with your approval that this resolution should be considered by your committee and reported back to this conference for action.

CHAIRMAN MATHEWSON: Will you kindly turn the document over to the Chairman?

If there is nothing further to offer, we will consider the meeting adjourned.

The meeting convened at 2 P. M. Wednesday, November 17, 1920. Mr. W. J. Loring, of San Francisco, presided.

THE CHAIRMAN: In the absence of your Chairman I have been requested to take the chair this afternoon.

The McFadden Bill in Brief

I am going to ask Mr. Seaman to give a short outline of the McFadden Gold Bill. At a later meeting I hope somebody will ask Mr. Seaman, or somebody else, to describe the Bill in greater detail, and the reason for such a bill, because I am afraid that there are a great many people interested in gold who do not understand the Bill. I say that because I have been asked whether it was for the purpose of changing the monetary value of money. Newspaper men, of all people, should know what the Bill is, and I had one prominent newspaper man in San Francisco ask me if that was the case. If the men occupying public positions do not understand more about the McFadden Bill than to ask questions of that kind there may be some gentlemen attending this Conference who do not quite understand the reason for it.

MR. SEAMAN: Mr. Chairman, with your permission may I introduce a reconstructed resolution? Yesterday we passed a short resolution favoring the McFadden Bill. We have seen fit to change that slightly, and I would like to read the amended resolution as prepared by the committee:

"WHEREAS, the Government of the United States is justly committed to the gold standard; and

"WHEREAS, the maintenance of a healthy gold-mining industry is absolutely essential to the maintenance of a gold standard; and

"WHEREAS, the gold-mining industry of the United States is in deplorable straits, having almost ceased to function, and it is necessary to apply immediate measures for relief; and

"WHEREAS, the McFadden Bill, H. R. 13201, offers the best present solution of the problem;

"RESOLVED, that the American Mining Congress, in Convention assembled, heartily endorses the McFadden Bill, and pledges its support to the measure, and urges a like support on the part of all our citizens who have at heart the maintenance of the gold standard and the common welfare of the country."

This resolution was signed by all of the members of the Gold Conference Committee, and I move its adoption, Mr. Chairman.

A DELEGATE: I second the motion.

THE CHAIRMAN: Gentlemen, it has been moved and seconded that the resolution just read be submitted to the Resolution Committee, is that correct?

MR. SEAMAN: Yes.

(Thereupon the chairman put the motion to the delegates present and the same was carried.)

[The resolution as finally passed, will be found on page 56.]

MR. SEAMAN: There are only a few of us here, but as your chairman has stated, it seems that while innumerable copies of the McFadden Bill have been distributed, there is still an uncertainty as to what its real meaning is. Many of our people, even miners, believe that the bankers are afraid of this proposition because it will emasculate the gold standard. We must spread the propoganda that such is not the fact.

What the McFadden Bill Specifies

In the first place, in order to bring such a measure before Congress, it was very wise—Mr. Loring is responsible for this Bill—to place it on the theory that it is a revenue bill, primarily it is such, simply placing upon the users or the manufacturers of the product of our energy a tax that will bring it up somewhere near commensurate to the cost of the raw materials which they use. That is a simple statement, and we are entitled to that much consideration at the hands of the people. The McFadden Bill simply says that all manufacturing jewelers, and all gold used in the arts, when sold, is chargeable with a tax of \$10 per ounce for the gold contents of that article, not when it is manufactured, but when it is ultimately sold. That \$10 does not amount to much on a little piece of jewelry. Jewelers, I think, use the major portion of the gold. Jewelry is a non-essential to begin with; and if it is so, why should they enjoy the fruits of our labor without paying for it? That is the principal argument. By means of the McFadden Bill the Government will get a greater revenue than it dispenses to the mining industry. Mr. Loring has calculated that there will be \$8,000,000 or \$10,000,000 more on last year's business to the Government.

In the next place, when the jeweler wants gold, many people will say, "Well, he will go to Mexico and bring gold surreptitiously across the border, and will manufacture it. Now, that will be against the best interests of our industry. It does not make any difference where the jeweler gets it, because the tax is not imposed until he sells it; so the argument that he will get the bullion does not apply. We do not care where he goes, but when he sells it he must pay the tax. Furthermore, the jewelers, and others who use gold in the arts, have been going to the Treasury of the United States, buying gold bullion to the extent of \$5000 or more at a time, and converting it into jewelry or for other purposes. Now the jewelers are opposed to this Bill because they think that it is an infringement upon their business.

Gold Exports and the Jewelry Trade

When war was declared; when we found that our gold was seeking cover, as it always does in times of disaster; and when we found that Japan took \$253,000,000 of our gold before we knew what they were doing; then the Treasurer of the United States wrote to every mining man possible, beseeching him under the guise of patriotism to continue producing gold in order that we win the war. Yet the Secretary of the Treasury sells \$80,000,000 of gold to jewelers. That is an inconsistency I can very well air right here.

All we ask as a result of the McFadden Bill is that they return to us somewhat of a measure of relief for the conditions in which they have placed us. They used our gold, not only as a national value and standard for our currency, but as a commodity, only at one price, and it could not respond to the law of supply and demand. The McFadden Bill places the burden upon the man or woman who thinks he or she should have a giddy trinket to wear.

If there are any questions you would like to ask, I would be glad to answer them if I can. There must be a widespread misunderstanding as to the purposes and effects of the McFadden Bill.

THE CHAIRMAN. Mr. Seaman, would you mind describing in some detail what the producer does with his gold, and how the Bill brings him any permanent relief. There are only two sections in the whole Bill that concerns us very much.

MR. McCUTCHEON: I am against any resolution that will place us on record, or will start us attacking the gold standard. I think it will take us into politics. We can support the McFadden Bill if it will do any good.

MR. SEAMAN: For your information there is a resolution covering every question that you have referred to, only that it is for the general conference. That resolution was prepared this morning.

MR. McCUTCHEON: I thought this was the general conference.

MR. SEAMAN: No, this is only the gold conference. The other resolution is for the general conference. All we want in this gold conference is to see that the Ways and Means Committee gets the Bill and puts it through the House, and that the Senate gets it and puts it through the Senate. Then we can get \$10 an ounce extra.

MR. McCUTCHEON: I am in favor of anything that will give relief.

MR. SEAMAN: I have been requested to explain how the gold producer realizes, and would realize on this \$10 per ounce.

How the Gold Producer Benefits

We produce gold largely by the cyanide process and by smelting. We do not send a great deal of placer gold to the Mint; it is nearly all shipped in the form of bars. We have Government Assay Offices throughout the

country, which re-melt the bullion and give a certificate as to fineness and the amount due, with a draft upon the Treasurer of the United States. We can send that draft to any point and get cash—in any kind of coin, gold coin, Treasury notes, or anything else. But we have a right to demand gold coin or gold bullion if we wish. When the Treasury Department has sold the bullion to jewelers or others, the consumer of that gold for the arts make a return on a blank prescribed by the Government for the amount of tax that he pays, and that is turned into the Treasury. The Treasury calls upon the proper department for figures on the amount of virgin or new gold produced, then gold producers will get from the Treasury an additional draft covering the \$10 due because of this gold. There will be two transactions—one for the usual \$20.67 per ounce, and the other \$10 after the Government has determined how much producers are entitled to. We only ask for a temporary relief for five years. That answers the question, does it not?

THE CHAIRMAN: Yes.

THE CHAIRMAN: You have heard certain sections of the McFadden Bill explained, are there any points you would like further illumination on?

MR. DEWITT: In regard to the size of the dollar, will it be smaller or the same size?

MR. SEAMAN: It has no relation to that at all, it comes out of the excise tax on jewelery through the machinery of the Treasury Department in determining the amount of our gold at that time. In other words, the Government won't make \$20 or \$30 out of it.

THE CHAIRMAN: I am glad that point was mentioned, because it is just exactly what I was afraid of, that the people of this country interested in the gold industry do not understand the meaning of the McFadden Bill. It has nothing to do with the changing of the dollar. We take our gold to the bank or Mint and cash it for \$20, or \$30 an ounce.

MR. SEAMAN: In my testimony, when I was under cross-examination by the Ways and Means Committee, all of these questions were discussed because they did not understand it either.

MR. YATES: As manager of one large producer [the Homestake] I wish to say that whether Republicans or Democrats, as a Nation we should protect our industries.

MR. LAWRIE: I would like to say, this being a matter of concern to the entire Nation—it might be well to bring it to the attention of other mining men—that it will strengthen the purchasing power of Europe, and rehabilitate the market for copper and other products, which largely depend upon the export market for their prosperity. By calling attention to this, I think we will obtain the co-operation of other branches of industry.

Gold in Base Ores, But little Base Metal in Gold Ore

MR. SEAMAN: I just want to emphasize the fact further that there is hardly a producer of copper, lead, silver, tungsten, or zinc but produces more or less gold as a by-product; whereas there are a large number of gold mines which contain none of these other metals, so that all mining companies are interested in this measure.

THE CHAIRMAN: Are there any other questions?

MR. ROBERT I. KERR: I endorse the statement made that we take our bars to the Mint and get \$30 an ounce for gold.

MR. SEAMAN: No you don't; you get \$20.67. After the article has been manufactured and sold, then we draw an additional \$10 per ounce out of it. That is my understanding of it.

THE CHAIRMAN: That is correct.

MR. LAWRIE: In other words, it comes from the consumer on a luxury tax, doesn't it? and does not fall on the general public.

[Some extraneous discussion here followed.]

THE CHAIRMAN: I would like to ask Mr. Lawrie whether he has investigated the inflation or deflation of the quantity of gold produced in Europe since the war was declared.

MR. LAWRIE: Yes. All of the figures that show relationship between the gold reserves of foreign nations, and the currency which they have issued since the war period, or during the period of the war and since then, have been expanding since that time. It is true the commodity prices in the various countries have increased more or less proportionately with the ratio of gold and currency that has been directed upon it. That destroys the quantity theory of money, because as European countries lose the gold they had accumulated, their prices advanced during the period they lost the gold, and they are still advancing because they have

Currency of Foreign Countries Weak Makes the Dollar Strong

not the gold with which to re-adjust. It is not that the dollar in this country is so strong as it is that the currency of foreign nations is so weak.

THE CHAIRMAN: I would like to ask if you have investigated the output of the various European countries in terms of gold as compared to pre-war periods?

MR. LAWRIE: Well, before the war Great Britain controlled in 14 producing countries 62.3% of the total gold output of the world, and this year it is estimated that the British Empire will produce about 75%. The reason for that increase is because the United States proportion declined from 23% in 1914 until in 1920 it will not exceed 11%. The cause of that is first the gold producer of America has been subjected to an economic pressure to which he has not been in other countries; and

secondly, the British gold producer has been assisted materially by the exchange premium, and for that reason the British gold decline has not been so great as it has in the United States. Great Britain will gain a great supremacy in production of gold unless we do something.

Gold as a By-product

During 1918, \$8,000,000 of gold was recovered as a by-product from the treatment of copper and lead ores, while in 1919 it was less than \$5,000,000; and in 1920 it will probably be much less than \$4,000,000. The question cannot, therefore, depend in any sense upon the gold produced as an incidental by-product in the treatment of base ores, and that is the reason why measures should be promptly taken before the gold-mining industry ceases.

MR. BETTS of Oregon: It seems to me that the point to be discussed or emphasized is that the McFadden Bill is not a measure merely to allow the gold-mining industry to recover, but it is one that affects the whole country. Whoever you talk to should be made to understand that it is a national question, not merely a gold producer's question. It affects all of our industries, and it is a financial as well as an industrial question.

THE CHAIRMAN: It should be remembered that if the McFadden Bill is passed, the Government will share in the profit, as gold producers will have more money for developing mines and other properties; consequently there will be more taxable property in the United States.

MR. ELBERT of Alaska: There is a question I would like to ask Mr. Lawrie: In the first place, what is the total gold reserve of the Nation, about six or eight billions?

MR. LAWRIE: No, the amount is \$2,646,615,750, as I showed in my address of yesterday.

MR. ELBERT: Then can the United States issue any form of currency against that gold to the extent of 2½ times that amount?

MR. LAWRIE: The fact is, when I say the gold stock is \$2,600,000,000 or so, that has been segregated by the effort of the Federal Reserve Act so that approximately \$2,000,000,000 of that amount is properly given in as a reserve against the currency and net deposits of the Federal Reserve Act. The Federal Reserve Act specifies that of net deposit of the Federal Reserve System 35% must be carried in gold. After setting aside that

Gold Back of Federal Reserve Notes

amount, there is to be 40% gold maintained against the Federal Reserve notes in circulation. This means that there is a gold cover in excess of that required by the Federal Reserve Act of 6.6 cents of every dollar for Federal Reserve notes in circulation. There are 12 Reserve districts, New York Reserve probably commanding the most important position, by volume of business. Their ratio has been down practically to the zero

limit under the Federal Reserve Act, and it would be impossible for the whole Federal Reserve to reduce it to 40 cents and maintain the gold cover in the various subsidiary districts. So, at the present time, they are down to the minimum. That gold is tied-up. They have to draw in and cancel Federal Reserve notes or lessen the net deposit in order to release that gold for other purposes.

MR. BETTS: Then, I understand that practically all of the gold reserve is consumed?

MR. LAWRIE: Practically, there is no free gold for any other use than reserve against the currency and credit of the Federal Reserve Banks. There is very little exportable surplus, we will say.

MR. BETTS: Can you tell me how much the Liberty Bonds outstanding total in gold?

MR. LAWRIE: The Treasury Department has \$1,800,000,000, and I think the net debt is something like \$22,500,000,000 still outstanding that has to be met.

MR. BETTS: Then, the Government has got \$23,000,000,000 promised and nothing to meet it with?

MR. LAWRIE: All of these promises do not come due at one time, they are all projected into the future, and it is supposed that the financial structure of the country will become so straightened that there will not be any embarrassment with regard to the redemption of the interest and payment of Liberty Bonds.

MR. BETTS: If we are not going to produce gold we will have a hard time paying Liberty Bonds in gold.

MR. SEAMAN: Mr. Lawrie, you have special information on some of these subjects, but just to show to these people how the wind blows, and to show that we are only asking a simple act of justice from the Government, I wish you would state in what way the Government is profiteering itself against the gold-mining industry by the Treasury Department giving the subsidy to the jewelers. They themselves are guilty of giving this subsidy to the jeweler. Will you state the reasons for that?

MR. LAWRIE: The reason that this premium to the gold producer has been attacked is on the ground that it is a subsidy to the gold producer. As a matter of fact it is merely part compensation for the loss of the

Premium not a Subsidy to Gold Mines

purchasing power of the gold produced due to the purchasing power of the dollar, and that arises from the fact that the Government is arbitrarily fixing the price of gold. What the Government has done it should also be able to relieve, as it becomes a matter of national necessity, and the Government certainly must have the power to relieve a situation that it has already created. On the other hand, inasmuch as the gold con-

sumer in the industrial arts has been supplied with the metals at a pre-war price, while all other industries have been forced to pay increases, it is perfectly plain that this excise tax is only a part tax, while all other industries are paying about 120%, so that the industrial consumer in the first two or three years and a portion of this year, will still be subsidized after paying the excise tax, as they will be getting their material at a percentage of increase less than others are forced to pay.

MR. SEAMAN: I was getting at the fact that the Government was accepting 40% on excess profits to pay the cost of war; the Government itself is profiteering to the extent that it is interested in that 40% excise.

MR. BETTS: Mr. Lawrie, if the reserve of the Federal Reserve system is up to the limit, and we will say the jewelry trade draws a considerable amount of gold from the Treasury, isn't it a fact that they have to decrease the notes in circulation so that the reserve will not be full up to the limit?

MR. LAWRIE: Of the \$2,600,000,000 of that amount, approximately \$2,000,000,000 is in the Federal Reserve system. It is not from the Federal Reserve system that the gold is drawn for that business. That would not in any way complicate, or would not force a reduction in the note circulation and net deposit liabilities of the Federal Reserve Bank.

THE CHAIRMAN: Are there any further questions anyone desires to ask? We have plenty of copies of the McFadden Bill, and all of those who have not read it I would suggest that they get a copy.

Mr. McFadden Unable to Attend

I have a telegram from Mr. McFadden at Washington, as follows:

"Transportation arrangements had been completed for my attendance tonight, but at the last moment most important matters concerning the program of financial reconstruction compelled me to remain here and forego the pleasure of addressing the Convention upon the most important subject of maintaining the normal gold production, which is fundamental to the financial security of the Nation. My reply, delivered before the Convention of the American Bankers' Association on October 21, to the adverse report of special committee, explains fully the need for this constructive legislation to protect the monetary gold reserve. Please convey to the Convention my sincerest regret that circumstances prevent my attendance at this most important meeting."

(The meeting then adjourned.)

TARIFF CONFERENCE

American Mining Congress

THURSDAY, NOVEMBER 18, 1920, 2 P. M.

Mr. Nelson Franklin, of Denver, presided.

MR. H. W. SMITH: I want to introduce to you as Chairman of this afternoon's meeting Mr. Nelson Franklin, of Denver, who has been active during most of the past year in Washington in behalf of the War Minerals tariffs, with particular reference to the tariff on tungsten.

MR. NELSON FRANKLIN: It is not my purpose to make any speech on the tariff question, or on any other question, or to take up much of your time. You are not here to hear a lot of statistics and technical information in reference to these so-called war minerals, but you are here to know what is being done in Washington, and what efforts are being made towards getting legislation enacted to protect the mineral interests of this country.

Status of the Tungsten Bill

As Mr. Smith said, I spent about seven months of the past year in Washington, particularly concerning legislation on tungsten. Congressman Timberlake introduced a bill on tungsten in June, 1919. That bill passed the House in August after a hearing by the Ways and Means Committee, and went to the Senate. We participated in a number of hearings in the Senate on the tungsten bill, one in November, 1919, and another one in January, 1920. We had expected during the last session, which closed in June, that the tungsten bill would become law before the close of that session, but on account of the great pressure of business before Congress, it failed to pass. The bill is now [November, 1920] on the calendar of the Senate, and those who have charge of it, other than myself, are promised by the Senators that the Senate will take action immediately on the convening of Congress in December.

On all of the bills that go especially before the Senate—and the same is true of those before the House—considerable information has to be given. They do not pass lightly over these matters, and they do not agree, when you talk to them, to put your bill through; therefore it needs considerable persuasive argument.

That is the condition of the tungsten bill at this time. We received every assistance from the American Mining Congress. Frank Griffin of California and myself were in charge of the bill all the time; we were assisted by others part of the time. We worked with the people who had the zinc bill. I think that any tariff legislation on other minerals will be hard to get through in the short time between December 6 and March 4.

However, I believe that the next session of Congress will pass the general tariff bill on the so-called war minerals.

Need for Tariff on Tungsten

To give you an idea about the necessity for the tariff on tungsten, I will say simply that at the hearings before the Ways and Means Committee and the Finance Committee of the Senate we presented sworn statements as to the cost of producing tungsten in different parts of the United States. It was shown that the average cost of producing a unit of tungsten is \$13.60, exclusive of depletion or depreciation. Of course, there are a lot of mines that can not work at a tariff of \$9 a unit. It was \$10 a unit, but finally those that had it in charge in the Finance Committee cut it to \$9. That carries with it a compensatory tariff on all the official products of tungsten.

Tungsten is now coming from China at \$5 a unit, c.i.f. New York, or any other seaport, and shows a profit, for this reason: In 1918 they discovered a large surface deposit of tungsten in China. Up to that year they had probably not exported to America more than 700 or 800 tons in any year. We cannot compete with the low-paid labor of China, but with a tariff of \$9 a unit we can start to do business; and as the mines develop, we can probably compete with China on that tariff. In the meantime, there is not a tungsten mine in operation in the United States

We are expecting our Colorado representative on the United States Tariff Commission, Mr. E. F. Costigan, to tell you what their plans are, and the evidence being accumulated concerning all of these minerals.

Meanwhile, I will first call upon Senator Voorheis of California, whose company, the Atolia, was the first to discover tungsten in California, and the first to produce any large quantity. Tungsten was first discovered in the United States in 1900—in Boulder County, Colorado

Cost of Producing Tungsten

SENATOR VOORHEIS: We can never mine any tungsten in the United States without a tariff. During the last year that our company operated, it cost \$13.60 a unit to produce the ore. Chinese ore is delivered in New York and sold for \$4.50 and \$5 a unit; therefore no mine can operate without a duty, unless we could get labor at the same price as paid in China. That we never want to see happen. If the bill passes and the President signs it, the act will immediately become a law, but the large stocks that are now in the country will have to be exhausted before the price will be raised sufficiently to allow Californian and Colorado mines to operate. We hope for favorable action by Congress and the President.

CHAIRMAN FRANKLIN: We have with us today the author of the present tungsten bill, our good Congressman from the Second District of Colorado, the Hon. Charles B. Timberlake, who knows all about the progress of the bill, and I will call upon him to come to the platform.

MR. TIMBERLAKE: I am the author of the bill, due to the fact that I represent the Second District, in which lies Boulder County, where tungsten was originally discovered in Colorado. Soon after my election in 1914, and after going to Washington, I acquainted myself with conditions in the Boulder tungsten fields. I saw that a tariff was necessary, and I introduced the present tariff bill in 1919, but the first one in 1916. War intervened, and nothing further could be done; but when the armistice was signed we were not long in doubt as to the future of the tungsten

Condition of Tungsten Mining in Colorado

industry, when our markets were opened to foreign products. Shortly after, all of the tungsten mines in this country were closed down, being unable to compete with products from South America and China. It was at that time [1919] that I re-introduced the tungsten bill. I was induced to do this by the President in his address to Congress, in which he recounted the experiences that had been gained in this war with reference to the necessity for this country to protect itself in the future by encouraging production of those metals and minerals which had been found to be so necessary.

[Mr. Timberlake thereafter detailed how the tungsten bill was steered through Committees; its passing the House in August, 1919; submission to the Senate; opposition by certain manufacturers, etc.].

CHAIRMAN FRANKLIN: We have with us Judge John F. Davis from California, who spent a great deal of time in Washington last year during the progress of this tungsten legislation.

HON. JOHN F. DAVIS: I feel like apologizing to you for the action of the Chairman in calling upon me to say anything on this subject, but, of course, I recognize that when we are waiting for something that almost anyone can be drafted from the audience as a filler in, without having the privilege of registering his protest.

[Mr. Davis thereupon gave his views on the political situation generally].

CHAIRMAN FRANKLIN: We also have with us Mr. A. Cressy Morrison of New York, whose company is largely interested in manufacturing products from the tungsten of our mines.

MR. MORRISON: It will interest you to know that the electric furnace in which ferro-alloys are made, largely had its practical development in this country, and many of these alloys originated here. That early work gave promise of great advantage to America, but shortly after it had got a mere foothold, the two principal manufacturers took up the production of ferro-alloys. Up to about 1908 there was little ferro-alloy business done in this country. By ferro-alloys is meant a mixture of iron with some mineral such as chrome, manganese, molybdenum, silicium, tungsten, and zirconium [some of which Mr. Morrison described]. They are used in making special steels.

Tariff on Ferro-Alloys

Owing to misinterpretations there was practically no protection on the ferro-alloys, prior to 1908, and at the time of the Payne Bill nothing had been done to secure protection. By the Payne Bill, the tariff on ferrochrome was 22% for what is called low-carbon chrome, and 25% for high-carbon chrome, and 25% on the other alloys. Then came the Underwood Bill and I am inclined to think that had Underwood not been in a position to appreciate the value of ferro-alloys the duty would have been reduced still further; it was reduced from 20 and 25% to 15% flat, and there it is today. That is not an adequate protection.

You will be interested to know that at the tariff hearing where Mr. Underwood was presiding, the argument was advanced in 1912 or 1913 that should this country enter war, ferro-alloys would be absolutely essential. The laughter arising from such an argument would have been amusing if it had not been so tragic. As a matter of fact, no attention whatever was paid by the Underwood committee to the theory that we should build up in this industry the ability to manufacture war essentials.

CHAIRMAN FRANKLIN: I will now call on Mr. Harrison Wilson Smith, chief of the minerals division, American Mining Congress, to explain what are the ideas of that organization concerning this legislation.

MR. SMITH: The American Mining Congress is not a partisan organization; it at no time adheres to the tenets of any political party; it is neither a free trade nor a protectionist organization; but it has ceased to apologize for and it has ceased to explain any activity for worthy tariff measures on American metals that need protection; because any American mining industry that buys its materials, supplies, equipment, machinery, and labor in a protective market, should be entitled to sell its finished products in a protective market, in case such protection is necessary for the life of the industry, and that industry is necessary for the industrial fabric of the Nation.

Cloud of Conservation

One of the first objections that we have had in our tariff fight has been the influence—the shadow you might say—that has hung over this country for a period of 12 to 15 years, which we can call a cloud of extreme conservation. Any man who predicted any statement, any theory, any platform on the necessity for conservation of some natural resource, was held immediately as a prophet, without regard to the economic principles involved. It was a sort of a front-parlor conservation of resources. This type of conservation is to be severely criticized, such as by a member of the U. S. Tariff Commission, who made this statement:

“That such conservation, regardless of the needs of American industry is the conservation of inertia, and a totally undeveloped natural resource is as indolent to American industry in times of peace production as a totally depleted one; and between the two we must find some industrial means by which our American resources can be operated on an economic basis. We have learned, since the cessation of the war, that

these mineral industries are more than war minerals—they are peacetime minerals; their development and the production from these American mines is necessary. All these minerals are so interwoven with our industrial fabric that these threads of industry cannot be pulled out and leave the fabric whole. They form not only part of the pattern, but they form part of the strength of the fabric.”

I think that I can give you a clear illustration of why the tungsten people got results: Not only were they on the job in Washington, but they were intelligently on the job; and regardless of all efforts the Mining Congress put forth, regardless of all the interests that the investigating bureaus of the Government have and the confidence that they may give to these tariff officials, it is apparently absolutely incumbent upon the industry to have its own representatives there to present the standpoint of the producers and the owners of the property. I am not as well versed in tungsten or graphite or pyrites as the gentlemen present, but the Mining Congress, through its tariff organization, does gather a unit of information which interlocks all of these interests, and brings them together as one problem, in a way in which no one interest can present for itself.

Result of Idle Mining Fields

We have before us, and we must show that the country has before it, the question of whether or not we are to have idle mining towns, abandoned and flooded mines, men seeking other employment, the permanent loss of skilled miners and other workers in these particular industries, the disturbance of industrial conditions in communities that range as high as Boulder, Colorado, or even of some of the outlying districts contiguous to Butte, Montana [such as Great Falls], where their alloy furnaces are located; or whether we are to have a continuous operation, busy towns, operating mines, with the money for this labor, for this production, and for the minerals remaining in this country?

Among your problems, and possibly the first one with which you have to deal, in presenting any of these mineral questions to Congress, is the very effect of the interlining of your industry with the industrial fabric. Where your industry crosses the lines of another, and where they are temporarily securing their raw materials from abroad at a price lower than it can be purchased in this country, we may expect opposition. The best crystallization of sentiment with regard to just such opposition was expressed by the Chairman of the Ways and Means Committee in the hearings on graphite. The largest graphite manufacturing company in the United States was opposing the miners of graphite from Alabama, Pennsylvania, and the West. Their representative was asked this question after he had finished his statement in opposition to the tariff:

Double Attitude on Tariff by Graphite People

“Do you, then, oppose a tariff on the American graphite mining industry?” To which he replied: “I emphatically do oppose such a tariff; it imposes too great a burden on the ultimate consumer; it is unnecessary for the protection of the industry; if the industry has merit, it can live

without a tariff, and it will seriously disrupt all the manufacturing business."

The Chairman of the Committee then asked him: "You have, have you not, a tariff on your manufactured graphite products?" To which he replied, "We have." "Do you wish it discontinued?" To which he replied: "We would perish without it."

Following that statement, the Chairman said: "I have small patience with any branch of any industry enjoying prosperity under protection that appears before this Committee and asks that the same right of protection be denied to leading branches of the same industry." (Applause.)

I want to emphasize further, in speaking of work in Washington, what Mr. Davis said regarding the attitude of legislators who are considering these problems: The attitude of the business-man up to the last few years has been to put his feet on his desk and swear at some of our Congressmen and some particular group of Senators (Laughter). The longer I work in Washington the more I am convinced of the serious, earnest, conscientious thoughtfulness with which all of these men approach the great problems before them. You have no conception, without a close contact with activities in Washington, of how far-reaching in their effects are all the measures that come before Congress for serious consideration. Every man that goes to Washington asking for some particular thing, although you may believe that it is something that need not be granted, puts up a good argument. That is the condition with which one has to compete. People come to Washington wanting special things; executive departments want special things in the way of legislation, and go away disgruntled and dissatisfied with their Government because they do not get as good service as when they go to a cigar store for a smoke. It cannot be done that way.

How the Mining Congress Assists

In its work on tariffs the Mining Congress has two measures of activities: The first is in its co-operation with members of Congress who are anxious for basic statistics on which to form their opinions. The Mining Congress endeavors to supply these figures or information, and the entire basis on which the legislation is asked for, is as concise, non-technical, and understandable as possible. The more intricate work is presented to the Geological Survey, particularly to the Tariff Commission, of facts and statistics with regard to domestic and foreign production, precise labor conditions, and balances of credit between this and foreign countries.

I have with me a sheet which will give you something of an idea of the class of work that the tariff division of the Mining Congress does in this regard. This sheet is long and intricate, and is much too-detailed and technical to consider, but by reading the headings, you can see the economic basis on which our requests of the Tariff Commission are made.

Data are given in this sheet on the following minerals: antimony, pyrites, chrome, graphite, lead, manganese, molybdenum, potash, tungsten, and zinc, including the annual production in the United States—pre-

war, war period and post-war; imports from foreign countries—pre-war, war period, and post-war; and the prevailing prices before the war, during the war, and at present; cost of production in the United States under the various conditions cited, and the cost of production in foreign countries; and the relative trade balances of these countries with the United States for the year ending June 30, 1920; the existing tariff, if any, on these minerals; the tariff necessary for continuous operation of the industry; and the probable mineral deposits available in the United States. This is a type of information that must be flexible, elastic, and subject to constant revision, as the basic facts on which the statistics are based undergo changes.

Frankness Required by Congress

I want every man who is interested in a mining industry which needs protection, if he does not feel so already, to be absolutely assured that the Tariff Commission wants to understand your problems. It wants to give you in its reports to the Ways and Means Committee the utmost frankness, and the utmost fairness and the utmost completion in all details. The Tariff Commission does not recommend a policy—it presents facts based on these statistics, which shows the relative conditions of these industries with foreign countries and the conditions on which the Ways and Means Committee must base its position whether or not it will grant a tariff. You are not sitting down to a blind game of poker in asking for a mineral tariff; the cards are all on the table; they are of interest and value to mineral tariffs, and when presented to the Tariff Commission will receive their due weight and consideration.

The Mining Congress, through its Tariff Division, pledges its continuous and general co-operation in presenting to the Commission and to the legislative bodies of the United States all information necessary in asking for justice for American industry, and in asking that American mining industry not suffer longer under the incubus of foreign production, cheap foreign prices, and a depreciated foreign market.

I shall be glad to answer any questions that you may feel like asking me as representative of the Tariff Division of the American Mining Congress, whether it applies to your own industry, whether it applies to tariff policy, or whether it applies to the tentative program for the coming year, it does not matter.

A MEMBER: I should like to ask a question regarding manganese: Mining manganese at Leadville is dead because it is impossible to ship it. Is that to be protected? or is there a special effort to be made in regard to getting that protection? It does not seem to be mentioned in connection with the tungsten bill. Is there any bill being offered for their protection?

Status of Manganese and Graphite

MR. SMITH: I will read from the statistical sheet exhibited: The only mention that I remember in connection with manganese was the

suspension of operations at Butte and Phillipsburg. Manganese has not been ignored; I have a property myself. Congressman Flent has introduced a bill that is now before the Ways and Means Committee, which asks for a duty of 35 cents per lb. on the manganese content therein, and 75 cents on the manganese content in ferro-manganese. This bill has not been debated, but I have been working with the Congressmen, assembling statistics and getting the material in shape.

A MEMBER: What is the proposed tariff for graphite?

MR. SMITH: I have it on the sheet, but it is not re-classified. There have been three graphite bills introduced: The first was by Mr. Heffner of Alabama, on request. It provides, first, on crude crystalline graphite ores, 1 cent per pound of ore for ores containing 50% or under of graphitic carbon; 2 cents per pound of ore for ores containing over 50% of graphitic carbon—the term “crude graphite ores” being defined for the purposes of this Act as ore which has not been subjected to any process of refining or concentration which changes the graphite content of the ore as mined.

Second, on lump or chip crystalline graphite, 3 cents per pound of graphite, and so on,

Third, flake crystalline graphite, 6 cents per pound of graphite.

Fourth, all other products, manufactured materials and compounds, containing graphite, 5 cents per pound for the graphite contained therein.

They have two other bills—H. R. 11815 and 11581, in which crude crystalline graphite ores are protected on a basis of 1 cent per pound of ore for ores containing 50% or under of graphitic carbon; 2 cents per pound for ores containing over 50% of graphitic carbon; lump and chip crystalline graphite, 3 cents per pound; flake crystalline graphite, 6 cents per pound, and all other products 5 cents per pound for the graphite contained therein. Those are before the Ways and Means Committee of the House for consideration.

We have representatives of several other industries here who have not had anything to say about the needs of their industry. I should like to ask either Mr. Baker, Mr. P. S. Smith, or Mr. Woodruff, to tell us respectively of mercury, or of the graphite problems, if they will be so courteous to do so. And I think I see Mr. Fletcher Hamilton of California. He promised faithfully to say something about quicksilver this afternoon.

The Quicksilver Industry

MR. HAMILTON: Quicksilver is on the down grade in California. Last year I spoke before the Tariff Committee in regard to the industry, and at that time I outlined the great need there was for protection to it. California has contributed practically 75% of the quicksilver produced in the United States for many years. During this year [1920] we have seen property after property closed. At the present time there are two operating out of probably three hundred which at one time or another have yielded quicksilver. Those two are producing a normal amount of metal. The largest mine, which yields 50% of the quicksilver of California, has been closed and does not produce any today.

Ordinarily, our production in California is around 16,000 flasks. During the war, when there was greater need for that product, California was able to produce more. For this year, according to estimates given me, production will amount to about 10,500 flasks.

The price of quicksilver is something that none of us knows from day to day; we do not know what is going to happen to it. We go along quietly for a week or two, or two or three months, with an apparent fixed price, when suddenly there will be a drop, with a decline of from \$5 to \$20. That is not a condition under which any industry can progress or develop.

It has been said by some Government officials that there are not any great resources of quicksilver in California, but I beg to differ from any opinion of that kind. The conditions under which the industry in California, as far as quicksilver is concerned, has been developed are these: The great production in Europe is in Spain and Italy. They have ores that are of a much higher grade than those in California. In Spain it runs from 5 to 10% mercury; $1\frac{1}{2}$ to 2% in Italy, I believe. In California the average quicksilver content is something like 0.5%. There is no question that in Europe, where the quicksilver market has been controlled by the Rothschilds in the past, and practically so today, if they desired, there could be produced sufficient metal to flood the markets of the United States so that the industry here would be absolutely frozen, and I do not know of any reason why that has not happened in the past; it is a fact that we have been suffered to live.

Cost of Producing Mercury

At the present time the cost of producing quicksilver in California is around \$65 per flask, exclusive of depreciation, interest, and the like. That is the bare cost of production. Quicksilver has been quoted at \$80 for the last two weeks [November, 1920], but Italian quicksilver is being imported into the United States at a price lower than that, and lower than the producers of California, or the rest of the country can stand. It seems to me that if the industries which consume quicksilver are to have a dependable production, and have a condition under which the resources can be developed, there must be a tariff placed upon imported quicksilver as well as upon the products manufactured from quicksilver which are imported into this country. I believe that any efforts made by the American Mining Congress towards placing a tariff upon imported mercury and upon products therefrom will at least tend toward the establishment of a protection for the United States.

I trust that the efforts of the American Mining Congress will be successful in getting relief for the quicksilver mining industry. (Applause.)

CHAIRMAN FRANKLIN: Before we adjourn I would suggest that it is necessary to appoint a committee on resolutions.

MR. DAVIS: Mr. Chairman, pursuant to your suggestion, I move that a committee of three be appointed to draft suitable resolutions to present

to the Resolutions Committee expressing the idea of this conference with reference to tariff legislation in Congress.

A MEMBER: I second the motion.

CHAIRMAN FRANKLIN: It has been regularly moved and seconded that a committee of three be appointed—how?

MR. DAVIS: By the Chair.

CHAIRMAN FRANKLIN (continuing): by the chair to draft suitable resolutions, comprising the sentiment of this Convention, to present to the Resolutions Committee. (The motion was carried.) I will appoint Judge John F. Davis of California, Mr. Hawk of Oregon, and Mr. MacKenzie of Utah.

The session then adjourned.

MINE TAX CONFERENCE

American Mining Congress

TUESDAY, NOVEMBER 16, 11 A. M.

Mr. George E. Holmes, acting chairman.

CHAIRMAN HOLMES: In the absence of Mr. Paul Armitage, who has been delayed, I have been asked to take the chair to make the introductory remarks and report what your Committee on Taxation has done, and what it proposes for the attention of this meeting. The Conference on Taxation will hold a series of three or more meetings to discuss various phases of the question. They will be roughly divided into three groups:

(1) What shall we do with respect to back taxes—taxes for past years that still remain uncollected?

(2) What shall we do to improve the administration of current taxes—tax laws for the current years?

(3) What shall we do with respect to new tax laws—what program of taxation should the American Mining Congress advocate?

The Tax Problems

The last is an extremely important subject on which there has been a great deal of thought throughout the country. The Congress, in connection with other bodies, initiated a movement last spring that resulted in the formation of the so-called Allied Tax Committee, which has considered the subject of future revenue legislation for the past seven or eight months and recently prepared a tentative report. Mr. Armitage and Mr. Allen are members of this Allied Tax Committee, and have done a great deal of work in that connection.

This morning we present for your attention a report of the Tax Committee of the American Mining Congress relating to the collection of back taxes. I will read this report, after which the meeting will be thrown open for a round table discussion of the merits and demerits of the plan.

Report of the Committee on Taxation—American Mining Congress

Your Committee is of the opinion that one of the most important tasks before the Government in the matter of taxation—if not indeed one of the most important tasks of any character—is that of finally and definitely settling and disposing of the uncertain liability which hangs over thousands of taxpayers with respect to the amount of income and excess-profits taxes they will ultimately be called upon to pay for the period in which the excess-profits tax has been in force, namely 1917-1920, inclusive.

The excess-profits tax, as we all know, is a most complicated and difficult form of taxation. We tender our profound respect to the

Bureau of Internal Revenue, and the many able and patriotic citizens who temporarily joined its forces during the war, for the work that that has been done, but we are deeply impressed with the fact that the task of gathering the war revenue is far from accomplished.

During the war, a large group of public-spirited men, actuated primarily by a desire to aid in meeting the crisis, and disregarding the compensation they received, voluntarily took up the burden of assisting in the administration of the law. But as soon as the national emergency was at an end, these men returned to private life. The Commissioner of Internal Revenue was left with a partly-completed task, and was in the position of carrying on the work with a greatly reduced staff of experienced assistants. He was called upon to renew his force with inexperienced men, attracted to the work primarily by the compensation offered for their services. It is notorious that Government salaries are grossly inadequate in many cases. We believe this to be true to a great degree within the Bureau of Internal Revenue, and this is one reason why men of the calibre of those who surrounded the Commissioner during the war period are now seldom to be found on the Government's side of the table when tax cases come to be settled.

[CHAIRMAN HOLMES: I want to interject a brief statement here, which is, that of all the various divisions of the Bureau of Internal Revenue, I do not believe that there is a single division which has in it today the able men that the Sub-division of Natural Resources has. These men—engineers, trained and intelligent—meet the task in the spirit that all of the departments and sub-divisions of the departments met the task during war times; but in practically all, if not all, of the other sub-divisions of the Bureau of Internal Revenue, there is a tendency to fall back into the routine, red-tape method of handling cases—a tendency to postpone decisions, a tendency to “pass the buck” that greatly militates against the settlement of back taxes. There are a large number of cases for 1917 still unsettled, and there seems to be little likelihood they ever will be settled unless we adopt drastic means to settle them.]

The numerous changes in the personnel of the Bureau has increased the delay and uncertainty in the settlement of back taxes, and there is now no prospect of the excess-profits taxes being finally settled within any reasonable period, unless new and radical steps are taken.

Many large taxpayers, employing expert talent to present and argue their cases, have been able to settle their taxes with the Department for the war period and up to the present date. But thousands of smaller taxpayers find their cases still unsettled, even so far back as 1917, and are either worrying over the amount of additional taxes they may be called upon to pay, or are blissfully unconscious of the claim which the Government may at any moment assert against them.

Until Taxes are Settled Business Hesitates

By reason of the large amounts involved in excess-profits taxes, this situation leads, on the one hand, to extreme uncertainty in business, to hesitation in entering upon new transactions, and to a tendency towards conservation of capital in the form of cash or securities. On the other hand, many taxpayers are now risking their funds in new enterprises, and when the Government eventually

comes to assert its claim to a part of those funds it may find that they have been dissipated or invested in such assets that liquidation cannot take place except at a great loss to the taxpayer. The difficulty of borrowing money to pay taxes is now extremely great, and, no doubt, will increase as time goes on.

Many taxpayers have come forward with the facts pertaining to their cases, and have settled the matter of their tax liability for the war period. Many others have held back, postponing and delaying consideration of their cases as long as possible. Your Committee believes that we must see to it that these delinquent citizens be made to bear their just share of the war tax burden without further quibble and delay. Still other taxpayers have, by reason of circumstances surrounding their particular cases, been compelled to pay an unjust amount of war taxes and they should receive prompt and effective relief. Some cases are indeed impossible of settlement within the strict terms of the statute. We may as well recognize this fact and proceed directly to a compromise settlement of such cases on terms fair to the taxpayer and Government alike. These considerations, and in fact every consideration of both Government and taxpayer, points to the absolute necessity of cleaning up the situation which now confronts the business world and hampers the Bureau of Internal Revenue in the difficult task of carrying on its current business in a post-war period that has many problems of its own.

Cleaning up the back taxes for the years in which the excess-profits tax was in force is an extraordinary and complex proposition. It is analogous in some respects to the necessity of clearing up the multitude of claims against the war and navy departments of the Government, to which Congress has given special attention. If Congress has deemed it advisable to take extraordinary steps to settle claims of citizens against the Government, why should it not take such steps to dispose finally of the old and indefinite claims which lie against taxpayers for the same period and arising under somewhat similar conditions?

Relief Under Act of 1918

The Revenue Act of 1918 contains several extraordinary relief provisions, such as the provision for inventory losses, amortization of war facilities, and the treatment of net losses arising within the period beginning November 1, 1918, and ending December 31, 1919. These special provisions are peculiar during the war period and immediately thereafter. Their administration is throwing an additional and extraordinary burden upon the Bureau of Internal Revenue. The question arising in the course of their administration, together with the difficulties of valuation that enter in the computation of invested capital, require the keenest intellect, the soundest judgment and the widest discretion for their proper solution.

We respectfully submit that these and the other problems of our extraordinary war-time taxation should be solved with the greatest diligence, and that this cannot be done by leaving the matter to the routine activities of the Bureau of Internal Revenue, limited as it is in its operations by strict statutory and departmental rules and procedure all tending to delay and indecision.

Proposed Board for Tax Decisions

We propose, therefore, that the American Mining Congress recommend to the Federal Congress the enactment of a statute authorizing the President to appoint, by and with the consent of the Senate, a bipartisan board of 10 men, composed of lawyers, accountants, engineers, and business men, who will sit for a period of one year, to pass upon

and settle the cases of taxation arising during or consequent upon the war-time period of 1917 to 1920, both inclusive.

Such a board might be called special commissioners of income tax. Its powers should be of the broadest character; to summon witnesses, to compel the production of books and papers, to determine questions of fact and law, and to make assessments under both the general terms of the statutes and those special remedial provisions embodied in section 210 of the Revenue Act of 1917 and sections 327 and 328 of the Revenue Act of 1918.

The board should have power to compromise taxes in cases where the need arises, and should be given a power which is not now provided for in our statutes, namely to postpone the payment of taxes for reasonable periods, or to provide for their payment in two or more installments where the board deems it necessary in order to prevent undue hardship on the taxpayer, requiring, of course, adequate security from the taxpayers to safeguard the interests of the revenue.

[CHAIRMAN HOLMES: That is a procedure which is followed in Great Britain in connection with her excess-profits tax. The Tax Bureau assesses a man promptly, his liability is determined, and then the Commissioners of Internal Revenue give him all the time that is necessary to get together the funds with which to pay his taxes. He is not called upon to pay them in a single installment as we were prior to 1918, or four installments at specified dates as we are now. If necessary, he may be given a period of more than one year.]

There exist many cases in which large amounts of tax depend upon the construction of an ambiguous or obscure provision of the statute compelling him, as is necessary under the existing provisions of the statute, to pay in the tax before commencing suit to contest the legality of the assessment. Under the uncertain conditions of the post-war period the payment of large sums of money to the Government to be held by it, without paying interest, until some doubtful provision of the statute can be interpreted by the courts, may spell ruin and disaster to the taxpayer. It may be of small avail to him that the courts eventually set aside the assessment and order the return of his money. In the meantime his capital has been tied up and unproductive, his business has suffered for lack of the money which has been held by the Government during a long drawn-out period of litigation, and the Government has gained nothing for the injury inflicted upon the taxpayer. Under ordinary circumstances, the present rule of paying the tax and suing to recover it back is desirable and practical; but the war period saw taxes of such undreamed of magnitude that ordinary rules must be set aside to meet extraordinary conditions. For 1918, the tax may take as much as 80% of the net income of a corporate taxpayer. It thereupon becomes exceedingly important to determine the real net income—a small error in that calculation may result in the tax exceeding 100% of the real net income, and becoming in fact a tax on the capital of the taxpayer. It behooves us, therefore, to not only safeguard the interests of the Government, but those of the taxpayer as well, and this leads your committee to recommend that the board shall have power to postpone the collection of taxes in such cases until after the case has been heard and determined by the courts, adequately protecting the Government by requiring such bond or other security from the taxpayer as will assure the collection of the tax and interest upon final determination of the tax liability, and that the courts shall be given authority to hear and determine such cases.

Board Only Responsible to Congress

We strongly urge that the board shall be an independent body separate and apart from the Bureau of Internal Revenue and the Treasury Department, responsible to Congress only. Free from red-tape and bureaucratic methods, the board must act promptly and decisively to settle the cases before it. The procedure under which it should operate would be analogous to that of an appellate body to which the taxpayer could appeal from decisions of the Bureau of Internal Revenue, or to which he could refer his case in the first instance if the Bureau failed within a reasonable time to make an assessment or finally approve of his reports for the years in question. The board should have authority to remand the case to the Bureau of Internal Revenue, with instructions how to close it, or on the other hand to dispose of the case summarily and determine the final assessment.

Appeal would, of course, lie from any decision of the board in the District Courts, or the Court of Claims, as is now the case upon final rejection of a claim for refund by the Commissioner of Internal Revenue.

If, however, a determination and assessment is made in the case of any taxpayer and an agreement in writing signed by the taxpayer and the board shall be final and conclusive, then (except upon a showing of fraud or malfeasance, or misrepresentation of fact materially affecting the determination or assessment thus made) the statute should provide that the case shall not be reopened or the determination and assessment modified by any officer, employee or agent of the United States, and no suit, action or proceeding to annul, modify or set aside such determination or assessment shall be entertained by any court of the United States. This provision (which is now proposed in somewhat similar form in House Bill No. 14198) would enable the board to settle expeditiously cases on terms satisfactory to the Government and the taxpayer, and with the assurance that neither the Government nor the taxpayer could thereafter attempt to re-open the assessment. In the opinion of your committee, such provision is absolutely essential to the expeditious handling of cases by the proposed board.

Your Committee believes that men of the character and ability required to perform the important duties of this board could be found if the work would not last for a period of more than a year and the compensation were commensurate with their ability. We therefore strongly urge that the compensation to each member of this board should be fixed at a sum not less than \$25,000 per annum. It must be borne in mind that this board will have an exceptional and extremely difficult task, to which the very best talent should be directed. Men of the stamp required must be paid at a rate somewhat approaching the current market value of their services, and that to take less able men or to attempt to attract able men by offering compensation ridiculously below the value of their services would be a shortsighted policy certain to doom the whole plan a failure.

Salaries of Members to be High

Your Committee suggests a large board, one composed of ten members, since the work it will perform may be divided into three or four general classes. The full board should not be required to sit in every case; three members should constitute a sufficient quorum to hear and determine the case, although more members may sit on complicated or important cases. The decision in each case should be subject to the written approval of a majority of the board, including those members who sat on the case.

A sufficient appropriation should be made to enable the board to employ an adequate staff of clerks and assistants. In addition, it should have power to call upon the Bureau of Internal Revenue for such auditing or other assistance as it might require in any particular case.

We believe the energetic, impartial operation of such a board, clothed with broad and ample powers, would result in the settlement of practically all the cases of war taxation within a year, and leave the department free to carry on its current work. We do not believe the present system of handling back taxes will ever accomplish the final completion of the work—the task is too stupendous, the amounts involved are too great, the need for sound judgment followed by prompt and courageous action is too apparent to be handled by ordinary means of tax administration.

(Signed) PAUL ARMITAGE, chairman.

CHAIRMAN HOLMES: This plan is not entirely new. A board of this character has been discussed for at least two years. That is, a board intermediate between the Commissioner and the courts to which the taxpayer could appeal, or the Department could appeal, and which would act somewhat as a board of referees. Your Committee feels that we have undertaken the task of collecting this tremendous revenue more in the spirit of solving a difficult scientific or mathematical problem than in the spirit with which, for instance, the British have approached it—that of approximating as closely as possible what tax burden the various taxpayers should pay under the extraordinary strain of the war. We have a large organization in Washington and in the field the Bureau of Internal Revenue consisted of approximately 10,000 men at the close of

Staff of Bureau of Internal Revenue

the war. It may have been reduced at the present time. The total number of Internal Revenue employees before the war was 3,000. We have expanded the Bureau approximately 300% for the purpose of collecting this extraordinary revenue. That expenditure has principally been on the employment of auditors, inspectors, and clerks; and it has been the tendency, both in the field and in Washington, for these auditors and clerks to pay more attention to the strict and literal interpretation of the law or the regulations than it has been to settle cases speedily, collect the revenue, give the Government the use of the money, and give the taxpayer the assurance that his burden has been fixed for the particular year or years in question. No other procedure could very well have been followed in the Department under our system of collecting revenues. The evils that have arisen therefrom must necessarily follow from such a system. And those evils have been delay in determining the precise amount of the assessment in the case of taxpayers having at all complicated cases. During the war, an Advisory Tax Board was appointed by the Commissioner, on which Dr. Adams, Mr. Sterrett, and Mr. R. C. Allen, Mr. Ralph Arnold and Mr. Ramstedt of this Mining Congress, and other able men, took active part in formulating regulations, laying down rules of procedure and handling the difficult cases.

Sub-Committee's Powers Restricted

That was followed by a Committee on Appeals and Review which is now operating within the Department. But the difficulty with these bodies is that they are bound by certain strict statutory rules and certain strict rules of procedure, certain regulations which, while they are changed from time to time, are difficult to change because they have established precedents. What we need at the present time to cope with this extraordinary situation is a board of greater power than can be created under the present law—a board with powers particularly to compromise or arbitrarily fix rates in cases where it is impossible to ascertain definite values or to determine fine points of law or accounting. Such a board would have an extraordinary task before it, and must necessarily adopt extraordinary methods to handle the situation. It is precisely what the courts will have to do eventually if these cases are appealed to them, and such a board, acting in a judicial or semi-judicial capacity, would relieve the courts of a great deal of burden, would settle cases most expeditiously—more quickly because away from the muddle in which we find ourselves at the present time on account of war taxation—and could start in on the collection of current revenue and keep the business of the Bureau of Internal Revenue more nearly up to date.

I should like very much to have you take up the discussion of this proposal. (Applause.)

MR. RAVANEL MACBETH: I will state for the information of the Congress that the tentative draft of the 1918 act contained a provision somewhat similar to the report made by the Taxation Committee of the American Mining Congress. That provision was for a board to consist, if I remember correctly, of seven members, with a salary of \$9,000 per annum each. The objection was then made on the part of Congress as to the salary to be paid to the members of that board. I simply give you this as a matter of information.

CHAIRMAN HOLMES: That suggestion went through and is a part of the 1918 statute, if I remember correctly, and it is under that that the Commissioner has appointed this Committee on Appeals and Review. I recall the argument on the question of salary, and we feel the question of getting adequate salaries will be the most difficult thing about this proposed measure.

MR. THOMAS T. BREWSTER: Is it not true that the thing which ties up all these cases is the difficulty of determining values as of March 1, 1913, which serves as the basis for depletion and depreciation charges, and also serves as the basis of testing invested capital, because invested

Difficulties of the Tax Problem

capital includes earned surplus, the prime test of which is whether proper depreciation and depletion charges have been made? Not only the difficulty of determining values as of that date, but the true value as at any time when paid in for stock. How are we going, at this late date, to get

the human mind in shape to determine what the value was of the coal property or a metal mine as of March 1, 1913, especially when we had hanging over us that value regulation, which in determining the value of a deposit of coal, the value in block should be taken into consideration without regard to improvements, developments or any other attendant circumstances? That value regulation was the one thing, beyond any thing else, which caused the income taxpayer to throw up his hands in disgust. They got discouraged and they dropped their valuations. No one anticipated war, no one anticipated subsequent legislation, but when it did come—when the war-tax legislation came, it found the operators of wasted resources just as unprepared to meet the taxation problems as the country was unprepared to meet other war problems.

As I see it, most of these difficulties in determining these back taxes, and under the present law, if it continues, is to find out, to determine some yardstick by which we can value those properties. The regulation is very wide; as it reads, it permits the adducing of any possible proof, and yet I am told when it comes to adjudication of these cases in the Department the minds of the examiners are absolutely closed. They interpret the thing much less liberally than they might under the regulation.

Another point: In the many conferences that we have had regarding this matter, we had a three-day conference last winter in Washington, and it was clearly pointed out that one of the great embarrassments was the absolute inability or unwillingness of the taxpayer to come with a clean statement of convincing fact. Now, the taxpayer has a duty on him to make his case, and if the taxpayer does not make his case, if he can not adduce the convincing proof, a board of 100 men with a salary of \$250,000 a year apiece are not going to clear up this situation. It is true we must have the court, but the taxpayer must come into court, and with clean hands. (Applause.)

CHAIRMAN HOLMES: I think Mr. Brewster's remarks are very pertinent. Not only is the question of value for the purpose of depreciation and depletion necessary, but the question of value as of the date of acquisition, which may be away behind March 1, 1913, is necessary for determination of invested capital. It is that thing which makes the excess-profits tax so difficult to administer. I think perhaps no one can speak more authoritatively on the question of valuation and the difficulties of valuation than Mr. Dick, head of the Sub-division of Natural Resources in the Bureau of Internal Revenue. We should like to hear from Mr. Dick if he has any remarks to make in this connection.

MR. J. C. DICK: Mr. Chairman and gentlemen: I was asked to go to Washington some 17 months ago to assist in formulating methods by which we could value mines, especially metal mines. I am not exactly on the outside here, because I am a member of the Congress, but that I may more clearly put the thing before you, I will read what I have to say.

[Mr. Dick's paper will be found on page 671 of the Proceedings.]

CHAIRMAN HOLMES: You have all listened with great interest to Mr. Dick's statement. His remark about the questionnaire reminds me of the old Chinese proverb, "Nothing is difficult to him who knows how." The questionnaire might be filled out in 30 minutes by one who has lived with it 30 months or more, but I daresay that some of us find considerable difficulty in filling it out.

The Sub-division of Natural Resources has done and is doing splendid work along the line of valuation. It meets only one of the difficulties in settling the tax question, and there are many other questions raised in accounting, many questions of law.

Time Needed to Clear Back Taxes

Mr. Brewster made the remark, how are we going to clean up this thing even with a committee of 100 men as long as the valuation is so difficult. My answer to that would be that if the excess-profits tax is going to be eliminated, as appears very likely at the present time, or at least greatly modified, and we need not necessarily establish values as a precedent for all time to come, our principal purpose, then, is to determine the tax liability of the taxpayer during the war period. We can reach a more approximate valuation than is necessary under the present system. We can, in a measure, look at the result we want to achieve and use that as a check on the valuation. In other words, is A, on the basis he proposes, paying his fair amount of tax, as compared with his competitors B, C, and D? We have enough valuations on sound basis to give us a comparison. The whole difficulty is to get men who will and who can select the proper comparatives to determine what shall be paid by those who have not yet settled their tax cases in the Department. The thing that impressed your Committee most of all was that, working as the Department is, hard as it is, with as large a force as it has, it is not keeping pace with the constant number of new cases coming in. If we are not correct in that assumption we should like to be corrected. What are we going to do with these cases constantly accumulating in the back? I would like to have any and all sorts of criticism directed against this proposal. That is the purpose for which it is presented to this meeting. Has anyone anything he wishes to say?

MR. WILLIAM B. GOWER: One feature of this taxation strikes me in what has been said, that is as to the necessity of creating a new appeal body. I think that where you propose a new body, supplanting as it would a present body, you must show more clearly than you have shown in your report the reasons why they are to supplant this body.

Another Board Might not Expedite Matters

I do not believe that you, in saying that the accumulation of cases is your governing reason, give a sufficient reason. We will admit that there may be an accumulation of cases, but have we any statistics on that, are we sure of that? I am by no means sure that, even if you appoint another body of eight or nine members that you will expedite the settlement of these cases. What can such a body of men do to relieve the

congestion, if there is congestion, in that Department? You must find deeper reasons, and that brings me to one that has not been touched on in your report, which seems to be something that is blocking the expedition of cases in Washington, if they are being blocked, as we think they are. We all know that this law of 1917 and 1918 is complex. We also know that it is permeated all through, not with common-sense ideas and present-day value ideas, but with a lot of accounting ideas. We seem to forget, a good many of us have forgotten, that these accounting ideas which saturate both of those laws, are based on a fixed science; that all these questions can be determined, these accounting questions can be determined by looking up the practice in accounting and looking up the text books, or some other way. To illustrate what I mean, you will find that the Department a short time ago, in talking about what was meant by various earned surplus and undivided profits in the tax law, very blithely said it included the entire body of principles of accounting relative to the determination of surplus. That is what we would call a very large audit. If there is any man living who can tell me what comprises the entire body of principles of accounting relative to the determination of surplus I would like to hear it, because nothing has been more disputed in accounting than that very question. There is more uncertainty, and there are more divergent customs and methods—far more uncertainties than in law, although I do not pretend to speak from the standpoint of the law. I am not a lawyer, but I judge there are a lot of uncertainties in law, and in accounting we have multitudes of them. What happened in 1917?

What Happened in 1917

They appointed a board of tax advisers on which there was a certain element of accounting experts represented, notably Mr. Sterrett of the firm of Price, Waterhouse & Co. What did these gentlemen do when they came face to face with the uncertainties that they had to solve so this tax law might proceed? They settled them in their own way; they had to settle them. This tax law had to proceed. Mr. Dick now tells us that we have Regulations 45 as the primary, the best accredited course in the administration of that law. Now, Regulations 45 is saturated with accounting ideas, but do you believe that those accounting ideas are accepted by the whole body of accountants? Not by any means. They represent the solution that Mr. Sterrett and his associates were obliged to make at that time. Here was an uncertain question they had to settle. I might mention one point: When they had before them the very difficult problems of inventory valuation of the entire country, what did they do? Put out one fixed basis of inventory valuation, cost, or cost or market, whichever is the lower. Ever since that they have been changing, whittling, and messing around, getting away from this very thing the gentlemen settled in the Regulations. Now, what seems to me is blocking today, if there is a blockade in the income-tax unit, is that the body of men you have referred to in the paper as experts, and who were experts, have passed away from the life of the Department and have been succeeded by others, and the Regulations

which this body of 1917 drew, so far as accounting is concerned, stiffened into these regulations like a dead hand on a bolt. One of us will go down and say that general rule is not applicable to this industry, or to that industry, yet these gentlemen feel a reluctance to touch them. I do not say they fear responsibility, but they are hypnotized by the written word which was put out in 1917 by that first board. Now if the body you propose will do nothing else than get away from the hypnotic influence of the accounting ideas that were embodied in Regulations 45, and which are disputed by thousands of accountants today, if it does nothing else, it will perform something; if not, it is to the committee on appeals we have got to look for a better interpretation of what was done in 1917 so they will get away from thinking that the last word was said by the advisory board in 1917 on accounting subjects. (Applause.)

MR. FRED SNYDER: (Representing fee-owners, and especially fee-owners who made leases of their properties prior to March 1, 1913.) Right along the line made by Mr. Brewster I will state my reason for supporting this Committee's report. Speaking for mines owned largely by private ownership prior to March 1, 1913, and most of which are

How Leases are Affected

leased on mining leases prior to that date, and running back some 12 or 15 years prior to that, these mining leases run usually for 50 years. The time which they run, when they were made, so far as the fee-owner was concerned, was an inconsiderable problem. He was willing to give a 100 years if it had been asked. Why? Because, he said, you will obligate yourselves to take out 50,000 or 100,000 tons per year. If you fail to take it out, you will pay for it at the rate of the royalty specified—15, 20, or 25 cents a ton, with the right in any subsequent years to apply that money you have paid thus in advance on ore which you might take out subsequently. So, you see, that feature of time in a lease was immaterial when it was put in there. It was not determined at that time when that ore might come out, nor was it known in many cases at that time how much more ore was in the property. Now, you come to March 1, 1913, and this large number of fee-owners, many of whom had a meeting before I came and instructed me to bring this message, are asked to place a value upon their interests as fee-owners—lessors in these leases. March 1, 1913, comes; we will say there are 40 years to run on one of these leases; we will say at that time the engineers or owners, who in many cases had explored it before the leases were made and knew for themselves how much ore was in there—the engineers at that time could tell definitely whether the ore would have to come out in 15 or 25 years in order that the lease paying the minimum would recoup the owner for his money—that fee-owner, in that position coming before the Department is not permitted now to show the actual exhaustion period of March 1, 1913, but his property must have a depletable value based on the remaining part of the lease—30 or 40 years. We protest against that, and we could meet with gentlemen in Washington, we could meet with engineers with affidavits, we could show that this or that property

on March 1, 1913, although not actually opened at that time with an output which would show it would terminate in 15 or 20 years, we could

Calculate Depletion on the Exhaustion Period

show that fact must happen. Therefore, we ask that in calculating the depletable value for any interest we have the right to use as one of the factors, not the unexpired term of that lease, but the actual exhaustion period of that property. If they have not the discretion to solve a question of that kind, involving so many interests in Minnesota, their solution of which would go so far to do away with a lot of this congestion, I think we ought to have a board of this kind with discretion before whom we might get relief in such cases. (Applause.)

CHAIRMAN HOLMES: We have with us Mr. Robert N. Miller, formerly Solicitor of Internal Revenue. We should like very much to hear from him in this connection.

MR. ROBERT N. MILLER: Gentlemen, I have been much interested indeed in what has been said, and there has not, to my mind, and in my judgment, been a single word said that did not have truth in it. That is what is characteristic of this tremendous problem. This tax problem is as big as the United States, and as full of difficulties, and you can hear weeks of discussion about it and still not run out of the things we have got to consider when we are really deciding the question. Now, this body has a better right maybe, certainly as good a right, to say something definite and forceful on this subject as anybody in the United States. This is the most hazardous business in the United States, and in spite of the hazards, not only of what is unknown in the ground, but those that are involved in trusting things to the personality of managers, this business has managed to pay practically 10% of the taxes paid by corporations. So this body has a right to speak definitely as to what ought to be done.

Correct and Incorrect Filing of Returns

I am not going to speak very long now, but this I would like to suggest: I had not seen until I got here just the way in which this resolution is phrased. To me, who went into the Department just about when the first returns were being filed under the law of 1917 and stayed there for nearly two years, it is now absolutely plain that we have reached a point where the disadvantages of final and quick judgment (and they do exist) are more than overborne by the advantages of getting this thing finished and done. Of course we all want to do things absolutely right, and of course we realize the necessity of following principle, but we are in a situation here that does absolutely require the cutting of a knot, and I believe it is very important to consider what has been proposed here. It is important not only from the standpoint of the taxpayer individually, but also from the standpoint of the taxpayer as a part of the Federal Government, because the Government side of the problem is our problem too. There are men who did not file their 1917 returns correctly, but

there are some who came pretty near filing them so. To settle them just as filed is an injustice to the fellow who filed them right. There are some people who ought to pay more taxes in justice to those who have paid the right amount, and the time is passing. In a few months the Government will be barred as to a great many 1917 taxes, so that this relief, some kind of sudden relief, is just as good for the Department and for our own Government, which belongs to us, as it is for the taxpayer.

One other phase suggests itself: Even if we get a high-grade board as has been suggested—an appellate board—the successful functioning of that board of ten men, even if it had 500 assistants—I know by real contact with these millions of returns—I say the successful functioning of that board depends absolutely on the successful functioning of the Internal Revenue Bureau too, because that board is not going to be able to dispose of millions of disputed cases. For that board to function well, the Bureau must examine millions of returns before any of them get to that board, so that the number of questions does not exceed the board's capacity. So that, however good this board may be, we ought at the same time, I think, all of us, to figure on giving the Department what it has never had yet, and that is money enough to hold the good men that it has got and to get some more. (Applause.) I could give you so many examples of men who have grown by contact with the thousand cases,

Loss of Government Employes

and I tell you contact with a lot of cases broadens those people rather than makes them narrow. The Government, when it lets a good man go, lets something go that is worth a lot of money. I often think when a big fellow who has learned broadness by contact with taxpayers who are the victims of peculiarities in the law and who sees, as Mr. Gower says, that there is no little, narrow answer to each one of these questions, after you have him educated to that point, why, of course, somebody pays him three or four times what he is getting and the Government loses him—I think of him as a great, big tree that takes a generation to grow and after a while is cut down. To replace it you must plant seed, and it is a long time before it grows to useful size. It is of enormous importance, not only to have a great group of men who can take and decide some big principles, but to have many competent men working hard down below among those millions of cases—each one a most important question to the fellow whose case it is. That is a necessity, and right down there in the Bureau now there are splendid men in the Department on the point of going. There is a spirit of unrest, because so many people are going out and getting three or four times what they can make in the Department. It is lunch time. Thank you. (Applause).

CHAIRMAN HOLMES: Unless someone wishes to speak at the present time, this meeting will stand adjourned until 3 o'clock, at which time we hope that we may hear some more from Mr. Miller whose valued remarks come from a great fund of experience. Mr. Miller was through the mill

during the war and knows what this situation in the Treasury Department means from every angle.

The meeting stands adjourned until three, and we hope members will be ready with their criticisms at that time.

AFTERNOON SESSION, 3 P. M., NOVEMBER 16, 1920

CHAIRMAN HOLMES: We concluded the session this morning with some remarks by Mr. Miller, and I will request him to continue for a short time at the opening of this session.

MR. MILLER: There is too much to be done this afternoon to make it fair for me to do more than just finish what I started before lunch. In the first place what seems to me clear, is that there is an immediate necessity of doing something. The war taxes must by some means or other be determined soon. Not to determine them soon, but to put them off a long time is going to make great and unnecessary hardship; we have got to do something right away. I confess I am still considering the problem as to just where this decisive action should come in. It is a big question, but I submit for your consideration this thing that I believe is very important: Wherever this body, this determining body, is put in use, in the Treasury or outside of it, its success, as I said before, depends on having a great deal of work done on the cases before they are referred to the remedial board, because there are literally millions of these returns every year to be audited and studied. And there are two points, each of which has to be cleared up. There is the principle referred to as the 210 Section in the 1917 law of 327 and 328 Sections in the 1918 law; that is, special relief as to the rate of tax people ought to pay that relief cannot

Determination of Net Income

be applied until the net income of a taxpayer is determined; the determination of net income is one of the difficult things that would have to be decided and decided promptly by the Bureau before the question was really put up to this relief body. The determination of net income is one phase that is still dragging, and I will say dragging not because of any fault of the Department. Many people find it hard to believe that the Department has done a reasonably good job, and yet I honestly believe it has done a remarkable job, and the hardship of this tax on the taxpayer has been due to the difficulty of the problem; so that, to provide for this smaller group of highly paid men—and they have got to be highly paid men to carry the responsibility we are asking them to carry—there must be some more money spent down in the Department in order to permit it to keep abreast of its responsibilities, and get the cases ready for final action. About ten months, or almost a year ago, the Consolidated Returns section, which handles, of course, the biggest business of the country—they have a single return sometimes that involves a lot more than 100 active subsidiaries, all of them complicated by inter-company relations,

and all in one return—they planned a program to try and finish the 1917 returns by the first of March, and they found that they would need about a thousand extra men; and that those men, even though they were men of ability, at the start would have to study about six months in a regular class before they were very much good to the Department. Now, that plan was started in the Department but it was not long before it became evident that it could not be carried out, for lack of funds. That's the situation right this minute. They have their plans to try to develop new men and try to hold the trained ones, but they have not money enough even to run on the present basis. We are all interested in it. The fact is, as we all realize when we think about it, the well-instructed man with the background is the only man who has courage to give away money that belongs to the taxpayer. He realizes that some day Congress may ask him, "What did you give that money away for?" The only man who can look forward with confidence to that question is he who knows just why he did it, and the success of the taxpayer who ought to have money returned depends on having men in office—even those somewhat below the grade of this necessarily strong board—that have the nerve to say, "Yes, the taxpayer ought to have this, and I am going to give it to him." I think the prime need for any great administrative job is to have, long before you get to court, two groups of people to whom you can present

Where to Place the Proposed Board

your case: First, the fellow who grew up with the case on the Government side. Second, an appeal should be possible to another administrative group that didn't grow up with the case—who, when they see it, will see it as a fresh matter, free from that the wholly unconscious fixity of impressions once formed. That is something to be observed at all costs, and is one of the great things that is guaranteed by the kind of body that is here proposed. Of course, there are arguments for and against putting this adjustment board outside the Treasury Department instead of inside it. Right at this moment my inclination is to put it inside the Treasury. I think this situation is of the greatest importance and that something must be done that will speed up the processes of the Bureau in determining net income, and will also make possible a final settlement and adjustment of war taxes.

CHAIRMAN HOLMES: I will take this occasion to read two letters received from men who have given a great deal of study to the subject of taxation. One is from Professor Haig of Columbia, who recently spent several months in England, making a study of the British excess-profits tax law, and is about to publish a report on that subject for the American Economic Association. The tentative report of the committee was submitted to him, and this is his reply:

"COLUMBIA UNIVERSITY,
IN THE CITY OF NEW YORK,
SCHOOL OF BUSINESS.

"November 10, 1920.

"*Mr. George E. Holmes, 15 William Street, New York, N. Y.:*

"MY DEAR MR. HOLMES: You were good enough to send me a preliminary draft of the report of the Committee on Taxation of the American Mining Congress and to ask me for comments on the proposal it contains from the point of view of British experience in dealing with the problem. I am very glad to do this, for, in my opinion, we must at once radically improve our income and profits tax administration if we are to escape very serious fiscal and economic consequences. I thoroughly approve of what the committee report says of the urgency of the situation and of the necessity for such action as will result in speedily fixing the precise liability of taxpayers.

The British Tax System

"Under the British system a condition like that now confronting us is quite impossible. There the accounts are carefully examined, and the tax liability determined by a capable Government assessor, before the tax is assessed or collected, and their force of civil servants has proved equal to the task of keeping up to date with its work. They have the fullest possible provision for appeals to administrative authorities and to boards organized and operating on the principle of arbitration by disinterested outsiders. Our Civil Service, in spite of its best efforts, has fallen far behind, and unless some emergency organization is supplied it is difficult to see how the situation can be met. A board of Special Commissioners of Income Tax, such as you suggest, would undoubtedly command the respect of the taxpayer and would deserve the confidence of the Government. Congress should not hesitate to vest such a board with power to arrive at agreements with the taxpayer. The interests of the Government would receive proper consideration.

"In the case of such taxes as the income and profits tax, the liability of the taxpayer rests to a very material extent upon items which represent mere estimates and valuations. There is a possibility of wide differences of opinion between the Government and the taxpayer as to the correctness of these items and there is usually no absolute standard for determining which view is right. The only way to settle the problem satisfactorily is for the Government to establish somebody in whose intelligence and fairness the taxpayer has confidence, and to give power to this body to make decisions as their judgment may dictate after full consideration of the facts. The British, who have had 80 years of continuous experience with income taxation, fully appreciate the necessity of elasticity in administration and grant to their local assessors, as well as to their higher officials, what seems to us to be an amazingly large degree of latitude in arriving at agreements and compromises with taxpayers. It would be foolish for us at this juncture to de-centralize our system and vest our local authorities with power similar to that exercised by the corresponding British

official. Before we can do that we must build up a force of skilled, responsible, and able civil servants comparable with the British force. But the plan of the Committee calls for the establishment of a board, which unfortunately must probably be temporary in character, which could safely be given power to arrive at decisions and there should be no hesitation in granting them the power. British experience plainly indicates that such power must be delegated to some factor in the administration if the income and profits taxes are to be promptly and fairly assessed.

Prompt Determination of Tax Liability

"In a word, we must arrange for a prompt and certain determination of tax liability. To secure this we must empower some capable, intelligent and trustworthy authority to use their judgment and discretion in arriving at agreements with taxpayers. A board such as you propose would, I believe, be a body which could safely be entrusted with the necessary authority, and the plan would undoubtedly meet the present emergency. A complete solution of our general problem rests fundamentally upon our ability to build up a capable, permanent force of civil servants.

"Faithfully yours,

"ROBERT M. HAIG."

CHAIRMAN HOLMES: The other is a letter from Professor Plehn of the University of California, who has also given considerable study to the subject of taxation:

"UNIVERSITY OF CALIFORNIA,
DEPARTMENT OF ECONOMICS.

"BERKELEY, November 8, 1920.

"Mr. Robert G. Wilson, *American Mining Congress*,
"Albany Hotel, Denver, Colorado:

"DEAR SIR: Replying to yours of November 2nd, I wish to say, as emphatically as possible, that a Federal Board of Adjustment, to deal with the accumulated tax returns of income and excess-profits taxes, is absolutely necessary.

Hold-up of Tax Settlements for Years

"With billions of dollars at stake, it is worse than penny-wise and pound-foolish to delay. It is fundamentally wicked to hold up tax settlements for five years. They hang like a great rock suspended by a thread over the head of industry, and threaten to fall when industry is at its weakest. The Government at present is using pick-and-shovel methods to work a mine where blasting and steam shovels are needed.

"If you will look at page 3 of the Digest of Income Tax Rulings No. 10, June, 1920, you will see that there are 10 different official sources of rulings on income-tax decisions. If you will read any hundred of such decisions, selecting ten from each source, you will find numerous inconsistencies, often flat contradictions. Added to this confusion are the

unrecorded and arbitrary decisions of 'auditors' and 'inspectors,' who often deal with industries and accounts of which they have less than an elementary understanding. How far would you get in operating a big mine if you had 10 independent sets of orders going out to gang-bosses who had never been in a mine before?

"There are many radical reforms of administration necessary before we can have a workable income tax. But the first thing, the most pressing thing, is to clean up the past output, to get the ore that is above ground into the smelter and the metal out. "Yours truly,

"CARL C. PLEHN."

CHAIRMAN HOLMES: This morning we heard some excellent statements from Messrs. Brewster, Dick, Gower, Snyder, and Miller. I trust that the members of this meeting had time, during the somewhat liberal luncheon recess, to give further consideration to this subject, and are now prepared to give utterance to their criticisms of the report. The Committee feels that all it can do is present the report to this Conference, and that the Conference must approve or disapprove of it. The Committee would prefer much, perhaps severe, criticism, out of all of which would probably grow a final recommendation avoiding some of the weaknesses of this, adding other points of strength. Mr. Gower referred this morning to the advisory board that was in operation some two years ago, and spoke of the rulings which the members of that board had to make under stress of circumstances, and asked if the proposed board would be a similar body. The Committee's intention is that the proposed board shall be

Proposed Board to Be an Arbitrator

a body of very different character—one which will act in the nature of a referee or arbitrator between the Government and the taxpayer. Mr. Miller has expressed a doubt as to whether this board should be outside the Bureau of Internal Revenue, independent of it, or should be an arm of that Bureau. The Committee would like to get an expression of opinion on that point. It feels that because of the extraordinary functions and its temporary character, it should be an entirely independent body, one designed to do a particular work and then disappear; that in accomplishing that extraordinary work it is doing something extraneous, something which is not now a part of the duties of the Bureau of Internal Revenue, except, perhaps, to a limited extent. That board will have power to do more than merely follow the letter of the law. It will have power that is now vested in the Commissioner, but rarely exercised, that is, the power of compromising taxes where it evidently appears that the taxpayer would not be able to pay the taxes which it seems the law assesses against him. For instance, in the case of a taxpayer who has had a large amount of income in one year and no income for two or three years thereafter. Under the present law, the Treasury Department is required to give consideration only to the particular year in question. That is an unwise provision of our statute. It has been recognized in Great Britain that the net income of a business is the income from a longer period of time than one year; that what it earns in three years, the net after its

losses are deducted, is really its net income. Our law, however, does not take that into consideration; the 1918 statute does to a very narrow extent; it takes into consideration the loss for 1919, for a very short period of time. I happen to know where the fiscal year of a corporation ended just a few days before the beginning of that period, and of course there was a situation where the express provision of the statute could not be made operative.

We should like to hear from other members of this meeting.

MR. MACBETH: I would like to make a brief statement: I said briefly this morning that when the act of 1918 was pending, a number of men made an effort to obtain the passage of a bill somewhat similar to that provided for by this report. We worked several weeks on this matter in

A Question of Salary

both Houses of Congress. We asked a salary of \$9000 for a board of seven men, but a \$7500 Congressman could not see a \$9000 employee, so the result of our work is that today you have the Board of Appeals and Review. We accomplished something. Now, are you going before Congress made up of \$7500 Congressmen and ask them to appoint a board of 10 men with a salary of \$25,000 apiece? Where are you going to land? Let us look at this from a common-sense standpoint: We should cut that down, in my opinion, if we want to get anywhere, and make that salary about \$12,000, and I doubt whether you will get far with \$12,000.

CHAIRMAN HOLMES: Senator Macbeth raises an important point in the discussion of this measure. The Committee gave considerable thought to it. We recognized the difficulties of getting Congress to appropriate anything more than the salary of a Congressman as a salary for anyone else. We realized this was an amount far in excess of any salary, except perhaps, that which the highest executive could demand. But, on the other hand, the strength of this measure lies entirely in the quality of the men that may be obtained. And we feel that it is useless at this time to try to encourage men to undertake this work unless they are paid a salary somewhat commensurate with the value of their services.

MR. MACBETH: The Chief Justice of the United States Supreme Court receives \$17,000. Are you going before Congress and ask for \$25,000 for each member of this board?

CHAIRMAN HOLMES: We realize that, Senator. We framed this in a way which we hoped might be an argument; we made this board to exist for a year. We made this compensation to be the compensation of the board during its existence, to get away from the idea of an annual salary for a long period of time such as is the case with the Supreme Court Justice who gets his salary long after he retires, whenever they do retire. It is one of the big problems of this measure, one of the biggest difficulties that confronts a successful introduction of this measure. We should be glad to hear from other members on that or any other point.

MR. MACBETH: I want to say something else: You will find it absolutely impossible to create an independent board subject only to Congress. That board will be under the jurisdiction of the Secretary of the Treasury. Don't forget that. It will be the purpose of the party that comes into power after March 4th to consolidate; you are going to find a general cutting down of expenses. We have observed that by statements in the press, made by prominent members of the party who will be in power. Now it is the purpose of this measure to create another independent board which will require a larger expenditure of money. You cannot get away with anything of that kind; it is useless. We want to recognize that fact.

CHAIRMAN HOLMES: Is there any other member who wants to speak on this point?

MR. CLARK: Would there be any of the sting of this high salary taken out of this proposal if the mining companies whose accounts were being audited were made to pay a small fee, or some fee in proportion, or in a lump sum—would that help any?

MR. MACBETH: I hardly think that would be possible. It would be something very unusual, something that is never done.

MR. GOWER: Has it occurred to the Committee at all to consider the possibility of this proposed board serving without pay as the British do,

Serving Without Pay

at least I believe they do; I am not very familiar with that point. Possibly if you require so many lawyers, accountants, and business executives, you might, by appealing to the national bodies of lawyers (I know there are such), secure the men in that way. You speak here of the board lasting but one year, possibly two; we know that one year usually runs into two. Could you not secure these men for that length of time to serve without pay and thus remove the practical objection that Mr. Macbeth has very clearly indicated? Perhaps also you could find business executives who would be willing to serve for the limited time without pay.

MR. MACBETH: With respect to that, the Tax Advisory Board was composed of men who served for a dollar a year and paid their own expenses. The Government allowed \$15 a day, but I happen to know these gentlemen never took the money. I believe we can find a board of men who will serve as Mr. Gower has suggested.

CHAIRMAN HOLMES: That is another interesting point. It was possible during the war to get a large number of men to serve in these public capacities without pay. Is it possible in a strenuous period of reconstruction to do the same thing? We should like to hear from other members on that point.

MR. GOWER: On that point I could, perhaps, speak about the accountants, being one myself and a member of their national body. I feel sure

if a matter of that kind were put up to them, and the Government required them to furnish one or two men for such a board, that if this financial stress you speak of was a factor the national body of those accountants would bear the stress itself, it would be to its advantage to do so—pay the salary themselves.

CHAIRMAN HOLMES: Are there any further remarks on that point?

MR. ROBERT G. WILSON: It being one of the essential prerequisites of such a board of special commissioners that it be vested with sufficient authority to prove really effective, I doubt very much whether Congress would vest that authority in a board serving voluntarily. We do many new, strange, and experimental things these days, but I doubt very much whether that would be a feasible proposition.

CHAIRMAN HOLMES: The British Board of Referees, I believe, is composed of a large number of men—I don't recall the exact number. I think they only serve occasionally, and a small number makes a quorum; some attend one or two meetings a year. I think the work here will be too strenuous for anything of that sort. The men who go in will have to give all of their time, energy, and thought to it. We should like to hear from Mr. Miller as to whether he thinks a board of this kind could be organized at the present time to work without pay.

Views of Public on No-Salary Men

MR. MILLER: I am afraid of that on this ground: The success of such a board, or almost anything that anybody does, depends on the way it strikes public opinion. No board could last very long or do very good work unless the people are pretty well satisfied. Frequently I have run into the feeling—when a man is working for nothing the report gets around—"Oh, well, he is getting his out of it some way or other." That is human nature; and this board cannot succeed without everybody feeling confidence in it. You could get the men, and they would do real good work; you might get better men that way than any other, but they would not have that backing up of the public without which we cannot do anything.

CHAIRMAN HOLMES: England has a great advantage in having a large leisure class she calls on for special work of this kind. Our leisure class is not of the same grade of intelligence and experience as the British class. Are there any other remarks on this point of discussion?

MR. C. A. FISHER: Isn't the taxpayer's need sufficiently urgent so that he could at least make his Congressman say that a man who is capable of settling a question that involves so many million dollars as the tax question does today should be properly paid, and that such a man could not be obtained unless he was paid a \$12,000 or \$15,000 salary? I believe you could get men to do it for \$12,000 a year, and if that is what is going to kill the recommendations of the Committee, let us reduce their salaries, as every taxpayer in the country realizes we must do something; we

cannot go on this way much longer. I have, for the last two years, been spending a great deal of time with the Department, and I think that the Natural Resources Sub-division, with which I am quite familiar, is doing splendid work, and settling these cases as fast as an organization only two years old could be expected to. When you look at the files in the Treasury Department that are untouched—and let some of those men who have charge of these files point them out to you—then sit down and consider the time you have spent on one tax case, and think of the time it will take to clean up those files. If you could make the taxpayer realize that situation, he would be perfectly willing to send his Congressman to Washington to do something, if it did cost a lot of money, because the indus-

Industry in a Quandary

tries today are at a point where they scarcely know what to do. They don't know how much their tax is going to be; they do know it is going to be heavy; they cannot lay out a rational policy on account of the tax; and certainly this whole situation has become acute enough so that we can make the Congressman realize that something must be done. You cannot get good men to take responsibility such as a man in that position would have to take without paying him something for it; but I would rather see the \$25,000 cut down than the recommendations of the Committee lost. I think you might find men who would do it for \$12,000 or \$15,000, but this holding men down to \$7000 because that is the salary of some of the law-makers I think is not good business.

MR. MACBETH: That's a fact.

CHAIRMAN HOLMES: It is a fact, and we all know it is. This reminds me of a former President who said, "We are facing a condition, and not a theory." On the other hand, we must get these old taxes cleaned up and the billion dollars collected. Is there any further discussion on this or any other point in the report?

MR. WILSON: If there is no further discussion, Mr. Chairman, I should like to make a motion that the present Chairman of the Conference be authorized and directed to appoint a committee of five to draw up resolutions to offer tomorrow before the general session of the Convention to be followed by the introduction of such resolutions to the Resolutions Committee.

The motion was unanimously carried.

CHAIRMAN HOLMES: The chair appoints Mr. Paul Armitage, Mr. R. C. Allen, Mr. Ravel MacBeth, Mr. C. A. Fisher, and the chairman. I would request that Mr. Miller will kindly consent to act in an advisory capacity to that Committee.

MR. CLARK: As a direct result of Federal legislation, coal miners have been required to raise their wages approximately 100%, and the Department employees have had something that is not even an extra raise, but simply a bonus of approximately 10 or 15%. I wish the Committee would

mention that, and I hope they will make the recommendation strong so that those men in office and holding Federal employment be given a good, substantial raise such as other men have received in the past few years, in the hope it will encourage the men now there to stay and do better work. That will be a great source of relief.

CHAIRMAN HOLMES: The Committee will bear that recommendation in mind.

The next group of subjects that this Conference will consider are those relating to the current tax situation. That is quite a considerable subject. Discussion will take place on that this afternoon, and if necessary, it will be carried over to the session that will be held tomorrow morning at 9.30. That session is not on the program. It will include a further discussion by Mr. Miller and a paper by Mr. C. A. Fisher. This afternoon will be devoted to such brief discussions, criticisms, and suggestions as may occur to members present. Mr. Gower, I believe, has something to say about depletion.

MR. GOWER: In the discussion this morning I alluded to the Board that was formed in 1917, on which we had at least one accountant of national reputation. The decisions of that Board have been largely incorporated in the present regulations. Now, the regulation that I wish to speak to you about is one which has been fastened upon the mining industry by accountants, particularly by those who served on the Board in 1917, and the gentlemen who fastened this rule upon us—although I don't speak in any derogation of their great ability—I think knew very little

Distinctions in Industries and Respective Taxes

about the mining industry, mine accounting, and mining generally; and in making their rules they endeavored to make general regulations covering manufacturing, trading, and mining, as though there were no distinction between those classes of business. This rule is one which I think has hit more or less every mining company in the country. A good deal depended upon the age of the mine. In a case that I have in mind, the company was severely hit because it had been operating 20 years. The foundation of that rule is this: The Department says in Article 829, Regulations 45, every time a piece of ore is taken out of the ground, from the time the first pick and shovel are put into the ground, that mine has suffered impairment of its original invested capital, no matter what the circumstances of the mine may be, whether the mine is worth 10 times as much today as it was when it started. Yet the fact that the ore was mined—so say the Regulations, or rather, so they are interpreted—has impaired that invested capital, and the Department takes the quantity of ore that was extracted from the time the first shovelful was removed, and it multiplies that tonnage by a uniform constant rate, and on the result so obtained is proceeds to take from our invested capital, no matter what the conditions are. No inquiry is made into that; the mere fact that it extracted ore, the Department says, has impaired the invested capital. We all know that invested capital consists of two or three elements.

They say, taking out that ore 20 years ago impaired our profits, and if we come in today with several millions of dollars of profits as part of our invested capital, the Department says no, they are not profits; part of them is a return of your original capital, and that rule they work out by Regulations 45, Article 839. It is to combat that rule I will read this paper. I would like to have it fixed in your minds clearly that what the Department is attacking is the status of our profits. They say our profits are not true profits, but contain a large element of original capital, and therefore they say they may deprive us of millions of dollars of profits.

[Mr. Gower's paper appears on page 649 of the proceedings.]

CHAIRMAN HOLMES: We have listened with a great deal of interest to Mr. Gower. He has taken exception to an established rule of the Treasury Department. His argument is the kind that will help develop our law. He is bringing out forcibly one side of a very difficult question.

Depletion and Depreciation

It is an interesting point to which the Treasury Department has given considerable thought—whether it is necessary to reduce the invested capital by a calculation for depreciation or depletion when there has been an actual increase in value over a period of time. In other words, Mr. Gower's property was worth \$26,500,000 in 1904; it was worth \$41,000,000 in 1913; there was no loss in value; there was a greater market value at the end of that period than at the beginning. The Department says, however, you must reduce your surplus by \$11,000,000 to take care of a mathematical loss in your original investment.

MR. T. O. McGRATH: Mr. Gower has brought out the side of the successful mine, but the problem of the unsuccessful mine or the prospective mine, has not been presented. I am connected with a mining concern that has spent \$3,500,000, but has not yet developed a mine, although it has a chance to make a big mine in Bisbee, Arizona. There, ores are not found in large deposits; they are in fissures and stringers, and if you once find an ore-bearing zone it is fairly persistent, so companies never open their orebodies more than one, two, or three years ahead of production. Assuming that this company which has spent \$3,500,000, next year reaches ore-zones where it can start opening the mine and shipping on a commercial scale; and say within a year or two copper prices rise, the company will want to get back some of that expenditure on a good copper market. Say it extracts \$4,000,000 of ore, and its costs \$2,000,000 for operating expenses, then the Government says part of that \$2,000,000—the difference between the \$4,000,000 gross and the \$2,000,000 expenses—must be set aside as depletion and the remainder is income. There is no way for such mines to determine depletion. They have no enormous tonnage such as the mine Mr. Gower mentions. They have to estimate what they call probable ore, which is a very difficult thing to do. I would say regarding a mine of such character, that the Department should recognize the difference between a developed mine and a prospect. A lot of little mines are operating at a fair profit, but they do not know how long they

are going to do that; still, they have to estimate their depletion and put the rest in as income. If they were exempt from all income taxes until they had discovered sufficient ore to warrant them in believing they would get their investment back, then they would be in position to know they would not be taxed on return of their capital, but in the present case a great number of mines are paying income taxes on returned capital.

CHAIRMAN HOLMES: That is, perhaps, a situation which is impossible, in the final analysis, to avoid altogether. We will no doubt gradually develop our law so as to take care of it as fairly as possible in a practical manner when each particular case arises.

The meeting then adjourned.

REPORT OF PROCEEDINGS

WEDNESDAY MORNING, NOVEMBER 17, 1920

Mr Paul Armitage presided.

CHAIRMAN ARMITAGE: We were discussing a paper by Mr. Gower, and we are to hear from Mr. E. L. Blackman this morning on the legal side of accounting, with some definitions.

MR. BLACKMAN: I have been requested to make a few remarks on the legal side of the accounting problem, which Mr. Gower developed yesterday. He showed that the mining industry and mine accounting had never accepted the rules set forth in Articles 838 and 839 of Regulations 45. I have been asked to tell you the legal effect and legal results which follow from such action by the mining industry.

It may be suggested that the Income Tax Bureau has power to enforce a new rule despite the practice at the mines. I am here to show you that it cannot be. It may be suggested that the statutory depletion provisions of 1916, 1917, and 1918 established a new rule, and gave the Bureau power to apply this rule backwards to the beginning of operations as well as forward, and to extend the now well-recognized depletion rule for ascertaining annual taxable profits to the whole economic history of the mine, and to require depletion to be written in from the beginning of operations. I hope to show you that there is something in that contention; that the law, so far from authorizing any such thing, on the contrary states explicitly that past profits must be computed according to the rules that existed in the past, and not according to these new rules.

Intent of Congress.

In determining the meaning of a tax measure, there is one fundamental principle to be kept in mind all the time, and that is the intent of Congress. We get into abstractions and discussions of all kinds and begin hair-splitting, and forget entirely that the whole thing to determine is, what did Congress mean by the words it used. In the law now under discussion Congress used broad language. It said in Section 207, the article that provides for invested capital, that invested capital may consist of three items, one of the three being paid-in or earned surplus and undivided profits. Earned surplus and undivided profits is a broad general phrase, and it is necessary to determine what was meant. There are two sources to which we can apply for information in order to determine what Congress actually meant; one is the dictionary, which is usually referred to and sufficient to determine the meaning of any legislative act; the other is the accounting practice. It may be that the dictionary is sufficient in this case. If that be so, then we have a broad definition of earned surplus—one that would include practically every

accretion in value, which was the result of effort, and so was earned and which would exclude merely speculative or unearned increments. The Treasury Department of the Bureau of Internal Revenue quickly recognized that, and early in its discussions and rules on this subject stated that the terms "earned surplus and undivided profits incorporates into the law by reference the entire body of principles of accounting relative to the determination of surplus;" that is, the Department holds that "surplus," as used by Congress, referred to the accountant's surplus and not to the surplus that the ordinary layman might arrive at.

What Is the General Accounting Practice?

For the purpose of this discussion we will take the Treasury Department at its word. We will admit, for argument, that we cannot refer to the dictionary alone, but we must refer to the accounting practice of the country. If Congress bases its interpretation of "surplus" upon accounting practice, it bases that meaning and interpretation upon something which was in existence—not something that would be brought into existence thereafter. If Congress intended its meanings to be discovered by a reference to some authority it intended that such reference should be to an existing authority; and in other words, that the reference should be to the accounting practice of the country as such practice existed—not as that practice might thereafter exist, and not as some department of the Government might think that the practice should exist.

Congress gave no authority to any branch of the Government to formulate rules and regulations for determining invested capital or earned surplus. It based its language squarely upon the existing facts, and we must refer to them in order to see what was meant. Mr. Gower showed clearly what those facts were, and that the mining industry had rejected the ratable depletion rule based on a deduction from profits for every unit of ore removed from the mine, and that it had substituted in place thereof a valuation. Now, if "earned surplus" is to be determined by reference to accounting rules, and if a mine surplus is in question, the reference must be to mine accounting, not to manufacturing accounting, or mercantile accounting, or any other kind of accounting. Mr. Gower also showed that there was no uniformity in accounting practice; that each important industry had built up its own practice; that those practices were based upon the necessities of the various industries and their peculiarities, and that the methods varied widely. When we come to a mine we cannot say we will determine its profits by referring to the manufacturer's accounting methods; and that brings us to the crux of the situation—which is exactly what the Treasury Department has sought to do in this case. It was familiar with the manufacturing rule of depreciation, not confined to manufacturing, but extended to many other industries and businesses. The Department was familiar with the general rule for depletion that is applied to profits which are above ground, and are known and ascertained. They decided that those depreciation and depletion rules were good and logical, and that it would fashion a yardstick along the line of those rules and apply such to the profits of every industry. That is exactly where we take issue. We say

The Department Has no Such Power

Congress conferred upon the Department no such power; that all the Department has a right to do is to accept the accounting practice of the country as it finds it, to base its rules and regulations on that practice, and that it cannot change that practice by making accounting in all industries uniform where is found those practices most divergent. It cannot force one industry to adopt the practice of another but new to it simply because the Department thinks that the new practice is superior from the standpoint of logic or utility of any other standpoint. That would seem to suffice. That consideration would seem to be a complete answer to this effort of the Department to fasten upon the mining industry a rule which it has always rejected.

Mining men did not reject the manufacturer's rule because they were ignorant, or because they were obstinate; they rejected it because while it was a good rule for the manufacturer it was a poor rule for mines: it could not be applied practically in any way. There is a fundamental difference between a mine and almost any other kind of business. Mr Gower gave extracts from the Supreme Court of the United States on that subject: I shall not repeat, but I want to point out this distinction: where a man purchases a timber tract, or a manufacturing plant, or any other assets of that kind, he makes an investment; he knows within certain limits what he is getting, and what he can reasonably expect to do. When a man puts somethings into mining he is speculating; it is not an investment at all, it is a speculation. The results will not be commensurate with his payments or his efforts; the results depend upon chance. In the great majority of cases, the mine is a failure; there is no possible way for the mine investor to get back his original investment, because there are no profits from which to get his investment. Where the mine is successful, it produces profits many times the amount of the original investment. Of course I am speaking generally, with regard to the fact that a mine, after it has been fully developed and known to be a great producer, is seldom if ever sold.

Manufacturing and Mining Are Different

Usually a mine is sold in early stages of development. For these reasons, a rule that was perfectly reasonable for the manufacturer would not be applicable to the miner. The manufacturer has a machine that he knows has a 10-year life. At the end of that time he knows that it will be worthless, therefore he divides the cost of his machine by ten, and each year appropriates the proper percentage by deducting from profits, in order to return to himself what he had originally invested, so that when the machine is gone he will have an amount in cash or other property equivalent to his original investment. But the miner cannot do that. There is no stable basis that he can adopt to bring about that result. The Bureau, at the end of a long period of years, says in effect to the mining company, "We value your assets today at so much; we find you have so many thousand tons of ore in your mine; prior to 1913 you extracted a certain number of tons, so that the total content of your

mine at the time you acquired it was the sum of those two figures; therefore, we will require you to deplete from the beginning upon the basis of that tonnage." That is all very well when you have come to the end, or near the end of exploration, and know what the content of the mine is; but how could the miner, when he started operations, say 20 years ago, know what basis to adopt? Every year his estimate of the total content of the mine would vary; every year he would have, if his mine were a good one and developing and expanding as he went along, a larger and larger basis of depletion. In such year that he had actually made a deduction for depletion he would have deducted too much and he would have to make some adjustment on his books, and the ordinary miner would be in hopeless confusion. Because of those facts, he threw the whole manufacturing depreciation rule out of the window, and said: "It has no application to mining; I will follow a practical rule which does apply to mining, and when it is necessary for me to determine whether I have depleted my mine or not, I will examine it and find out how much ore is there, and if there is sufficient ore to make good my original investment I will consider that I have suffered no loss by depletion, and that all I have received in the way of net revenues is profits."

That rule, it seems to me, when it comes to logic, is preferable to this other rule that will not work. That, I think, covers the position in so far as it is affected by the recent statutory depletion rules. In 1916, 1917, and 1918, as we all know, Congress passed statutes authorizing the Department to make rules and regulations for allowing depletion, which the latter passed, and we have no criticism to make. We think that possibly the rules as passed are about the only practical ones that could have been adopted. I will not discuss them as they are all familiar to you; but the Department apparently considers that because it is making an allowance to the mining companies from 1916 onward, and permitting

A Preferred System

them to make deductions from their net receipts, that it must go back and revise the mining accounts over the whole period of the life of the operation from the very beginning. That, I say, has absolutely no support in the law, and furthermore, is directly contrary to the express, plain provisions of the law itself. Under the law of 1917 you were all given a deduction, which was based on pre-war profits. It was 7 to 9% of your invested capital, ascertained by what pre-war profits were. In the Revenue Act of 1917 it is provided that you must determine your pre-war profits for the purpose of ascertaining the deduction. In Section 206, the next preceding 207, the statute provides that, for the purposes of this title which includes all these articles we are speaking of in sections, your profits are the profits which you have returned under the various acts of the past, and that any man in computing his pre-war profits must do so according to the law that was in effect in the year in which he made those profits. There, we see a direct conflict between the rule of the Treasury Department and the plain language of Congress.

Departmental Rule and Intent of Congress

The Department states that you made no profits until you deduct from your net income a proper allowance for depletion; Congress says that the profits you made in 1910 to 1913, inclusive, were those which you returned under the provisions of the acts existing for those years and those acts allowed no deductions for depletion. That conflict does more than directly refute the Treasury Department statement as to those particular years; it breaks down the whole rule. The Department's rule is based upon the theory that a uniform depletion rate extends over the entire period. Congress has said that in these particular years your rate is based on the law as it existed. The law as it existed, so far as the mine was concerned, from 1909 to 1913, was that you net proceeds from mining constituted your income—your taxable income, and you were entitled to no deduction whatever for depletion, and every time the miners took claims for depletion to court they were decisively beaten. In 1913, the law allowed a maximum of 5% for depletion, regardless of what the true depletion was. Congress says that the profits that you must return for those years, 1909-13, are these allowed under the laws of those years. That seems to smash any claim to a general rule of depletion based on a constant figure.

There is another point, based squarely on the law itself, and that is this law is made up of three sections:

The Law In Brief

First, it allows cash paid in.

Second, the tangible property paid in for stock. In this case Congress demands and requires a valuation of that tangible property on January 1, 1914, so that if you started with a mine worth \$1,000,000 and took out \$2,000,000 in profits, but your mine was nearly exhausted on that date, you would have to write in your accounts in that second sub-division the actual valuation of the mine on January 1, 1914, as shown by a re-valuation as of that date. The re-valuation would take into account the extraction of all the ore during the whole anterior period, because you could value as of 1914 only the ore still left in the mine at that time. If you were to follow the language of Congress, and still follow the Department's rules, you have to take this depletion deduction not only once, but twice; you have to take it off under the valuation provision of sub-division B, and according to the Bureau you must deduct it from your surplus so that we will get the same deduction twice, the mining company being required not only to make its deduction for depletion every year, but to make that deduction double.

CHAIRMAN ARMITAGE: Gentlemen, the subject is now open for discussion.

MR. MACBETH: Mr. Blackman and others have criticised the law, that is, the interpretation of the law in rules and regulations, and I would like to ask why they, instead of constantly criticising the inter-

pretation by the Treasury Department of the act, do not go into court and make a test case and ascertain whether their view of the matter is right, or whether the view of the Department is correct?

MR. BLACKMAN: We are going into court if we don't win in the Treasury Department.

MR. GOWER: May I mention, Mr. Macbeth, that we did not know that they were going to apply this rule just this way until three months ago. The regulations deal in very general language. It is when they apply the regulations that you begin to see how you are hit.

CHAIRMAN ARMITAGE: I would like to ask the gentlemen who have considered this very seriously if they have considered the effect of Regulation 41, Article 55 on this subject, which was contained in the regulations interpreting the 1917 act. It reads as follows:

"Actual cash value of tangible property, other than cash, bona fide paid in for stock or shares, at the time of such payment, but in no case to exceed the par value of the original stock or shares specifically issued therefor, unless the actual cash value of such tangible property at the time paid in is shown to the satisfaction of the Commissioner to have been clearly and substantially in excess of such par value, in which case such excess shall be treated as paid-in surplus: Provided that the Commissioner shall keep a record of all cases in which tangible property is included in invested capital at a value in excess of the stock or shares issued therefor, containing the name and address of each taxpayer, the business in which engaged, the amount of invested capital and net income shown by the return, the value of the tangible property at the time paid in, the par value of the stock or shares specifically issued therefor," etc.

MR. BLACKMAN: Yes, we considered that very carefully. We do not believe it has any application to the present situation. The asset we acquired originally, and which every mining company acquires originally, is the mine and not the part of the mine that is known, but the whole mine, and appreciation is always allowed in every case in so far as the appreciation offsets depreciation from other causes. The rule

How Appreciation Applies

for valuation at January 1, 1914, absolutely requires that. For instance, if you had a building that fell into disrepair, and its value was much reduced, but because of a shortage of houses and a general demand for real estate, it sustained an increase in value; and suppose that this happened prior to January 1, 1914. Of course in such case the valuation on that date would equalize all those factors; it would fix the worth of that property at that time. So, we say the valuation of the mine on January 1, 1914, finds the worth of the mine at the time, and it takes into account all of the loss which the mine may have suffered prior to that time either by reason of its depreciating in value for general causes or because of its exhaustion, or part exhaustion, through extraction of ores. Every factor is included when you have a valuation.

CHAIRMAN ARMITAGE: I do not know whether I quite made myself clear, but it seems to me Article 55 is inconsistent with the Treasury's depletion rule.

MR. GOWER: No, the Department's depletion rule about which we are complaining is not an attack upon the mine itself, it is an attack upon the surplus earnings. For instance, in the case I cited yesterday: the company had \$16,000,000 of surplus earnings, and the Treasury makes an attack on those earnings and not on the mine itself. They say that the \$16,000,000 is not all earnings, but \$11,000,000 is capital, which is already allowed for in the mine's valuation of \$26,500,000.

CHAIRMAN ARMITAGE: Then I do not know whether I quite understood Mr. Blackman's argument, that under the act of 1917, valuing the property and determining the capital stock, we were bound to value the property as of January 1, 1914, and therefore we had to take into account both depletion and appreciation, and the Treasury had denied you appreciation in charging you depletion; wasn't that his argument?

MR. BLACKMAN: That is putting it in one way. Of course, this company in question, having been incorporated with a small par value of shares, cannot get the appreciation usually gained by the company that is organized with watered stock. We are limited by the arbitrary provisions of the statute, but we say that we do not get appreciation; we must get appreciation, and every company must get appreciation, so far as it merely offsets depreciation or loss of any kind. We cannot claim any value above that we started with, because we are limited by those arbitrary provisions of the statutes, but we cannot be beaten down below those original values when the development of the mine has kept its value constantly above that original value.

MR. T. O. McGRATH: I wish to bring up another point, one relating to appreciation. I have a chart, which was prepared for the Standardization Committee, but Mr. Wilson wanted me to explain it in emphasizing my point. Mr. Gower stated yesterday that there is really no scientific basis to mine accounting, which is the point we are trying to bring out in the Standardization Committee—whether there is a scientific basis for standard accounting, and if there is, why cannot we all keep together on that basis, and make our reports in such shape that the authorities at Washington can study them without unnecessary delay. I drew this chart to show that there is a real basis for mine accounting. [This chart will be found in the Standardization proceedings. Your capital, we will say, is paid in either by capital stock or by borrowing money; you take that capital and use it for your operating disbursements and your production. You sell your production and deliver it, creating receipts which are afterwards liquidated by cash, and that same capital cash is used again for clearing your disbursements, to give more production, more sales, and more receipts. At the end of each operating period you enter what you have made in profit or loss; you take your receipts for that period, your depletion and depreciation, and put it in your profit and loss

account. The appreciation as of March 1, 1913, is something contrary to any principle that was ever brought forward prior to that date. The Government allows you on March 1, 1913, to value your property of that date, and if it is in excess of your investment value they allow you to write that up as an appreciation. You set up your proper appreciation reserve, and that reserve is of the same nature as a tax reserve or any other reserve. It is not cash-surplus, or paid-in capital; it is a book interest which the Government allows you to record as appreciation.

Departmental Ruling Tends to Uniform Accounting

There is one very important point which I wish to mention in making the depletion charge; I might say first that while this present Federal law is complicated, and has many inconsistencies, it has done a great deal for mine accounting in bringing it down to a uniform basis, and should eventually result in uniformity. It makes you divide your expenses and segregate those expenses which do not belong to the taxable period, as well as capital and asset charges. In previous times it was all put into one sum, and what was left over was called profit. The Government will not allow you to do that now. In charging off operating expenses at a mine at the end of a year you also charge for depletion, which is the cost of the product. Depletion, in a way, is nothing but the cost of your goods. The Government also allows you to deplete appreciation under Article 844, Regulations 45; you are allowed to deplete that appreciation, to segregate your depletion against the capital which you use for the purpose of cost and your depletion of appreciation value; you are not only allowed to do that, but you are allowed to use that appreciation value for invested capital. If the asset charges are \$1,000,000, and on March 1, 1913, the Government allows you to value your property at \$2,000,000, say your tonnage is 1,000,000, the Government will allow you to charge \$1 against every ton for depletion of investment, and it also allows you to charge \$1 against every ton for depletion of appreciation. That, as it is realized, can be used as invested capital, along with surplus and original capital paid in. I believe only one or two accountants have done that so far; but in the case of some of the larger companies if they charge appreciation values it means millions of dollars they can use for invested capital. To my knowledge several mines have not used that at all; it would save them thousands of dollars.

CHAIRMAN ARMITAGE: Is that what the Treasury Department calls realized appreciation?

MR. McGRATH: That is realized appreciation.

MR. DICK: I heard Mr. Gower's paper yesterday, and it seems to me that his difficulty is that he does not recognize the fact that the law does not permit inclusions of appreciated values in invested capital. If it did, you would have your discovery values and your development values added to invested capital yearly. Of course there is great discussion as to whether or not a taxpayer's invested capital should be valued as of March 1, 1913. The law does not permit any appreciated

value. It is difficult to understand why, with invested capital in the beginning of the period worth, say \$1,000,000, and every foot you go into the ground you add to your wealth, that your invested capital should be diminished; nevertheless, you reduce the value of the property you owned at the date of acquisition by every ton taken from the ground. There is no arguing that point, regardless of what that value was. We say the value was a million dollars; it may be a billion, but you are permitted a million; it was known only to have had a million originally.

Appreciation and Depletion In Mines

Now, what you did after that to make it worth more money was through development or discovery, in so far you have added to the value of that property through appreciation. Appreciation is not permitted except as realized through your depletion account, as well stated by Mr. McGrath. Your depletion when realized as a profit, as a gain, will go into your surplus. Another point about the argument is that it seems the law recognizes mining as a wasting of industry—a wasting asset. To argue that it is not a wasting asset, to argue that all income is profit, would make it appear that this depletion is a method by which the Government is giving the industry something it is not entitled to. I do not think that the Government is giving anything the mine is not entitled to. I think mines are entitled to depletion; every pound of ore taken from the ground diminishes assets by that extent. Under the head of depletion there is a deduction from income; it would be inconsistent to my mind not to treat it in such a manner in invested capital, but whether or not the Government should recognize appreciation in determining invested capital is another question. That, however, is the law.

MR. GOWER: In the course of Mr. Dick's remarks he made one statement which is the foundation of his argument, and in that statement is traversed the argument. You say when we take a ton of ore out of the mine we reduce something. We reduce a value of some kind; that is perfectly true. We all know that when a ton of ore is extracted something has gone, but what is it? Intrinsic, latent, economic value has been depleted, not necessarily the commercial value which was allowed. You have depleted something which is not allowed to us as invested capital; if you allow us latent, intrinsic, economic value as invested capital, your argument would hold. You allow us the original commercial value of the mine. Taking a ton of ore out of the ground does not necessarily impair that commercial value. You allow us the commercial value. When you can show me that lifting a ton of ore impairs the commercial value, the argument stands.

MR. DICK: Your invested capital at the date of acquisition does not take into account any appreciated value brought about by development or discovery. It is worth so much money; that is what the definition of invested capital is—cash value of the property, regardless of what is in the property, of which we know not. Later development will tell, but every ton of ore removed certainly decreases your investment. You may

have revealed a billion tons for your million; you bought it on the assumption you had only a million, but every ton you take of the billion tons leaves one ton less.

MR. BLACKMAN: Mr. Dick, I spoke on some of the points you have just referred to, before you came. I will briefly state this: We agree perfectly that Congress in 1916, 1917, and 1918, gave the mining industry something it was fairly entitled to in these depletion rules which were enacted in those years; but we say that although Congress gave such at that time does not authorize you to apply the same rule backward, but that the terms of the act of 1917 forbid you to do that. In 1917 there were a number of provisions covered; one of these was the ascertainment of the pre-war profits. Congress says that pre-war profits must be computed according to the laws existing in the years in which those profits were earned, and you must compute your pre-war profits for the year 1911 and 1912 according to the law in effect in that year. That was the law of 1909, which allowed a mining company no deduction for depletion, and you must estimate and compute your profits for 1913 according to the law of 1913, which allowed a maximum of 5%. In calculating the 7 to 9% deduction it must be done so in that way, according to the plain, precise, language of Congress. You say in effect that your profits for 1911 and 1912 for one purpose were one thing, and for another purpose they are another thing; we say that is impossible. Congress said that for all the purposes of this title your profits for 1911, 1912, and 1913 are according to the laws in existence in those years under which you paid taxes. The intent of Congress was perfectly plain. It intended

Profits Claimed and Taxes Payable

to allow a man to claim as profits only what he had paid taxes on, and to allow him to claim as profits all that he had been required to pay taxes on. Under the laws existing at that time the mine was required to pay taxes on all its profits, and the Stratton case, and other cases decided prior to 1917, held that a mine was taxable on all of its profits without deduction for depletion; and even the Supreme Court, in another case where it was shown that the ore was on the surface and exactly what portion of that total quantity had been used up each year, said this is a mine and this company is not entitled to any depletion because mines do not get depletion under the accustomed rules. Legislation has always generally regarded the income from a mine as the total revenues from the sale of its product less its expenses, and has always taxed it on that basis. In all Western States, where they use income and profits for five years past to three years past in determining the value for local taxation, that they never allow a dollar for depletion. We say that the explicit terms of the act forbid you from deducting any depletion in 1911 and 1912, and more than 5% in 1913. but we go further and we say that such was the plain intent of Congress, that profits should be considered according to the law in existence at the time those profits were made. The law in existence at the time mining profits were made from Adam down to 1917 was that there was no deduction for depletion,

and that a mine was taxable and therefore could get the benefit of profits, where such a thing was a benefit, without any deduction for depletion.

Appreciation to Offset Depreciation

When it comes to a question of appreciation, the law allows appreciation where it is an appreciation to make good a depreciation. You do that in every case where you have a valuation—a valuation necessarily does that. Supposing a property had depreciated so much that it was worth practically nothing in 1910, but by some extraneous circumstances its value was enormously increased from 1910 to 1914, the re-valuation on January 1, 1914, would allow that appreciation. It would only say, and that is all that Congress says, that appreciation must stop at the point where you reach your original value. You cannot go above that; we will not allow net appreciation; we will allow it to offset depreciation.

MR. HOLMES: That last remark of Mr. Blackman, I think, is peculiarly applicable to the law of 1917, and not to that of 1918.

MR. BLACKMAN: Yes, that's the law we are discussing.

MR. HOLMES: That last remark of Mr. Blackman, I think, is peculiar. Departments have reached which will have to be judicially determined. I believe the Treasury is quite fixed in its ideas of not recognizing appreciation in any manner, except as specifically authorized by the law of 1917. For instance, to recognize appreciation, you have this situation in the case of an operating mine having 1,000,000 tons of ore at the time it was acquired, and discovering no additional ore reserves: You would have to take into consideration a diminution of the investment arising from the very production which produces the income. A mine adjoining it may be purchased at the same time, and have the same amount of ore and may subsequently discover greater orebodies. The Department cannot see its way clear to recognize those greater orebodies directly or indirectly because it feels that the concept of the law, the excess-profits tax law, was to allow as invested capital the amount actually contributed by the stockholders to the enterprise, plus the amounts indirectly contributed to the enterprise; that is, the dividends earned but not paid out, and kept in the business. I think that both Mr. Gower's and Mr. Black-

Implication Not Allowed in Taxation

man's arguments on this very strong from a technical point of view; that is, in the construction of the statutes. Since the courts have laid down the rules that nothing will ever be implied, that the tax statutes will never be extended by implication, they will always be construed in favor of the taxpayer where there is any question of doubt as to the construction, and there is enough uncertainty and ambiguity in the law to raise a grave question of doubt here as to the meaning of the statute. So that the argument we heard in favor of allowing this, is, in my opinion, very strong on those technical grounds of the construction of the statutes; but I feel on the other hand that the Department's position is extremely strong from an administrative point of view, and I feel there would be

nothing gained from the Department on this point. It has been the Department's consistent position right along that it will not directly recognize appreciation, and the recognition of this situation would be to recognize indirectly the effect of appreciation. I merely wanted to state this, and hope it may clarify the discussion a little.

CHAIRMAN ARMITAGE: I think the fallacy in Mr. Dick's argument is this: He fails to distinguish between property we are valuing and tonnage. The law does not say you must value the tonnage of a mine in 1914 or 1913, or when it was originally contributed; it says you must value the property, and that the value of that property is the measure of the invested capital when it is contributed to the stock of the company. If we ignore the tonnage and value the property, we immediately get away from the difficulty of depleting that tonnage. Even though there had been an actual accretion to the tonnage in the interval, the value of the property has remained constant, and it is the property we are valuing and not a particular quantity of tonnage in the year in question. It seems to me that is the fallacy of the argument. The law is quite clear; I looked it up while Mr. Dick was discussing the question, and it uses the word property in each case; it says actual cash value of tangible property paid in for stock—that is the same phrase as in the law of 1917—in which case we are valuing property, and if we can show that there has been no depletion in that property by reason of the tons of ore taken out, because coincident with that depletion there has been a

How the Department Views a Mining Property

corresponding accretion, the argument fails. In other words, the Department looks upon a mining property on a certain date as a heap of ore which is exposed. Of course there could be no answer to the argument that as you sell that ore you deplete that value, but such is not true; it is not the proper aspect with which to view a mining property. It is a property, and in it we have uncovered or discovered a certain quantity of ore, and there is a certain quantity we do not know anything about. If we have uncovered just as much as we have depleted it the value of the property is not changed. I cannot see an answer to that argument, and I fail to see that the Department meets that by saying we necessarily have depleted the property. We have not depleted the value of the property, which is the real point: Have we depleted the value of that property? Let us assume that a mine at the date of valuation, that is, at the date of contributing, with 1,000,000 tons in sight, and it uncovers a similar quantity on a lower level, and then between 1910 and 1917, the period in question, it proceeds to sell the new ore and not the old ore; what would the Treasury Department do with that case? We have on hand, and blocked out, the identical tonnage we have in 1910, and all we have sold is the new ore. Would the Department in that case say we must deplete the mine? That shows the fallacy of attempting to value the property as a tonnage and not as a piece of property. They would say we have not depleted that mine, because we have not taken out one dollar of the original tonnage; all we have mined is the other

A Reverse Condition

tonnage. If we look upon the property, the property value has remained unchanged, and the answer is simply we have not depleted the value of the mine. If, instead of mining the new tonnage we had mined the old tonnage, the property value has continued and we have not depleted the mine. After all, what we are dealing with here is not a question of accounting, is not a question of business practice, but a technical question of the construction of the act—a legal proposition. What does this act mean as applied to the taxpayer? The Government has passed a certain law; Congress has passed a certain law, and it says under that law, the taxpayer owes a certain amount—that is a legal question, and is not a question of accounting or business practice. Let us see what the law is: The Government says that the mine-owner must deplete from the value of his property prior to the date when he was allowed depletion under the law; that is the position it takes. Prior to 1913 there was no allowance in the income-tax laws for depletion. Mine-owners came before the courts and disputed the Government attitude on that question. I do not quite agree with Mr. Black man and Mr. Gower that it has been the universal mining practice in accounting not to claim depletion in mines; I think that practice is more or less uncertain. I think there was a strong feeling among miners prior to that date that they were entitled to depletion but they came before the courts in the Stratton's Independence case and claimed depletion; they urged that before the law should impose a tax on their income there should be deducted from it an

The Government's Position

element of capital, and that capital was depletion. The Government took the position that such was not so; but said that all of these are profits—that's the rule, that's the law, that's the accounting practice. The Government has laid down the law for itself; it has established that law, and it should be held to that law. A few years elapse, and the interest of the Government is upon the other side. The question of determining invested capital comes up, and the Government's contention is that it shall reduce that invested capital by depletion in values from years when it said the miner was not entitled to depletion, and it went to the Supreme Court in a ruling that they were not entitled to depletion. I say in justice and in reason that the Government should be held to the rule it has laid down; that is, the miner is not entitled to depletion in those years. Such is the established rule on the subject, and I have yet to see any answer to that proposition as a matter of technical law, as a matter of equity and justice. The Government might have taken the other position; it might have said of course there is an element of capital, and the miner is entitled to depletion, and of course we are going to allow it prior to 1913. If it had allowed it there would be no answer to its position today, but it took the other position, because it meant more income and more taxes. Then it fought the matter with the courts and won. It is an established principle of law that when two parties have litigated a subject which has been decided, decision is final between those

A Once Favorable But Later Disliked Decision Cannot Be Reversed

two parties, no matter which way it cuts; and thereafter it is not for the plaintiff who has won in that case upon a certain set of facts and upon certain law that he has established, to claim subsequently in the same litigation between those same parties that he was wrong and that decision was wrong, because in subsequent years he may not like that decision. The Government has laid down the law; it cannot change it now, because it suits its convenience and it gets more taxes. I cannot see any answer to that argument; more has been advanced here, and I have not seen any Government official able to answer it.

Mr. Robert N. Miller will now discuss certain phases of the law.

[Mr. Miller's address will be found on page 683 of the Proceedings.]

CHAIRMAN ARMITAGE: I think Mr. Miller occupies a fortunate and agreeable position in that he has seen both sides of this subject intimately—from the Department's side, the difficulties and troubles it meets, and he is now beginning to experience the outside view, the view of the lawyer practicing before the Department. He is beginning to realize that it is not necessary for a lawyer to be consistent—and that he may be fighting on both sides of the case sometimes at the same time.

MR. C. A. FISHER: I feel like adding a word to what Mr. Miller said. It seems to me that much he has said is true, and it is a practical light on this whole question. I also have been on both sides of the force in this matter; I have worked as an Internal Revenue agent for a short time, with not nearly as much experience as Mr. Miller. It has been my experience that when you present your case, if you will go to Washington with an abundance of facts, and then go to the men who have to study them you certainly will generally get fair treatment, if you take the attitude that they are trying to work out a bad, inconsistent situation in the best way possible.

CHAIRMAN ARMITAGE: Last May the American Mining Congress, in conjunction with the American Petroleum Institute and the National Industrial Conference Board, held a tax conference in Chicago which resulted in the appointment of a Committee to discuss questions of Federal taxation. That committee was enlarged and worked during the summer, and it has recently drafted and issued a tentative report—which is here—of their suggestions and plans. I will ask Mr. R. C. Allen, who was a member of the Committee, if he will briefly summarize the substance of their recommendations.

MR. ALLEN: The report has been printed, and is available to all of you. I trust that each will acquire a copy, and give it some attention.

Report of Joint Committee on Taxation

The Committee was organized in May, 1920 and has been actively at work during the trying to find some reasonable method of revision of the

present tax system. In addition to utilizing all the talent and experience of the Committee members themselves, it has had the assistance of a number of the best experts in the country, including Dr. T. S. Adams, Mr. Geo. Holmes, Col. Montgomery, Professor Haig, Mr. Kahn (the banker) and others. Briefly, it has made an attempt to bring the best thought, talent, and experience available to bear on this difficult and intricate subject. The report as presented will not be satisfactory to all classes of taxpayers. It is not satisfactory to the members of the Committee, nor those particular classes of taxpayers and organizations that they represent. A measure of this sort must always contain an element of compromise; so, in presenting the report I wish to say on behalf of the Committee that it merely represents what, in their opinion, is best to be done under all the circumstances as we understand them to meet the fiscal requirements of the Government.

How Much Money is Required

The fiscal problem confronting the Committee was this: What is the sum total of taxes to be raised? The consideration of any tax system must start right there. After careful consideration of this question, the Committee came to the conclusion that any plan now devised should provide for raising the revenue which would be raised under existing statutes. We do not know, and we could not assume what Congress is going to do about the public debt. So, in our opinion, any tax system, which is proposed for the consideration of Congress, should provide for raising that amount of revenue which would be raised and has been raised under the existing statutes. If Congress sees fit to reduce the sum total of taxes, a reduced amount of taxes may be raised under the plan offered by the Committee; so in reading this report, that should be remembered. Since the printing of this tentative report, the Committee has received considerable criticism from various classes of taxpayers and other individuals, who, with one accord, criticise the Committee for not recommending a reduction in taxes. Our answer to that is that a reduction of taxes is a problem which is not properly before this Committee, or any other such committee. It is a problem for Congress itself to solve; we do not attempt to solve it. We hoped that our work would have a maximum usefulness if we did present a plan which, in its application, would, if necessary, raise the revenue now being raised under existing statutes.

Income Profits and Sales Taxes

The second main conclusion of the Committee was this: That the bulk of the revenues must continue to be raised from income and profits. No other question that came before the Committee received so much thought and investigation as the proposal to raise the bulk of the revenues by consumption taxes; in short, the sales tax. Day after day we listened to the most able and active proponents of the sales tax, and in the beginning all of the members, I think, with one exception, were sympathetic toward such a tax. We looked upon it with great hopefulness; we thought that it might provide a practical and equitable means of more broadly

distributing the burden of taxation. But after months of consideration and investigation, the committee, with one exception, came to the conclusion that the sales tax would not do. I won't undertake now to canvass the arguments pro and con; we have printed them in this report; I merely invite your attention to them. Nevertheless, we do believe in a broadening of the present basis of taxation. We do not believe that the entire fiscal system of the Government should be or can be dependent upon income and profits. This Committee believes in the principle of the income tax, and our conclusion is that the bulk of the revenues must continue to be raised by taxes on incomes in one way and another. But we do conclude, as I said before, that a much larger proportion of the revenue should be raised from other sources. Therefore, we proceeded to a plan that would reduce the sum total of revenue to be raised from income taxes, which would increase the relative amount of revenue to be raised from other sources. A third conclusion was that the excess-profits tax should be abolished altogether. On that conclusion the Committee has the support of almost the entire country. During our consideration of the whole subject we met with no support for the retention of the excess-profits tax; therefore, our first recommendation is the abolition of that tax entirely. It is not necessary for me now to review

Loss By Abolishing Excess-Profits Tax

the reasons why the Committee makes this recommendation; I think they are familiar to all of you. However, when we abolish the excess-profits tax, we face a reduction in the revenue of \$900,000,000, more or less. In this connection I may say that all of the estimates used by the Committee are those of Mr. McCoy of the Bureau of Internal Revenue, the gentleman who makes these estimates for the Committees of Congress and for the guidance of the Treasury Department. Since this estimate of loss was made it appears that perhaps the figure is somewhat high; in other words, the repeal of the excess-profits tax will lose us somewhat less than \$900,000,000, due to the fact that the tax is failing.

Whether repealed or not, some additional sources of revenue must be found as that tax cannot be depended upon to produce the revenue it has produced during the war years and 1919. Secondly, we believe strongly that the surtax on individuals should be reduced. Here again I may not stop to review all the reasons why we came to that conclusion; but I think all of us are convinced that surtaxes which mount up to 50, 60, and 70% of the income of the individual are so repressive that in their effect they tend to dry up, and eventually do dry up, important sources of taxable income. Income today is seeking a safe haven, which is found in tax-exempt securities, billions of which are abroad in the land and which are being issued month after month in ever-increasing amounts.

These securities are absorbing incomes that otherwise would be taxed under the surtax rates. A further consequence is that this income is withheld from productive enterprise. Therefore, it seemed to us, as a measure of pure economics, disregarding all arguments which may be based on other considerations, a reduction of the surtax is wise. How

then, to reduce the surtax rates? Shall we make a general assault on the rates as they now stand? Shall we reduce the rates as they now stand

How to Reduce Rates

by a percentage cut all along the line by re-adjusting the brackets on some other basis, or how shall we effect this reduction? That matter occupied the attention of the Committee for a long time, and after considering all of the various expedients we finally hit upon this: That such portion of the income of the individual which is spent and used by him shall be subject to the surtax rates as they now stand; but that portion of the income of the individual which is saved by him and re-invested in income-tax producing property shall pay a surtax rate less than the rates now imposed on such income. In other words, we think it is now time to place the emphasis on thrift and saving, rather than waste and extravagance. The provision made at the last meeting of the Committee early in November, 1920, is this: The surtax on that portion of the saved and re-invested income of the individual shall be reduced by one-third, in no case to exceed 20% thereof. The provision as it now stands is based upon the idea that the present surtax does not bear heavily enough on incomes up to \$50,000; in fine, if we were to revise the surtax rates as they now stand, maintaining the present rates in the upper brackets, we would revise the rate in the lower brackets so that they would rise more rapidly on incomes up to \$50,000. Therefore, the first provision was that the saved and re-invested income of the individual would be subject to surtax not exceeding 20%. This is no reduction from the present surtax individuals having incomes up to, say \$50,000. Frankly, we amended this provision because we believe that it is politically expedient, and that the former or revised plan is politically inexpedient, if not politically unattainable. What we are trying to do is to reduce the surtax rates, and to do this we must offer a plan that is politically expedient—something that Congress can adopt, something that is within the range of political possibility. Since the revision of which I have spoken, the question has been re-opened, and there is some possibility that the Committee will revert to the first plan. If we do this thing under the first plan we will lose another \$230,000,000 in revenue.

Total Losses Expected

The third main recommendation of the Committee is this: That the provision for net losses first introduced in the act of 1918 shall be extended to prior years and succeeding years, and made a general principle of the income tax. If Congress should adopt that recommendation we would lose, it is estimated, another \$500,000,000; and if all three of these recommendations were adopted by Congress we would lose \$1,180,000,000. In other words, the net effect of these recommendations is to take \$1,180,000,000 out of present income taxes. The next question is now, how can we replace this sum? We estimate that the provisions of the Cummins-Esch Bill will result in increased taxes paid by transportation in the amount of \$148,000,000. Therefore, the net reduction in present in-

come taxes is \$1,032,000,000. The Committee has proposed a number of alternative methods of raising this money. It was our opinion first that we ought to select for taxation a number of commodities of general use and consumption, and we did select tentatively gasoline, sugar, coffee, and tea for such taxes; but this proposal was met by a storm of protest.

Breakfast-Table Taxes

The country, it is said, does not like "breakfast-table taxes," and oil people do not like the gasoline tax. The Committee likes them for the very reasons on which they are opposed, perhaps, by the majority of the people. We think that every individual making a living in this country ought to contribute something to his Government, and that he ought to know that he contributes. Taxation makes good citizens; it makes responsible citizens. We have suggested also taxes on automobiles and trucks—a tax of 50 cents per horsepower. We recommend also that there be an increase in the so-called luxury taxes; in other words, with respect to certain commodities that we term luxuries there is a point in taxation where you get the maximum revenue. Our plan is to tax the non-essential commodities to the point where we will get the maximum revenue out of them. Tobacco is a good illustration; the consumption of cigarettes, chewing tobacco, and smoking tobacco goes merrily upward despite the tax. Liquor, which has gone now, was the same kind of a commodity; the tax did not decrease the consumption. There has been a slight decrease in the use of cigars. Perhaps, then, we ought not to put more tax on the cigar, because if we do, we will lose money by it; but we can put more tax on other forms of tobacco. Let us put it on to the point where we will get the maximum revenue because these are non-essentials; they are luxuries, and the individual need not pay the tax if he chooses not to do so. He can get along without such things; but he does not want to, and that is why the tax is so productive.

Another recommendation is to increase the rate on first-class postage from two cents to three cents. That has not been very severely criticised. Another suggestion is to quadruple the stamp tax. Mr. Kahn suggests in addition a stamp tax on checks.

Income Tax on Corporations

But the most important of these recommendations is the increase of the income tax on corporations. In considering the surtax on the individual on the one hand, and the surtax on the corporation on the other hand, the aim has been to preserve a sort of balance between the two because the fact is that the partnership, the sole owner and the personal service corporation are in competition with the corporation; there ought to be some approach to equality of income taxation as between the two classes. There is not any precise method of getting at this equalization. Suggestions were made to fix the corporation income-tax rate at all the way from 12 to 20%. The rate agreed upon was 16% on incomes of corporations, and this is coupled with the recommendation to abolish the exemption of \$2000 altogether.

As a net result of all these proposals, if adopted, we can raise \$1,293,000,000 which quite offsets the reduction of \$1,100,000,000 arising from the repeal of the excess-profits tax, reduction of the surtaxes on individuals, and the extension of the net loss provision.

We have taken the trouble to condemn certain other taxes, which have received a good deal of support in certain quarters. One of those is the Ralston-Nolan Bill, which proposes a tax on the privilege of holding land—a pet measure of single-tax advocates. That we have strongly condemned. Another proposal against which the Committee has set its face is the proposal to levy a tax on the undistributed earnings of corporations.

I ask you to give the subject of this tentative report your earnest thought and attention, and to wire your criticisms to the National Industrial Conference Board, 10 East 39th Street, New York. This Committee will hold its last meeting on November 20. We are then going to close this report. It will be printed and will be circulated throughout the country. The Committee will give careful attention at the end of this week to further criticisms which it may receive, and we solicit those criticisms from just such people as are here this morning.

CHAIRMAN ARMITAGE: Gentlemen, what is your pleasure in reference to this report?

MR. ROBERT G. WILSON: I should like to make a motion that the tentative report of the Tax Committee of the National Industrial Conference Board be given the widest circulation and publicity by the American Mining Congress, with the request that all of its members communicate their criticisms, suggestions, and recommendations as quickly as possible to the Tax Committee of the Mining Congress, at Washington, D. C., to be brought by the Tax Committee of this Congress before the next meeting of the Allied Tax Committee for consideration.

(Motion unanimously carried.)

CHAIRMAN ARMITAGE: The Allied Conference, consisting of the American Petroleum Institute, American Mining Congress, and National Industrial Conference Board, is to have a final meeting in January, 1921, the date of which will be announced later. The Mining Congress will see that you all get ample advice of the date of that meeting, and at that meeting this report is to be taken up and discussed.

MR. MACBETH: What is the Business Men's Tax Association?

CHAIRMAN ARMITAGE: The Business Men's Tax Association is a group of retailers and manufacturers who are advocating a general turnover or sales tax. Mr. Rothschild and various members of that association were heard before the Committee, and are strong in their advocacy of this general turnover. Do you know, Mr. Allen, the exact make-up of that Committee?

MR. ALLEN: That Committee has a heterogeneous membership, mainly composed of manufacturers of small articles, such as jewelry and

things of that kind, which are now taxed; but it also has a very wide clientele. The fact is there is a great deal of sentiment in the country for the sales tax, and there is no question at all about the pressure that is going to be brought on Congress to adopt such a tax. We feel that issue is going to turn on some such plan as the Committee has presented on the one hand, and a sales tax of some kind on the other.

MR. MACBETH: It is not the purpose at this time to have this Congress endorse the recommendations of this Committee, is it?

CHAIRMAN ARMITAGE: I don't understand the resolution so; I understand it is quite the contrary. It would not be fair or just to ask the members of this Congress to assimilate and pass upon a printed report of the length of this one on the question of taxation. I think the purpose of the Committee at this time is to present this report now for discussion and criticism; that is the object of both the Conference Board and the Committee.

I have, on the question of the proposal for a tax commission, a telegram from the Chairman of the Arizona Tax Commission, which I would like to read:

Phoenix, Arizona, November 16, 1920.

Bulkeley Wells,

President, American Mining Congress,
Denver, Colo.

Proposal commission liquidate tax controversies absolute necessity.

C. M. Zander, Chairman Tax Commission.

What other, or further subject, would you care to discuss at this meeting? Mr. Fisher, did you have some remarks to make on the subject of depletion?

[Mr. Fisher's address on page 677 of the Proceedings.]

CHAIRMAN ARMITAGE: Any other business?

MR. GOWER: While the subject is fresh in our minds about this attempt of the Department to take our invested capital away from us. I thought I would like to introduce a resolution which would embody the sense of the mining industry, because it is not one but all who are hit by this rule.

MR. MACBETH: I move that the resolution be referred to the Tax Committee of the American Mining Congress. There are too few of us here to take up this question and go into it, and beside we would like to have a report from the Tax Committee on that question before taking action on the subject.

CHAIRMAN ARMITAGE: I do not think that we can adopt a resolution. The procedure is that we should refer this resolution to our Sub-Committee I understand we have appointed here to act upon it, and if you will amend your motion by making it a motion to refer the reso-

lution to the Sub-Committee on resolutions who will take up this resolution and act upon it, either submitting it to the Congress, or the Tax Committee, that would be the more orderly way.

MR. MACBETH: I will amend the motion by referring it to the Sub-Committee.

(Motion unanimously carried.)

CHAIRMAN ARMITAGE: That practically closes our program here except for the work of the Sub-Committee appointed on these resolutions.

MR. MACBETH: I personally am anxious to have the Mining Congress go on record as favoring a repeal of the excess-profits tax. I believe the Chairman stands with me in this matter, and I should suppose Mr. Allen would also.

MR. ALLEN: I think all of us favor such a resolution. A similar resolution was adopted by the National Tax Association at its convention at Salt Lake City about two months ago [September, 1920]. Certainly, there is no objection to that kind of a resolution.

CHAIRMAN: We will make the resolution now and refer it to the Sub-Committee, which will meet and consider that subject.

(Adjournment.)

OIL-SHALE CONFERENCE

American Mining Congress

THURSDAY, NOVEMBER 18, 2.30 P. M.

DR. VICTOR C. ALDERSON, Chairman: Inasmuch as we are starting a little late, and it is possible to cut short any informal talks that may be made, while a man who has written a paper cannot very well cut it down, I am going to ask that a paper be read first. This will be by Mr. M. J. Gavin of the U. S. Bureau of Mines, entitled 'The Next Mining Problem.' It will be read by Mr. Karrick on account of the enforced absence of Mr. Gavin at a meeting with the Director of the U. S. Bureau of Mines.

MR. C. L. KARRICK: Mr. Chairman, Ladies and Gentlemen: As explained by Dr. Alderson, I have been delegated as Mr. Gavin's assistant at the Salt Lake Oil Shale Station to take his place this afternoon reading the paper that he has prepared. You are all familiar with the scope of the shale problem that we have before us, and especially as regards mining; so he has discussed the mining of shale under the head of the lecture that was assigned to him.

[Mr. Gavin's paper will be found on page 497 of the Proceedings.]

CHAIRMAN ALDERSON: I understand there follows Mr. Gavin's paper another on the same general subject, but with a little different title, namely, 'Mining for Oil' by our State Commissioner of Mines, Mr. Horace F. Lunt.

MR. HORACE F. LUNT: Mr. Chairman, Ladies and Gentlemen: I may say that these subjects were assigned to Mr. Gavin and myself, and neither of us knew that the other had the subject assigned until a day or so ago, and fortunately we treated it from a little different angle, although you will find that I have repeated what he said to a slight extent. I trust you will bear with me in those cases.

[Mr. Lunt's paper will be found on page 507 of the Proceedings.]

CHAIRMAN ALDERSON: The chairman has a little advantage in that he is privileged, if he is on the program, as I happen to be, to make his own place on the program. The little that I have to say, I shall make brief. From my recent visit to England and Scotland I have brought back some fresh information.

Status of Oil-Shale in Scotland

The problem of the oil-shale industry in Scotland today is not one of technique, but a pure matter of business, the difference between the cost

of production and the selling price. They mine approximately between 4000 and 5000 tons of shale a day. They employ above and below ground approximately the same number of employees, one man for each ton of shale mined. William Fraser, the managing director of the Scottish Oils, Limited, told me they were making approximately two shillings, or, under normal exchange, fifty cents a ton.

The present company, mentioned above, is a consolidation of six previous oil-shale companies. It is controlled by the Anglo-Persian Oil Co., Ltd., which, in turn, is controlled by the British Government. The capitalization is £4,000,000, or \$19,400,000, in \$14,550,000 preferred and \$4,850,000 common stock. On the financial side it should be noted that for many years these constituent companies have been paying dividends, not only on their preferred, but on their common stock. For the past five or six years they have paid 6% on preferred without a break, and their dividends on common have run from 10 to 40%. I inquired particularly about these points, especially the latest dividend which was paid in February, 1920, of 3½% on the preferred stock. The expectation is that this will be paid regularly. I brought that over especially for our financial friends who may have a lingering idea that perhaps the oil-shale industry will be profitable. It has been paying in Scotland for seventy years.

[Mr. Alderson's complete paper will be found on page 511 of the Proceedings.]

CHAIRMAN ALDERSON: The next speaker is Mr. G. B. Morgan, State Geologist of Wyoming, who will address us on the subject of 'Wyoming Oil Shales.'

MR. G. B. MORGAN: Mr. Chairman, Ladies, and Gentlemen, I didn't know until I came to this Convention that I was on this program; therefore, my paper will be short and general in character. There has been little prospecting in Wyoming in the oil-shales, but I expect there will be considerable done in the near future.

[Mr. Morgan's paper will be found on page 529 of the Proceedings.]

CHAIRMAN ALDERSON: I feel that a meeting like this would not be complete with merely the formal presentation of papers, so I have scouted around a little to get some individuals to consent to speak.

MR. LUNT: Mr. Chairman, if nobody will start anything, I would like to ask why you say you quarrel with my figures? You say that the cost of mining in Scotland is \$1.14; now, I don't question that at all, and you also say that the men there get something like \$4.25, was it?

CHAIRMAN ALDERSON: \$4.37 now in the coal mines.

MR. LUNT: Why our men get a good deal more than that, and I am assuming it will be more of a coal mining than a metal-mining job. As I recollect it, the minimum wage in the coal mines is something like \$6, and the miners figure on making considerably more than that. Now,

without knowing the cost of explosives and other things, I think that is enough to boost the price of mining in this country considerably above the figures you have given.

CHAIRMAN ALDERSON: What I thought of when you were speaking, that I would bear in mind, was that you thought it would cost from \$1.50 to \$2 a ton to mine the shale. I assumed that was the cost to the company; but over there the cost is exactly \$1.14 to the company, without considering what the miners get.

MR. LUNT: May I ask if that includes the opening of the mine, and repairs to haulage apparatus? Of course we would not have any hoisting plant, but all those overhead charges are sometimes not figured in mining cost. The cost of the actual operating cost will be considerably below those figures. I mean, that to include everything properly charged to mining by those companies which keep careful and accurate costs—including depreciation, amortization, and all those figures that perhaps would not be considered by the average person who wasn't familiar with mining operations. Do you know just how much of that is included in that \$1.14?

CHAIRMAN ALDERSON: I got these figures at the mine, and I had them verified at the office in Glasgow; I did not go to that extremity. The figures I gave you were exactly what was given to me. A man is given a block of ground to work—it is really a lease—he employs his own men, buys his powder, supplies, tools, timber, if necessary, does everything. The company pays him 4 shillings and 7 pence for each ton of shale that is put in the car and hauled or trammed by the men to the nearest main haulageway. Then the company does the rest; \$1.14 pays for it. It doesn't pay for sinking of the shaft, opening of the mine, or other overhead charges.

MR. LUNT: That would account for a considerable part of the difference between us, because I figured in all those items. When you say the cost of mining, without modifying it, then it is largely a matter of bookkeeping, and I tried to make it clear in my paper that such was the total cost and not simply the cost of delivering it to the pit mouth.

CHAIRMAN ALDERSON: I would revise that, and make it total cost—cost of everything, so it will not be misunderstood as I misunderstood it.

MR. LUNT: Quoting from my paper, "These point to a total mining cost, including equipment, development, operation, repairs, and all the overhead expense properly chargeable to mining, of between \$1.50 and \$2 per ton."

CHAIRMAN ALDERSON: I missed that.

Over on the Western slope we have a town that has a name that will be mentioned a great many times. I often wondered where it got its name until I found a man of the same name, and I concluded that he named the town. Since we will hear a great deal of that place in the near future, I am going to insist that Captain De Beque say a few words.

CAPTAIN DE BEQUE: Mr. Chairman, and Gentlemen: I certainly appreciate your kindness in asking me to say a few words, but unfortunately I have no address prepared for this occasion. It is gratifying to see so many people gathered here, interested in the oil-shale business, and while at the present time we are an attachment of the Mining Congress, as a part of the mining business, it is safe to predict that in two years we will have a convention of our own—the oil-shale convention. As I say, I have nothing particular to speak of. I thank you for the opportunity of saying a few words. (Applause.)

CHAIRMAN ALDERSON: We ought to hear from an official from the Western slope. I don't see anybody else but the Mayor himself—Mayor Hanson of De Beque. (Applause.)

MAYOR HANSON: Mr. Chairman, Ladies, and Gentlemen: As Captain De Beque says, I am just as much unprepared as he is. I would like to have Mr. J. B. Jenson explain. He has the ability to tell us something more about it. I would hate to keep all these people waiting here standing up and saying nothing. Mr. Jenson has gone into the oil-shale retorting and refining more thoroughly, I dare say, than any other man on the Western slope or in Utah. Mr. Jenson, I implore you to get up and say something. (Applause.)

CHAIRMAN ALDERSON: I will say in behalf of Mr. Jenson that he has a paper prepared, but he pleaded sickness. He will deliver his manuscript which will be printed and you will have the chance to read that later. I wish, Mr. Jenson, you would come up in front and talk to us for a few moments.

MR. J. B. JENSON: The talk I had prepared was on some different lines, and I didn't understand just what was wanted of me until yesterday. In going into the subject, I have touched a little here and there, leading up directly to the treatment of the shales of our Western slope.

Treatment of Shale in Rocky Mountain Region

My understanding was that I was intended to cover that subject in such a way that in case there were among the audience some who had not gone into, at least in a preliminary way, the basic principles of retorting, those principles would be touched on briefly in order that it might be known what points I am attempting to make in my paper. For that reason, while I am attempting to confine myself to the shales of the Western slope—by which I mean those shales which are included or were originally included in this great Uintah Basin before it was segregated into the Green River Basin—you can see under those circumstances in the short time that is left it would be useless to attempt to cover this subject. If it is so desired, and there are enough of the members in this audience who care to do so, I should be glad to meet in one of the rooms this evening and go over this subject, and also to enter into such discussion as might be of value to those who are interested in the development of the shale industry. And while here I would suggest one thing: You all

recognize, at least those of you who are burdened this year with the matter of development work on shale locations, that we are very much in the dark—and it is a lamentable fact that at this time we have not had some definite information pertaining to the matter of assessment work, particularly as lessees—and the reason for it is, of course, that our mining laws as at present framed were never intended to cover oil-shales, due to the fact that they have only recently come into prominence. And for that reason there are apparent conflicts between the placer mining law, the lode mining law, and the petroleum placer law that should be cleared up. It occurs to me what we need now—inasmuch as many of us are engaged in extensive development—is a rule by the Department of the Interior defining what is expected in the way of assessment work and what will be permitted. And I had in mind to propose to the Chairman of this meeting that he appoint a committee of, say, three, who shall first endeavor to get as quickly as possible a ruling from the Department to serve as a guide for the remainder of the year, in order that we might, as fully as possible, comply with the requirements of the law and not do

Mining Law as Pertains to Oil-Shale

needless work. Then, in the meantime, also prepare a petition, or whatever this Committee sees fit, directed to Congress to expedite the matter of revising the mining law and making it applicable to oil-shales. I believe, and I think it is reasonable to expect, that with the great amount of work that Congress will have in hand pertaining to the period of reconstruction, that there will be a tendency to postpone matters of this kind, perhaps indefinitely; but it is certainly important and absolutely necessary that before another year goes by we must have some definite fixed statute, or a revision of the law, which will apply to the mining, development, and obtaining of oil-shales.

I would therefore move that you, Mr. Chairman, select a committee to confer with the Department of the Interior and obtain a ruling pertaining to the requirements of assessment work, which may be published at the earliest possible date; and that this be followed by taking the matter up directly with Congress, for a revision of the mining law in such a way that we will have a definite guide for next year.

And there is another question which I should refer to, that concerning grouping of claims. From the best legal advice we can get, no definite conclusion has been reached that we are allowed to group. It is true that under the petroleum act we are permitted to develop or make discovery on five claims by putting down one well; but that, as I understand it, was enacted because of the fact that it is not possible or practical to sink a well on each quarter section without undue hardship. In the matter of the development of the oil-shales, the plotting of the shales and a testing ground are important items, and it seems if that law is applicable to petroleum claims it should also apply to oil-shale claims. In the case of metal claims it is not necessary to install large, expensive plants such as are required in the development of oil-shale deposits. For instance: one might open either a placer gold claim or a lode gold claim and strike ore, paying his way; you can't do that in the oil-shale industry.

Large Investment Needed for Shale Mines

Before you can have one dollar of revenue, you must invest heavily in a retorting plant, and possibly in a refinery involving thousands, up to hundreds of thousands of dollars; so, if the mining law permits grouping of metal claims and developing at one point, there is no reason why it should not also apply to placer shale claims. If we are permitted to develop or do assessment work, or make discovery on a certain tract of oil land by grouping, this likewise should apply, as it resembles at least in principle the oil-shale claims. I therefore move that a committee be appointed for this purpose.

[Mr. Jenson's paper will be found on page 532 of the Proceedings.]

MR. J. A. EDE: Mr. Finney read a paper on the "Interpretation of Mining Laws," referring to the oil-shale, coal, and metalliferous mining which are the subject of the mining laws, and I believe he is now in the city.

MR. JENSON: I withdraw that motion, then.

MR. EDE: In regard to the mining of shale, I don't see much difficulty, but I think it is premature to base any positive computations upon what you will be able to do. Opening a mine is very deceptive. It is when you get in for some thousand feet or more—the conditions you will have to contend with at that time and the cost of maintenance will be subjects that you will have to meet. The difference in the figures, so far as those which Dr. Alderson gives are concerned, while they may not be altogether correct, are comparative. We are in this country working our coal mines in competition with England, and if they are able to make that price over there it is likely that we may be able to do the same thing here.

Dr. David White is with us this afternoon, and we cannot afford not to have him talk on this subject, for I feel sure he will give us much to think about. To get at the nature of a thing we must understand that we have dismissed the idea that what they may do in another place would necessarily be the right thing for us to adopt. We have learned that the shale in Nevada and the shale in other parts of the United States have a different physical character. If we are working on these prices and trying to get this distillation, I think that the first thing we should do is to understand our subject and get all the information possible before we proceed any further. Therefore, I think we can't afford to lose an opportunity of listening to the Chief Geologist of the United States, who can speak to us most profitably along these lines.

CHAIRMAN ALDERSON: Really, Mr. Ede, you have stolen my thunder, because I have had my eye on Dr. White for some time. I was waiting until the proper time came to suggest that Dr. White be our last speaker and pronounce the benediction. Dr. White is the man in Washington who answers this sort of a description. With the consent of those present, we will conclude our conference with a talk from Dr. David White of Washington, D. C. (Applause.)

DAVID WHITE: Several comments regarding the first three papers are pertinent. Deposits of shale that will yield oil on distillation are fairly widespread in the United States; but in the Eastern States, the deposits of rich shale—shale adapted to the distillation of oil in large yield per ton—are restricted, being confined mainly to the remnants of cannel deposits and the so-called 'bastard' cannels of the Eastern coal-fields. All of these deposits are limited to small areas, and, as compared

The Eastern and Western Shales of America

to the great Western reserves, they are of insignificant volume. Some of them are rich, and will be used, without doubt; but when you view the annual oil consumption of the United States, the amount those deposits will furnish is relatively small. The rich ones are likely to be worked out rapidly. The more extensive shale deposits of the Devonian and Lower Carboniferous, where locally so rich in carbonaceous matter, and not so far altered but that they may be practicably used for distilling oil, are, at best, so far as the U. S. Geological Survey has information, inferior in capacity to yield oil by distillation. They cover enormous areas, but they are relatively lean. The greatest oil-shale deposits of the United States—enormous in quantity and of unusual richness—are here in Colorado, Utah, Wyoming and Nevada.

Estimates of the Green River Shales

Mr. Morgan is, I think, a little modest in his quotation as to the estimated content of the Green River oil-shales. I think it not improbable that a careful and complete usage of those shales—which is not to be expected—would permit the production of as much oil as all of the natural petroleum now known in the world and recoverable by current methods—present day methods. The estimates of the oil resources in the ground in the United States, prepared by the Geological Survey, and the estimates of 'The Oil Resources of the World,' which I published in May and which have been widely quoted by the Government and the press, are based upon present methods of recovery. You will bear this in mind. Improved methods, such as the U. S. Bureau of Mines recommends, are likely to result in a much increased production and will have the effect of increasing those estimates. But if the amount recoverable should be increased by one-half, bringing it up to ten or eleven billions, or if the recovery be actually doubled—which seems improbable—bringing it up to fifteen billions of barrels of oil recoverable with the help of new methods, you can calculate in short time how long that would last if the country were wholly dependent on our domestic production. Our country is already using more than half a billion barrels a year, and the consumption rate is increasing rapidly and inevitably, for our prosperity, our standards of every-day living, our industrial development and our expectations of the future are all based upon an adequate supply of petroleum. We must have it, and it must be assured in advance. If it is found to cost too high, we will have to curtail our consumption and use oil for the higher consumption purposes rather than the grosser. View-

ing the future by decades of years, and our consumption by half billions and more of barrels, the Eastern oil-shale deposits that are really rich will never go very far, valuable as they may be, and cannot carry the country through any long period. We must depend largely on the extensive as well as rich shale deposits of the Rocky Mountain States.

Geologic Age of the Shales

The Green River oil-shales are, however, different from the Paleozoic shales and cannels of the East by virtue of the geologic maturity, that is, the further advanced progressive alteration of the organic matter in these Eastern deposits. The Green River shales, which are in a relatively early stage in their geologic history, are comparatively unaltered—that is, they have been subjected to little progressive regional alteration, and, mainly by reason of this fact, give a larger percentage of unsaturated hydrocarbons. In this appears to lie one of the problems, perhaps the greatest, confronting those who in the West are earnestly endeavoring at the present time to put oil-shale on the map as a going industry.

Of the three problems confronting them, the first, mining, which has occupied much attention in this discussion, is, I believe, relatively unimportant. The question of disposal of waste and of securing adequate water are, on the other hand, likely to be under-rated. In some districts it is, however, probable that artesian water may be obtained.

The two great problems appear to be those of devising, if possible, a retort which will produce in large amounts a distillate readily convertible into the most valuable marketable products, in some of which saturated hydro-carbons in larger percentages will be present. What the retort men cannot do the refiner must do, and that is the other problem, the refiner's.

In regard to the mining of the Green River shale, I would add a word or two based upon the observations of the Survey during this summer and in former years. This shale is generally much lower in organic matter—that is, higher in ash, than the 'kerosene' shale in its best phases in Australia, which, I believe, sometimes contains as much as 87% of volatile matter. Our shale, which is 'rich' when it approaches 50% of organic matter, appears to be well laminated, and lies in relatively undisturbed horizontal beds. The question of strength of pillars ought not to present serious difficulties. Some of the rich rock will spall; probably there will be some scratching, especially in breaking up the lumps; but it is anticipated that the pillars will hold as well, at least, as in the average horizontal bituminous coals. Popping of the face of the freshly exposed rock under deep cover is not likely to occur.

Gas in Oil-Shale

Now, as to the gases: Our observations lead us to expect that, in some of the mines, as the oil-shale is mined in deeper, lenses of sand, washed in on the great pond of organic mud, will be found, and that some of these lenses of sand will be saturated with oil and gas. It is quite possible that, when encountered under heavy pressure, some of these will yield gas.

Fissures, are, of course, to be expected; that is to say, big, deep-seated, master joints are developed. This is proved by the great fissures pulled open and filled with gilsonite in the Uintah basin. More jointing of the refined type would facilitate mining of the shale. Possibly gas may come up through some of the fissures or joints; but it seems to me that the occurrence of gas in them is likely to be rare. Experience will answer this question. I think it more probable that such gas as is encountered will originate in oil-saturated sands inter-bedded or included in the shale. Much shale can no doubt be 'stripped' at relatively low cost. In some regions the oil-shales lies near water-level and may even be quarried under shallow cover on a dip slope.

To insure the establishment of an oil-shale industry on a profitable basis at the earliest possible moment the first and most successful retorting plants should be placed where, other things being equal, the shale may be mined most cheaply. This calls for teamwork and somewhat unselfish co-operation. The companies working with experimental plants should co-operate and keep in the closest touch with the U. S. Bureau of Mines, so that the best that is discovered will be promptly recognized and combined, and the most promising combination be given the best opportunity for results by trial in the most favorable area, thus putting oil-shale production at a profit on the map at the earliest possible date. (Applause.)

CHAIRMAN ALDERSON: The Secretary, Mr. Callbreath, would like very much to have the address of everybody here who is interested in oil-shale.

FLOTATION CONFERENCE

American Mining Congress

WEDNESDAY, NOVEMBER 17, 1920, 10 A. M.

Mr. George E. Collins of Denver, Colorado, presided

CHAIRMAN COLLINS: Gentlemen, will the Conference please come to order.

[Mr. Collins then read a paper on the history and present condition of flotation, which appears on page 551 of the Proceedings.]

CHAIRMAN COLLINS: The first speaker on our program tonight is Mr. W. C. Russell, who has prepared a paper, the title of which I will read: 'Has the Attitude of Minerals Separation Retarded the Development of Flotation Concentration?' Unfortunately, Mr. Russell has been called away, and is unable to be present here, but Mr. Keiner has kindly undertaken to read the paper.

[Mr. Russell's paper will be found on page 556 of the Proceedings.]

CHAIRMAN COLLINS: The subject is now open for discussion. In order to set the ball rolling, I will call upon Mr. T. A. Rickard, San Francisco, to make a few remarks. Mr. Rickard needs no introduction from me. He was a very prominent mining engineer of this city [Denver] and State [Colorado] for many years before he became a journalist, and since then his prominence has increased decidedly rather than diminished. Mr. Rickard has a paper [the *Mining and Scientific Press*] which he edits and controls, and a great many of the abstracts included in Mr. Russell's paper were taken from that journal. I will ask Mr. Rickard to address you.

MR. RICKARD: Mr. Chairman: I would like to waive the opportunity you have given me to address this conference. I would like to waive it until later, and I would like to suggest to you that having heard an attack, it would be good sportsmanship to listen to the defense. I sympathize with the attack that has been made, and I know that Mr. Cook has prepared a defense, and it seems to me that the interest in these proceedings will be heightened if an attack will be followed by a defense.

Attack on Minerals Separation to be Followed by Defense

You know that the representatives of Minerals Separation have been invited to come here and make an explanation or defense, and it is only courteous to ask one of them to speak now, and I shall be glad to speak later.

CHAIRMAN COLLINS: We are fortunately honored here today by having the presence of several of the most prominent members of the

Minerals Separation North American Corporation. We have with us today Mr. A. A. Cook, who is the counsel and one of the directors of that company; we have Mr. E. H. Nutter, who is the chief engineer; and we have Mr. C. B. Allen, the secretary. Perhaps these gentlemen would like to make a few remarks with reference to Mr. Russell's paper. Mr. Nutter, may I appeal to you to do so?

MR. COOK: Mr. Chairman, as I listened to the paper read by Mr. Russell, I was reminded of my school-boy days and of the story of Mark Antony, and you all recall that he said: "We come to bury Caesar, not to praise him." You were good enough to extend an invitation to Minerals Separation. I believe it was the first invitation ever extended to Minerals Separation by the American Mining Congress. If one had been extended to us before it would have been our privilege to have met with you gentlemen, because we appreciate, even though you may not think so for the moment, that the mining industry is something that should be encouraged, and that the development and welfare of the industry is a bigger thing than any single corporation, or any contribution that can be made to it by any corporation, or any owners of patents including Minerals Separation North American Corporation. In your letter you said that no conference with respect to the flotation process would be complete without Minerals Separation being represented, and in our reply I told you that we would be glad to attend and would be glad to acquaint the Mining Congress with the facts, as we understand them, and give them accurate information. Now, it is my purpose in being here to be helpful, if I can, to co-operate, which I should, and if it is agreeable to the Chair, I would prefer to have all of the attacks, suggestions, or criticisms that present themselves in the various papers read, then I will take great pleasure in an attempt by a heart-to-heart talk to members present to find out what is the truth of the situation.

CHAIRMAN COLLINS: Gentlemen, I will say that the suggestions as stated by Mr. Cook appear to the Chair to be reasonable and likely to lead to the best solution. If the members of the Committee on arrangements present think otherwise, I wish that some of you would advise me. Failing such I would be disposed to follow Mr. Cook's suggestion. The next paper is one by Mr. George L. Nye, counsel employed by the American Mining Congress, entitled, 'Particular Practices of Minerals Separation which Mining Men have Criticised.'

[Mr. Nye's paper will be found on page 570 of the Proceedings.]

CHAIRMAN COLLINS: Gentlemen, the program contains another paper which is of this controversial type, and directly concerns the relations between Minerals Separation and operation of the flotation process. This paper is prepared by Mr. Gilbert H. Montague, a lawyer of New York City, who is associated in advising, on behalf of the American Mining Congress, the counsel of the Federal Trade Commission, in connection with the proceedings now pending before them. Mr. Montague has come here from New York, largely, or entirely, I think, in order to address you, and I feel sure that you will be glad to hear and to consider his paper.

MR. MONTAGUE: Mr. Chairman, ladies and gentlemen: When your honored chairman asked me to read a paper, I said I would do so on one condition only, and that is that a discussion of my paper be led by Mr. Cook, counsel for Minerals Separation. The members of the New York bar are proud of Mr. Cook's career as a lawyer. He is one of the most distinguished members, for his age, and Minerals Separation made no mistake in entrusting the leadership of its legal matters to him.

Mr. Cook has stated that before he answers he would like to hear the whole case against Minerals Separation. Unfortunately, we will not be able to accommodate him, as testimony thus far taken by the Federal Trade Commission against his client is not complete.

Mr. Montague's address will be found on page 589 of the Proceedings. He added the following extemporaneous remarks:

Application of Patent After Expiring in 1923

Following the reading of this paper, Mr. Cook, speaking as he stated "subject to correction" by the Corporation's officials in New York, questioned my statement that after November 6, 1923, a Minerals Separation standard licensee "who has never used any process or apparatus belonging to Minerals Separation, excepting only the process" covered by Patent No. 835,120 ("fraction of one per cent. oil") then expired would still be obligated to continue to pay royalties to Minerals Separation.

To clear up this difference regarding the plain meaning of Article 1 of Minerals Separation's standard license agreement, which unequivocally provides, without any time limitation whatsoever (in this respect unlike Minerals Separation's agreements with certain favored licensees which by their terms expressly expire November 6, 1923), that "the Licensees shall pay royalties to the Licensors for the *use* of all processes and appliances embodying all or any of the inventions described and claimed in the Letters Patent within this license" at the rate specified by the agreement, Mr. Cook, at my suggestion, telegraphed to New York, and on the following day received from the President of Minerals Separation North American Corporation a reply to the effect that such a licensee would not be obligated to continue to pay royalties to Minerals Separation. Since this same official, in a letter read by Mr. Cook on the previous day, had stated that the obligation to pay royalties continued so long as the process was *used*, and since the vice-president of Minerals Separation North American Corporation had similarly testified in the Federal Trade Commission proceeding (record p. 580), I promptly expressed to Mr. Cook my grateful appreciation of this apparently magnificent concession by Minerals Separation.

Complex Situation Arising from Many Patents

Further discussion of the same point, however, promptly developed the fact that while so modifying Article 1, Minerals Separation was by no means ready to modify Article 5, which provides that "The Licensees shall not directly or indirectly during the continuance of this License nor at any time after the determination thereof dispute or object to the

validity of the Letters Patent within this License or the novelty or utility of the inventions specified therein," and that therefore any licensee using the process covered by No. 825,120 ("fraction of one per cent. oil") then expired would be obliged to accept Minerals Separation's opinion as to whether such process was covered by any of the scores of other "Letters Patent within this license," and would be prevented by Article 5 above quoted from ever "disputing or objecting" to Minerals Separation's opinion on this subject. The record in the Federal Trade Commission proceeding abounds in expressions of Minerals Separation's opinion to the effect that every conceivable process of flotation is covered by one or another of its scores of patents, so that so long as Article 5 stands, any licensee who after November 6, 1923, ventures to discontinue paying to Minerals Separation full quarterly royalties upon the basis specified in his license agreement, may be sued by Minerals Separation for alleged infringement of any of its scores of other patents, and by the provisions of Article 5 will be estopped from ever disputing or objecting to the validity of such patent or the novelty or utility of the alleged invention specified therein.

This apparently magnificent concession by Minerals Separation, with which Mr. Cook, by his gallant and chivalrous manner, succeeded in raising high hopes among his listeners at the Convention, thus proved to be entirely illusory. That every other restraint above described, imposed by Minerals Separation's standard license agreement, was in effect eternal because of the ingenious provisions above described, for extending the life of the agreement, was not disputed by Mr. Cook.

CHAIRMAN COLLINS: The meeting will now stand adjourned, and will re-convene this afternoon at 2 o'clock in Conference Room A, downstairs.

WEDNESDAY, NOVEMBER 17, 1920, 2 P. M.

CHAIRMAN COLLINS: The flotation conference will come to order.

For the benefit of any of you who may not have been here this morning, I will mention that papers were read by Mr. George L. Nye, and Mr. Gilbert Montague; that Minerals Separation, represented by Mr. Alfred A. Cook, one of the directors and counsel, would answer these papers. Mr. Nutter, the chief engineer, and Mr. Allen, the secretary of the corporation, are also with us.

MR. COOK: Mr. Chairman and Gentlemen of the Mining Congress: I am somewhat embarrassed, by reason of the fact that I am here at your invitation, and it therefore behoves me to say nothing that might be regarded as unkind, unduly critical, or offensive. I am also embarrassed by the more than professionally kind and generous introduction of me to you by my friend of the New York bar, Mr. Montague. I wish that I could have had the opportunity of familiarizing myself with the papers

read by Mr. Nye and Mr. Montague before they were presented. I might then have had the privilege of offering to you in written form such views as I thought might be germane to the discussion and helpful.

Minerals Separation and Federal Trade Commission

Please remember that in connection with all of the Federal Trade Commission's proceedings from which quotations were amply made, Minerals Separation has not yet put in its case. It is still the Commission's case; it is only what the witnesses for the Commission said and testified to—and in a number of instances withdrew upon cross-examination. We have not called our witnesses, we have not called our men, and it seems to me that we might await the verdict of the jury and the judgment of the court. Now, I do not say that critically, and I do not want to be offensive, but I do mean to say it has not been quite in that spirit that Minerals Separation has been met by the American Mining Congress. I shall speak to you, if time permits, of the attitude of Minerals Separation towards the mining industry, but will first deal with the attitude of the American Mining Congress towards Minerals Separation.

A year ago at St. Louis, Mo., without any conference or any invitation to us, without any suggestion upon the part of this great and powerful organization which can at times make so much for good in a disinterested way, and at others so much for bad, no attempt was made by anybody, to ask us in the interest of the mining industry to attend. Its prosperity is surely our prosperity. What did the American Mining Congress do? Instead of coming to us or even writing to us through its Secretary, it filed allegations and charges, and impressed the Federal Trade Commission with the fact that the Minerals Separation companies are German-controlled. At your meeting in St. Louis, an address was read by Mr. Nye, page after page of which charged Minerals Separation with being so controlled. Unless the facts substantiate a charge of that kind, that is going not only far afield, but is hitting, if I may say it, below the belt.

Fighting Spirit of American Mining Congress

In a letter that he recently wrote to the American Institute of Mining Engineers, your worthy and deserving Secretary said that the American Mining Congress was a fighting organization, and that such was its greatest strength and its greatest weakness. Yet I want to say even though my clients and I are to be the recipients of its fighting force and its fighting organization, that if there must be a fight, the fight should be fair. This article was distributed throughout the country, and the Federal Trade Commission, before its complaint was ever served on Minerals Separation, announced in the public press contemporaneously with the filing of the complaint, this alleged German-control. I speak of the article now because since my coming to Denver I have been furnished with reprints of the article. To what extent it has been distributed to the members of the American Mining Congress, I don't know, but I have here one of these reprints. In this article the assertion was made that two gentlemen residing in England, were in effect secret German agents and through their ownership or control of a majority of the shares, arrangements were

made so that Minerals Separation could function in this country as a German-controlled company. Who were these two? If any of you have some of these reprints I refer to, you can see mention of the names of Kindersley and Pusch. Who were they? The former is Sir Robert Kindersley, a governor of the Bank of England, a director of the Hudson Bay Co., and throughout the war the head of the War Savings and Victory Loan movement of England, recently knighted and given by his King the honors that fall to honest and deserving patriots. And who was Pusch? A Russian who came to England years ago, a naturalized Englishman who lost two of his sons, officers in the British cavalry in the war, and when England sent its Commission to Russia during the war he was either one of the members or the head of that Commission!

Investigation of Minerals Separation

Of course I know the force and effect of propaganda. I know that a rumor here and a rumor there grows and forces itself throughout any industry, throughout any community, and even gets to the ears of the Government, and so, practically at the instigation of the American Mining Congress, we had visited upon us for weeks and months the Alien Property Custodian, who goes through our affairs from beginning to end to determine whether this charge of German control is correct. Also the U. S. Bureau of Mines comes, and the Federal Trade Commission comes, and every conceivable Government agency. In 1917 the Canadian Government examined us. You heard the charge made this morning that if royalties are unreasonable in Canada the patent is forfeited; yet after that investigation by the Dominion Government, Minerals Separation completely cleared itself. Now, there must be some reason and some element of justice in the decision. So far as the two gentlemen whose names were mentioned are concerned, I did call the attention of the Mining Congress to the great injustice that it had done them, and to its credit be it said that an apology was forthcoming.

Let me take up another matter. Recently there appeared in the *Engineering and Mining Journal* an article headed: 'Western Hearings of Minerals Separation Companies by Federal Trade Commission,' and there were abstracts or attempted abstracts, in that article. One of this was as follows: "One licensee who testified that his relations with Minerals Separation had been pleasant said: 'The royalty is too high * * * we regard it as entirely too high * * * It becomes a very burdensome charge.'" Those words were used, but in connection with other words, and my only thought on the subject is, as long as we are to have a fight, let us be fair with each other and play the game. This is what was testified to by the witness: "I do not say I regard it as too high under those conditions. I say under present conditions we regard it as entirely too high. When I am not making any money at all, it becomes a very burdensome charge." Whether that is helpful to the Mining Congress or not, we were entitled to be quoted correctly.

Questions not Answered

In the case of the Evergreen Mining Co., represented at the Federal Trade Commission's hearings by Mr. Hollister, it was shown that their mill was not closed because of Minerals Separation, but on account of troubles with the machinery. When asked what oil he was using, and whether he was using less than 20 lb. to the ton of ore treated, Mr. Hollister declined to answer, just as many other witnesses declined to answer the same question, although some did tell what they were using and what they were doing. Now, either there was infringement or there was not. If a man is not infringing, he does not mind the question. When Mr. H. D. Williams wrote a letter to the Evergreen company and others to stop infringing, we [Minerals Separation] are threatening them; we are coercing them; we are abusing them, and we are doing things that the law condemns. If we did all these things, here was the opportunity for Mr. Hollister at least to prove to him beyond doubt that at any rate, so far as our letter to him was concerned, it should not have been written. Why was it written? Because the Patent Law says that if you learn of infringement you ought to give notice of some kind to the infringer of your rights.

I am somewhat limited in what I can or want to say. As I am not a patent lawyer I will not be able to discuss the patent situation. I do not think that arguments pro and con between the lawyers on each side, or the submission of patent questions to the Mining Congress, can bring forth anything useful, unless it be with a view to determine first what each claims. I shall not speak of patent law, if for no other reason than that the various matters are before the courts, and so far as I am concerned, they are in the hands of patent counsel, and I do not think it would be correct or proper for me professionally to discuss a situation which is *sub judice*.

The Status of Patents

I do want to make one comment, subject to correction by my Company or the patent lawyers, should I be wrong, and that is concerning what Mr. Montague said. I understood him to say that if any particular company is using the oil patent No. 835,120, when it expires in 1923, and a licensee of Minerals Separation uses none other of its patents, nevertheless, beyond 1923, Minerals Separation claims the right to continue to exact royalties from its licensees indefinitely. (I may be wrong, but that can easily be determined upon inquiry.) In other words, if when 1923 comes, and a licensee does not use any of Minerals Separation patents, I do not understand that he must pay any royalty to Minerals Separation. If, when the 1923 patent has expired, and he uses any other patent—let us say the soluble frothing agent patent—then his royalty continues. If he ceases using it, he pays no royalty. No licensee is called upon to pay any royalty unless he uses a Minerals Separation patent within the period allowed by law. It is possible I may have misunderstood Mr. Montague. It may be that he did not assert that that was our claim.

You listened patiently this morning to the reading of a great many

extracts from a license agreement; and yet, why that agreement of Minerals Separation, abandoned in December, 1917, should furnish the gravamen of charges made against us, is absolutely beyond me. There is no justification for referring to our old license agreement when we have a new one, from which have been eliminated a great many features criticised in one of the addresses this morning. One of these features concerns manufacturers of flotation machines, but since December, 1917, there has never been a time under the license agreement when a manufacturer could not sell his machine to any licensee of Minerals Separation. All that is required is that the licensee ask our consent to its purchase, which under the new agreement we must do. Another feature covered the inventions by Minerals Separation employees, by which they had to assign them to the company; that has also been eliminated.

[Following this, a discussion concerning the old and new agreements arose between Mr. Montague and Mr. Cook, and the latter digressed into the why and wherefore of certain restrictions.]

Literature on Flotation

We have been told that there is little literature upon the subject of flotation, but I say that if you want a history of the process, if you want everything connected with it, read the specifications of Minerals Separation patents. These are given to each of our licensees. In them you will find the history of everything we have done.

In our agreement, we say to licensees that if they invent or improve something, they should give it to us. Whatever we get belongs to each of our licensees, without extra charge, under the same royalty provision and the same royalty agreement. That is beneficial to us, also licensees. For instance, if the Anaconda Copper Mining Co. discovers something which is an improvement on our processes and our patents, and gives it to us, the right to use that improvement belongs to every licensee.

[Mr. Cook then recounted at considerable length the following points, which, more or less, have been covered in the technical press and are generally known:

The Alien Property Custodian's methods of investigating Minerals Separation; the alleged oppression of the mining industry; who were the inventors of flotation; flotation patents in the courts; Minerals Separation was the first to introduce air-froth flotation in America; what Mr. John Ballott said; the Hyde-Nutter-Butte & Superior affair; the Jackling-Hayden, Stone properties and their attitude; that from November, 1913, to December 31, 1916, Butte & Superior made a profit by flotation of \$20,876,247 from 1,773,820 tons of ore, and that these are the main figures upon which the accounting for infringement is now pending (it may take 5 years to complete it); Minerals Separation's work on porphyry copper ores, Inspiration being the first, where great improvements in recovery were made by flotation; Miami declined assistance, built a flotation plant, resulting in the Miami suit; Miami, while not controlled by the Jackling-Hayden, Stone interests, acted in

close co-operation with it; save these two groups, every large company has acknowledged Minerals Separation's patent rights and pay royalty; there are 450 unlicensed users of flotation who were told that they could get licenses upon their making an adjustment, which some did; legally, Minerals Separation has the right to issue injunctions, but has not; Anaconda made the first and only contract with Minerals Separation even when the courts had said the latter had no patent, etc.]

Apparent Discrimination in Royalty Charges

Regarding Mr. Nye's allegation that Minerals Separation charged one company—the Chichagoff in Alaska—50 cents an ounce of gold recovered by flotation, and another—the Vindicator in Colorado—using substantially the same process, was charged 25 cents an ounce, Mr. Cook explained that the former treated the tailing from a \$40 ore, while the latter treated \$4 mine ore. Chichagoff paid 50 cents an ounce of gold recovered by flotation, but Vindicator paid 25 cents per ounce on all gold recovered; yet each has the option of adopting the other royalty, so where is the discrimination?

Mr. Cook asked whether in a period of 9 years—1911-1920—any process has been used or developed to the good of the country as this method of turning waste into value?

The U. S. Bureau of Mines was informed during the war that Minerals Separation would not ask royalties from those who chanced to be oppressed, provided those who were the beneficiaries of this offer also would offer to the Government that the profit which would otherwise inure to them by the use of flotation would not be claimed or collected.

The Minerals Separation had been met in a slightly different spirit than that in which it has been met would have been better for the mining industry and for the company. There should be no antagonism between the two. Minerals Separation has done too much for the mining industry.

Suggested Joint Committee to Discuss the Dispute

I think that if the American Mining Congress undertook through its directorate to appoint a committee of men in the mining profession—unbiased and judicially minded—and told them to take up with us, we will be glad to confer with them; and so eliminate much in the way of misunderstanding and litigation. I am thinking that we should sit down in a calm, judicial, dispassionate way, determine what is right and fair, and if that is done, truly the Mining Congress is an American Mining Congress. (Applause.)

CHAIRMAN COLLINS: Are we to understand that your last suggestion is a formal invitation to the American Mining Congress?

MR. COOK: Mr. Chairman, I have tried to be informal in my remarks. I do not know whether, in view of the fact that the matters we are talking about are being investigated by the Federal Trade Commission, I would have a right to extend a formal invitation. This

is my view on the subject. If your committee is appointed, I know that if the suggestion I have made meets with favor, we will be glad to meet you.

CHAIRMAN COLLINS: Mr. Cook, I will continue my question, and ask whether it is your wish that the Chairman of this meeting should convey that expression of opinion to the president of the American Mining Congress, and ask you to meet him?

MR. COOK: Unhesitatingly, if you please, convey to the Mining Congress, the Board of Directors, this earnest suggestion.

CHAIRMAN COLLINS: The Chairman will have the honor of conveying that expression of opinion to the president, Mr. Bulkeley Wells, and we will try and arrange for you to meet.

MR. COOK: Thank you.

MR. MONTAGUE: Mr. Chairman, before we consider the question it might be worth while ascertaining if a single suggestion of recession from the present position has been made in the two-hour talk by Mr. Cook. We should know whether we have anything to confer about. Not a single suggestion has been made by Mr. Cook receding from his position.

MR. ROHN: Mr. Chairman, I think, as everybody else feels, that are all tired after listening for a whole day, but it seems to me that we have just accomplished very little indeed if we go away at this time. I want to say that our relations with Minerals Separation have been entirely friendly. I do not believe that any reasonable man who comes down to the facts will deny that Minerals Separation has done a great deal, first, to introduce flotation in this country, and secondly to promote it; so any fair-minded man should grant them a fair return for what they have done. But the thing that concerns me is this:

An Iron-Bound Contract

I made a contract with Minerals Separation in a certain form, very carefully worded by them. I don't know what it means; I had no choice. It is either take that, or take a lawsuit. We were in no position to fight them, therefore we took what they gave us, and I am anxious to know what it means. Must we pay the rate we have been paying for the rest of our natural lives—or as long as we continue to operate—or when this patent expires, if it terminates in 1923, on the particular process that we are using, namely, oil in quantities of less than 1%; and whether mechanical action to beat up the froth—whether when that expires, we are through paying them. I do not believe anybody has a quarrel with Minerals Separation on the fact that they are entitled to compensation; I think that the whole trouble is over this contract.

I have listened intently to Mr. Cook to hear what he said on the matter; and I heard him say that he personally thought there would be no intent or no attempt on the part of Minerals Separation to force indi-

viduals to continue to pay royalty after the patent expires on the particular, specific process that they are using; but I also noticed that he reserved correction on that, that he reserved the right to be corrected by his company. It seems to me that is the one thing which counts. If he can give us some assurance on that, then I think our day has been of some value; if he cannot give us any assurance or any enlightenment, I don't see what we have accomplished by sitting here and listening to a whole day's talk.

Two Types of Argument

I was impressed by the addresses of Mr. Montague and Mr. Nye. It seems to me that those gentlemen were talking advisedly, and seemingly had a sound foundation for the statements they made; but in listening to Mr. Cook, all that I have been able to get is that he has made certain assertions, but upon the main point he has not been willing to commit himself. Now, may we understand, Mr. Cook, that in 1923 the patents covering a small amount of oil is going to expire, and thereafter those who use just that thing, and no other, pays royalty?

MR. COOK: I told you, Mr. Rohn, just what I knew and thought on that particular subject.

MR. ROHN: Mr. Chairman, is it your understanding from what Mr. Cook has said that Minerals Separation will meet the committee from the Mining Congress, and will discuss and meet fairly, this question of whether they have a strangle-hold on the mining industry for the rest of our natural lives, or whether this patent is going to expire?

[Thereupon a discussion—some of it acrimonious—ensued between Messrs. Cook, Rohn, Montague, Nye, and the Chairman. Mr. Nye disputed Mr. Cook's explanations of German-control of Minerals Separation, the methods of payment by the Chichagoff and Vindicator companies, the peculiarities of the Anaconda contract, and that if Mr. Ballot refused to give the Federal Trade Commission figures as to Minerals Separation's earnings, Mr. Hollister was also entitled to decline to reply to queries as to the Evergreen Company's operations. Mr. Nye also told why Minerals Separation is so disliked in America, and discussed the "less than 1% of oil" factor in flotation. Mr. Montague suggested that Mr. Cook wire to New York as to the termination of royalties.]

CHAIRMAN COLLINS: With reference to what Mr. Cook said as to never having had the courtesy of an invitation to the meeting at St. Louis last year, your present Chairman wrote a letter asking representatives of Minerals Separation to be present, and personally I am confident that the printed invitations were actually mailed last year; and I think that it is very probable that they went into the waste-basket and none of the officers received those invitations. The hour is getting late, and it is going to be impossible to hold this meeting much longer. Mr. Montague, will you please read those resolutions?

MR. MONTAGUE: Mr. Chairman, the Resolutions Committee is now in session and wants to get any resolutions coming from this Conference.

[Thereupon the resolution, approving the Mining Congress stand on Minerals Separation, introduced by Mr. Montague, was read and handed to the Resolutions Committee, and reported back by that Committee to the Sixth General Sessions of the Mining Congress, which finally approved of the form as appearing among final Resolutions, page 53.]

DR. COTTRELL: I venture to interpose a word at this juncture from the point of view of a more or less impersonal onlooker who from past experience is in a position to sympathize on the one side with anyone who, having developed a new invention, undertakes to get his money back and a fair return for his speculative risks through straight out licenses rather than by an operating or merchandising policy; and on the other hand, can fully realize how hard it is to work out in advance a licensing system thoroughly consistent within itself and still fair in all its varied applications.

I have been interested for years, as many of you know, in the study of methods for arriving at a fair estimate of the public value of patents and the best methods for their licensing and exploitation, so that I may perhaps be in a better position to think dispassionately and objectively on this subject than some others here who quite naturally approach it from a more personal and specific angle, and I shall be glad if by so doing I am able in any degree to lessen the evident tension in this meeting and help get down to fundamentals.

This was driven home to me as I sat here listening to the discussion, especially to Mr. Cook's reference to my remarks of last night, part of which I would like to reiterate in this connection. I do not know of anything that illustrates better what I was trying to get at in my remarks last night than this discussion today. I was a little afraid then that the real point of what I had to say would be missed, for lack of concrete applications in the minds of my hearers, and I had no idea, when I came here today, that this discussion would run quite so close to the form of the resolution that was presented last night. Many of you doubtless heard the resolution, but if the Chair will permit, I am going to beg your indulgence while I read it again, in the light of what came up today, because I think it is pertinent to this question of the appointment of a committee, and I want to read it before Mr. Cook leaves, otherwise, I should not have taken your time tonight:

[Thereupon Dr. Cottrell read the resolution, which in slightly amended form appears among the final Resolutions.]

This is essentially a matter of public policy that we are discussing, and I am simply suggesting that it might be possible and expedient to avoid acrimony in this particular matter, and to get at it in a larger way, through a committee of this general type, which could function in both capacities. Such a committee would consider not only this particular case, but others that might come up, and would work with other bodies

like the Chamber of Commerce of the United States, for example, as well as with Governmental bureaus and the Patent Office. I bring this up at the present time so that you may have it in mind, think it over tonight, and take it up if desirable at tomorrow morning's session. I thank you for your attention.

CHAIRMAN COLLINS: This Conference is going to meet tomorrow morning at 10.30 to continue its work; I hope that all of you will be present at that time.

The Chair ventures to say on behalf of this Conference, and to repeat the invitation to Mr. Cook and his colleagues to come back tomorrow morning and confer again with us. There has been some inevitable friction and the atmosphere has been to some extent dense. I hope that sleeping over it tonight will tend to make us simmer down a little and make it possible to continue our discussion in the spirit of arriving at some conclusion if we can.

THURSDAY, NOVEMBER 18, 1920, 10.30 A. M.

CHAIRMAN COLLINS: Gentlemen, this Conference will please come to order. The subject of the discussion initiated yesterday afternoon is open for further debate. We hope to hear from any of the gentlemen present, and, personally, the Chair would be very glad if Mr. Cook could add a few more words in further elucidation of his position.

MR. COOK: Mr. Chairman, you were good enough last night to suggest after the meeting had been adjourned that I return this morning. I think that you made that suggestion because I mentioned during the debate that it was not my purpose to return.

CHAIRMAN COLLINS: Yes, sir.

MR. COOK (continuing): Dr. Cottrell told me he thought that I really ought to return, so in deference to your request and his suggestion I have done so. Considering everything, I thought that I could get a telegram through to New York and an answer by this morning, so I sent the following wire:

Minerals Separation Counsel Wires to His Principals

"Denver, November 17, 1920. John Ballot, Hotel Chatham, 48th St. and Vanderbilt Avenue, New York.

"Do we claim that if a licensee uses first patent in suit after its expiration in 1923, and his operations thereafter do not come under any other of our patents that he nevertheless must continue to pay royalty as long as he uses the process of the first patent. Please wire, quick answer."

I think that correctly sets forth the question that Mr. Rohn put to me, and which of my own accord I brought into my discussion, because I had

understood from Mr. Montague's paper that he thought, or rather he charged that Minerals Separation was claiming the right to collect royalty from its licensees under this first patent to the end of all time. I received this morning the following:

No Royalty on Expired Patents

"New York, November 18, Alfred A. Cook, Brown Hotel, Denver, Colorado.

"Thursday morning. Your telegram just received. The answer to your question is 'no.' We do not claim payment of royalty for use of first patent in suit or any other patent after its legal expiration, but we do claim payment of royalty for use of any other of our unexpired patents. John Ballot."

I trust, gentlemen of the Mining Congress, I have met what you may regard as the obligation you have imposed upon me, and answered Mr. Rohn's question as the question was put. (Applause.)

CHAIRMAN COLLINS: Mr. Rohn, the Chair will ask whether it is a clear and definite answer to the question you put?

MR. ROHN: Mr. Chairman, it certainly is, and it certainly is a start in the direction that I have had in mind when I put the question. I want to say that I did not wish to be understood, as apparently many did understand me, of throwing the gauntlet down to Mr. Cook and insisting upon his answering a lot of pointed questions that, in all fairness, he cannot be expected to answer here, but the purpose of my question was to start an inquiry and to start a discussion along the lines that it seems to me all of us are so much interested in.

MR. MONTAGUE: Mr. Chairman, I want to put myself absolutely in accord with Mr. Rohn's remarks. Mr. Cook's statement was worth coming from New York to Denver to hear, and if the American Mining Congress has never done anything else than to get that splendid statement he has made, it is well worth all the trouble of this whole Convention. (Applause.)

Mr. Montague's Views

The reason why this is such a magnificent thing is that in all the testimony that has been given to the Federal Trade Commission the emphasis has always been on the period of the use of the process. In its agreement, Minerals Separation states that licensees shall pay royalties to the licensors for the use of the processes and appliances at the rate, and so on, and every other condition in the contract was extended every time they got a new contract, for 17 years, and therefore everybody who has assumed to study this contract thought it was intended that it should be continued. You will notice that even in that statement which Mr. Ballot made yesterday he carefully said that so long as they used the oil process they would have to pay royalties. I say it is magnificent to have this statement from him to the mining industry, which means millions and millions of dollars, and the credit for it belongs to the American Mining Congress.

That statement requires a change in my paper of yesterday. It means that at the expiration of that date—1923—from anyone who has been using the oil process, he absolutely ceases to pay his royalty. As was stated in the telegram, Minerals Separation will promptly urge that if you continue to use that same process, you are caught under some other patent; but rely on that statement they have made, and refuse to pay your royalties from that point on, and then we will reap the real result of this victory and Mr. Cook's statement.

CHAIRMAN COLLINS: Let me introduce you to Mr. Nutter, chief engineer of Minerals Separation.

MR. NUTTER: I am no orator, but I want to say a few plain, blunt facts to you. Mr. Montague has just indicated that this is a new step that Minerals Separation has taken; he is in error. As long ago as 1912—I started flotation work for Minerals Separation in 1911—that question came up as to whether our license would expire with the patent, as the patents expired, and we were advised that no contract could extend the life of our patents beyond their legal limit, and I have constantly since then, in negotiating licenses, given that understanding. If there are any gentlemen here who have had negotiations for licenses with me personally, and have asked me that question, they know that I am speaking the truth. I have constantly advised those since then who have asked me that question, precisely along the line of Mr. Ballot's telegram.

Extending Life of Patents by Contract

The question came up again in the Federal Trade Commission hearing, and charges were made that we were endeavoring to extend the life of our patents by contract, and so I thought perhaps I had been going astray, and I specifically asked Mr. Ballot a good many months ago that precise question that has been asked and answered here today, and he said it is absurd for anybody to have the idea that we would endeavor to extend the life of our patents beyond the legal limits. Mr. Montague's statement, or implication, that this is a new step on the part of Minerals Separation is in error, and I want you to understand it.

There have been a number of points that have come up in this discussion, and I think that I can give some explanation in regard to the things about which we have been criticised, because I have perhaps been nearest to the facts. One is that of our contracts with engineers who come to us and want to be taught flotation; that was a condition we had to meet, and not a theory which we tried to impose upon the mining public. Engineers have come to me a number of times and have asked to be instructed in flotation, and they have availed themselves of the facilities of our laboratory and office—for weeks at a time in some cases—so I took the matter up with my company, and then I told such engineers that we would expect to be fairly treated and not to have any of the information which they obtained in rather a confidential relationship with us, used to our disadvantage. I also explained to them that we were working on the ores of a great many licensees and prospective licensees, and information about

such ores was necessarily confidential; so a contract was drawn up providing that such information be not used to our disadvantage. When engineers, therefore, have come to us asking to be given the privilege of learning all they could in our laboratory, I have shown them the contract and said that we would expect some such undertaking to be given to us, and they had entered into it in many cases.

Results From Company's Laboratory

I think perhaps some of you might be interested—some of you already know it—interested in what we are trying to do to help the mining industry in a technical way. We maintain at San Francisco an extensive and complete ore-testing laboratory and works for the flotation process. We have men as skilled as we can find, men who have had many years of experience in flotation work, and we have made it a constant practice to do all preliminary testing without charge to those who send us samples. We have charged for the assaying that has been done in connection with the tests at a wholesale rate. We were really forced to do this, because we found we were being taken advantage of by those who merely wished to have their ores assayed, but who sent in ores ostensibly for testing. We would do a lot of work that was entirely unnecessary.

We have worked on a great many problems. First, perhaps, in importance was the treatment of the porphyry ores, as represented by that from the Inspiration. We got the first results in our laboratory at San Francisco, which led to the hope that flotation would be beneficial in at least some part of the flow-sheet of the Inspiration mills. Following that work, more extensive tests were made at the mine, where results were considerably better than they were in the laboratory. That was done under members of the Minerals Separation staff. What we consider an important development of the art was made during that work, namely, the discovery that the efficacy of reagents was greatly increased by adding them to the grinding mills instead of directly to the flotation machine. That made the difference in the Inspiration ore between an easy success and a much more difficult success. Treatment of the Calumet & Hecla native copper slime was also worked out in our laboratory. We installed special apparatus, designed to handle that ore under the conditions which we thought it needed, and we got results which interested the Calumet & Hecla people. Following our report of tests, the special machines were put in, and there they got better results than we got on the small scale, not along precisely the line—that is, using some different reagents—but in general following the lines that our testing work indicated. These tests were in charge of Minerals Separation engineers.

First Tests at Anaconda

In the case of Anaconda, I think that if Mr. Matthewson is present he will corroborate what I say when I state that I bothered him for a couple of years about flotation before the Anaconda company took it up, and finally they thought that perhaps we might be able to treat their slime, at least do some good on this product. They sent us samples, and we got

results in our laboratory that interested them. Following that work we installed a special testing machine in their mill as Anaconda, and the results there again were better than we are able to get in our laboratory. That work was carried on in co-operation with the Anaconda Testing Station, and members of the Minerals Separation staff.

Now, these are a few of the outstanding things that I think we have helped to accomplish for the mining industry. Take the case of the differential flotation: That is very actively being pursued now at a good many mines, and I think the initiation of the differential has been wholly with the Minerals Separation staff.

There is one mine I have in mind where they have a testing plant—a plant of 800 tons a day capacity, and it is working on a large orebody—and differential flotation has added between five and ten dollars per ton net to the value of that ore. That, I think, is a worthy accomplishment. The work was done largely by the staff on the mine. I have no desire to detract from the credit that belongs to the men who worked on it, but the initiation was with Minerals Separation.

Those are the larger things that we have been engaged in. There have been, of course, on the other hand, ores that we have not been able to do so well on as some others have.

The Clause Relating to Inventions of Licensees

Criticism has been made of one of the clauses of our license, namely, that relating to having inventions owned by our licensees being passed onto Minerals Separation. A prominent mine operator of Colorado told me some years ago he considered that clause the most valuable one in the license for the licensee, for it gives him without further royalty charge, inventions and improvements made here and there, and every place all over the world, by those who had licenses from Minerals Separation, and they obtained free use of those improvements without further royalty charge.

Some rather extraneous discussion followed, after which Mr. Montague asked the following:

Suppose that Mr. Rohn, using the oil process stops in 1923, paying his royalty, and suppose that Minerals Separation comes back at him and says: "You have now another patent," will Mr. Rohn be free to stop paying the royalty and litigate that patent, or is he going to be caught on this other provision of the contract which says: "The licensee shall not directly or indirectly during the continuance of this license, or any time after the continuation of thereunder, dispute or reject the validity of the invention specified"? If after Mr. Cook's statement made this morning, it leaves Mr. Rohn free after 1923 to go to court and let it decide whether he is actually infringing another patent, then there will be freedom indeed, and everything I have said about the magnificence of the offer will be entirely correct. But there was something that Mr. Nutter said which leads me to believe even after 1923 Minerals Separation will catch him on this, and when he tries to raise the question in court they will tell you:

"You cannot raise it, and as to any one of those other sixty-five patents you cannot ever litigate." Can that be answered now?

MR. COOK: I do not think the question can be answered now. I think that will be a question very properly to be submitted and discussed in New York—questions like that and others that may arise.

I do want to call Mr. Rohn's attention, however, to the fact that he has received the advice of the counsel of the Mining Congress, and if for any reason or other that claim is made, he should not pay royalties, that the claim would be an improper and illegal claim. Now, whether that is correct or not, or whether or not it is said on the spur of the moment, there is no need of referring to it now, and perhaps I should not have made any reference to it.

CHAIRMAN COLLINS: The Chair is, anyway.

MR. COOK (continuing): If the Mining Congress wants to meet with us and to have answered the doubts that linger in their minds, if my suggestion of the appointment of a committee is adopted—and I made it not in the interest of Minerals Separation, but in the interest of the entire situation—well and good.

MR. MONTAGUE: My advice to Mr. Rohn is based, of course, on the assumption that when he says we shall have freedom after 1923, it means Mr. Rohn shall have freedom from this clause; and when that statement was made here this morning so frankly that after 1923 they were free, I supposed they were granting freedom from this. If that is not the case, it is evidently a question which can be considered, and everything I said as to freedom absolutely falls to the ground, unless the breadth of the statement made by Mr. Cook covers this clause as well as the other. So don't let anybody be under any misapprehension as to what I said this morning as to your freedom unless Mr. Cook will absolutely say that after 1923 you can litigate any of those other patents.

MR. ROHN: Without taking too much time, may I make a further suggestion, Mr. Chairman?

CHAIRMAN COLLINS: Let us be brief, Mr. Rohn.

MR. ROHN: It seems to me that we are moving absolutely in the right direction. It must be clear to everybody that Minerals Separation—and I certainly do not begrudge Minerals Separation wanting to get out of this thing everything it can—here is a large number of users of its process that want to get out of it everything they can, and the matter is one for negotiation. We cannot negotiate successfully individually and hope to get much, but it seems to me we can negotiate collectively. It should be fair to have a board representing the users of flotation sit down with Minerals Separation and thresh out the 101 questions that will arise.

Minerals Separation has 68 Flotation Patents

They have 68 patents pending. What they cover nobody knows. Some of them are litigated; some are not. To clear up the whole situation it

seems to me that if a board representing the American Mining Congress sat down with Minerals Separation that would be the most direct way of bringing it to a head.

CHAIRMAN COLLINS: We have with us Mr. T. A. Rickard of San Francisco. Mr. Rickard fortunately was not here yesterday afternoon when the discussion took place. I know that he has ideas on this subject that are very germane to the matters that lie nearest our hearts at this time, and I will ask him to address the conference.

MR. RICKARD: Mr. Chairman, I am not altogether certain that I am sorry I missed the discussion yesterday afternoon. Yesterday I waived the privilege of addressing this Conference, because I have the pleasure elsewhere of attacking Minerals Separation, and I have availed myself of it to the full. Therefore, I am not anxious to continue it on this occasion. Moreover, as I said yesterday, it seems to me that that the gentlemen on the other side—and they belong to the opposition so far as I am concerned—that they were courteous in coming here, and it seems to me that if I were in their place, I should hate to sit here and be attacked by man after man without having a chance to get back. And, moreover, I think these gentlemen were not given copies of these indictments, and it must have been difficult for them to reply extemporaneously.

Animosities Towards Minerals Separation

Now, I venture to say to you that we can consider nothing with a committee or without a committee, unless we face this matter without animosity. Mr. Rohn said he had no animosity towards Minerals Separation. I think most of us have some animosity towards Minerals Separation, and we will get no good by disclaiming it. Personally, I am strongly prejudiced against them, but it does not make me none the less fair.

Mr. Montague has described a statement given by Mr. Cook as "magnificent." I see nothing magnificent in it; I think it is a huge exaggeration to call it magnificent. Gentlemen, you were in the soup before, and you are now in the mulligatawny, which is the hottest kind of soup.

I am not a lawyer, but I have followed this litigation with keen interest. I know very well that with the patent experts the matter of expiration is of small matter, because they have other patents—68—and many of them are of the most exclusive character. There is going to be an enormous amount of work for the lawyer, and the more work there is for the lawyer the less work there is for the miners. In order to clear the ground, I venture to say one thing: Mr. Nutter, in days of old when I was in Colorado, we were good friends. I venture to say to you that what he said today also included some statements that were intellectually dishonest.

Nine Years to Show that Chalcocite Could be Floated

We are all given to insist that our actions are above suspicion. I am intellectually dishonest continually, although I am not aware of it. I know Mr. Nutter was the first man personally to show that a chalcocite ore could be treated at a profit, but he did not draw your attention to the

fact that the patent was granted in the United States in 1906 although it was not used until 1915—nine years. And why did it take nine years before this process was used? Because the metallurgists of Minerals Separation said it was not suitable for ores of that character. Therefore, I am generous enough to deny the credit that he has asked this morning.

We must clear the ground before we can go anywhere. I fear we are going to have interminable litigation. It is costing a half million per annum for the two suits, and it has been costing that many years. It has been costing the mining industry a great deal, not only in royalties—I think the royalty feature is a small one compared to the tyranny and imposition or position in which the mining industry has been placed, and, moreover, the choking of investigation.

That laboratory in San Francisco, gentlemen, I don't take much stock in it, I am sorry to say. It is well meant, undoubtedly, but the gentlemen who own that laboratory have done a great deal to check research. It is to their interest to prevent other people from finding out things.

Now, I have this suggestion to make: The litigation is going to be, as far as I can see, unending, and during all that time we miners are going to feel it. I imagine, judging other people by myself, that Minerals Separation must have had nearly their fill of litigation. I feel that the infringers have had as much as they want, although they are thoroughly prepared to go on. In fact, the position is now where the stake is so great that neither side can quit. They are like dogs that have a grip—they cannot let go. Now, I hesitate for a the moment, because I want to speak carefully. It seems to me that the time has come when those of us who are dissatisfied should be able to suggest some sort of settlement, and I venture, individually, without any responsibility from others—I am

Suggestion to buy M. S. Patents

simply a looker-on and interested—but it seems to me it would be possible for a committee to act fairly and intelligently to promote a settlement somewhat of this sort, and I make it now because a concrete suggestion is a good point of departure from anything of this sort. It seems to me that all of the American rights of Minerals Separation should be purchased, that the sum of money involved, so many millions—we will call it a million, if you like, for a unit—of course, it will be several times more. Then, of that million, a large part will be collectible at a fair royalty from those who have in the past applied the process to an advantage; that is to say, the principal infringers who are in litigation, and who will get out of litigation if this is carried through, they will then pay a part of that million or that sum, whatever it is, and on that, interest will be paid, and the amount will be amortized or redeemed out of the royalties hereafter collectible. Then when that sum has been redeemed, that then the patent shall be free for all users in the United States and North America, and in order to raise this settlement from the merely financial and pettifogging side, I venture to suggest that out of the royalty these should be at least one cent or more set aside for a research fund for the further development of metallurgy.

MR. PAYNE (Empire, Colorado): Mr. Chairman, as I understand it, the patent in 1923 pertains to the oil process. Does that mean the flotation process as applied with oil, or the flotation process itself? If it is the flotation process itself, can we use it without further royalty? That, I think, is the question we would like to know.

CHAIRMAN COLLINS: I think the Chair can answer that. Mr. Nutter will please correct me if I am in error, because it is a legal question, but we want to avoid legal questions for the present.

MR. COOK: I do not want to have any misunderstanding about it. I am not going further to take up the time of the conference, and I am not going to answer any more questions or ask them hereafter. I think, Mr. Rohn, acting upon what I hoped was a helpful suggestion, to the effect that somebody confer with us, amply meets the situation. I do not see how anything is gained by answer to any particular question, because if that question is answered, either favorably or unfavorably, doubts will exist as to a great many others. Doubts exist in my own mind; there is no question about that. The best way to solve them, I think, is along the lines that Mr. Rohn has stated, and I think they are acceptable to Mr. Montague and Mr. Nye. They are acceptable to me.

CHAIRMAN COLLINS: The Chair will then state, subject to the approval of this Conference—the Chair will report the result of the discussion that has taken place today to the president and the directors of the American Mining Congress.

MR. COOK: Before you adjourn the meeting may I express my thanks to the Congress for their indulgence and for the kindness and courtesy which the Congress has extended to me and to my associates. (Applause.)

CHAIRMAN COLLINS: This portion of the subject which deals with the discussion is now closed. The matter will be in the hands of the president and the board of directors of the American Mining Congress, and not in the hands of this Conference. The Conference is not over, although this particular subject is over. We have before us a program that may call the practical and technical side of this discussion, which has been lengthy, and which has been shelved in favor of what is a more urgent question.

Two Interesting Papers on Flotation

We have with us today Mr. Philip Argall. Mr. Argall is well known to all of you, I hope, as one of the veteran metallurgists of this State. He has studied flotation and taken a considerable part in a quiet way in the development of cyanidation. Mr. Argall has consented to say a few words on the modern and recent development in flotation.

MR. ARGALL: Mr. Chairman and gentlemen of the Congress: This has been a holiday for me. I have had a regular business and have spent most of the year in the lower altitudes, and I have been somewhat out

of touch with the more recent developments. What I have to say has been prepared in a hurry.

[Mr. Argall's paper will be found on page 607 of the Proceedings.]

CHAIRMAN COLLINS: The next paper is by Dr. Francis A Thomson, Dean of the School of Mines, University of Idaho. He has been kind enough to prepare a paper, but I have forgotten the exact title. However, the subject of Dr. Thomson's address is in brief, the indirect effect of flotation on metallurgy.

[Dr. Thomson's address will be found on page 610 of the Proceedings.]

CHAIRMAN COLLINS: Is there any one present who has any questions to ask or any remarks to make on these papers.

MR. STANDER (Kentucky): Mr. Chairman, I have been associated with the flotation process for about five years, and during the last week I have been told by a few of the prominent mining men that in oil flotation, that is, when oil is used, we are coming to the point where one oil can be used for almost all types of ores, or whether, as the practice in the past, you have to develop an oil for more or less every type of ore?

MR. THOMSON: That is a rather large question. If I may interpret it, however, I would like to emphasize further what I have already said, namely, that each ore is a problem unto itself, and that as far as our present knowledge of the art goes, there is no prospect whatever of our finding any one oil, any one reagent, which will fit all ores, nor do I think that is ever likely to become the case. I would say further that in the matter of differential or selective flotation—whatever you prefer to call

Selective Flotation

it—the problem becomes not one of causing the sulphide to flow, but of preventing various sulphides from flowing. For instance; in the zinc sulphides, or one of the iron sulphides, if you wish to separate zinc and lead, and both from iron, the problem really is to flow the lead while leaving the zinc and iron, allowing them to stay down or drop them, after which the next problem, which we do not do with entire success, is the raising of the zinc. We find that the more valuable minerals flow with almost an infinitesimal quantity of oils. That statement requires elaboration, of course. There are doubtless others here who can answer it much more fully than I can.

CHAIRMAN COLLINS: Are there any other speakers? I would like to say that my views of the development of flotation are entirely along the lines that Dr. Thomson has outlined. There is one little difficulty, that of handling some sticky flotation products with the shovel, but that is usually solved by the use of dusting the shovel.

MR. ARGALL: The paper read by Dr. Thomson is elaborate and covers the field; nevertheless, I think he failed to mention some things.

Some seven years ago I was producing a great deal of zinc concentrates by film flotation, using considerably over 1% of oil, and the concentrate itself contained 3 to 4% of oil. The first complaints we had were from the zinc works and the sulphuric-acid plant. They would not buy the ore because of the discoloration of the acid from the carbon formed during roasting. We made a contract with another party for a year's output from the mill. The first lot put through, to get early results on it, resulted in an explosion in the furnace, blowing out the end of one; and before we got over that excitement another blew up entirely, the roof was blown in. Nowadays, when a great many people are using over 1% of oil, the handling of concentrate is a difficult problem, and it will not be received at all by manufacturers of sulphuric acid, so that the only remedy probably is a light roast to get rid of the oil. And then that carbon might not be eliminated unless you gave a pretty strong roast.

CHAIRMAN COLLINS: Isn't it a fact that such is usually a temporary difficulty? In other words, don't we often obtain the ultimate result by the use of that quantity of oil?

MR. ARGALL: The particular process I was using then was film flotation, and we were using a fuel-oil—crude oil from the wells. We finally got an oil from Kansas—I forget from which field. It gave us the best result in the engines and for flotation, so we only had the one oil, apart from the lubricating oil, but we used it freely. In other cases where they use over 1%, the flotation concentrate is difficult to handle in sulphuric-acid plants, but I hope the day will soon come when oil will be abolished.

CHAIRMAN COLLINS: We will now have a paper by Mr. Geary.

The Brown Flotation Machine

Mr. Geary then described the Brown flotation machine, bearing patent No. 1351155, issued on August 31, 1920. Briefly, the machine consists of a rectangular air-lift compartment between a feed-chamber and a spitzkasten, all three in communication with one another. Contrary to usual practice, tailing is discharged at the top of the cell rather than at the bottom. The machine takes advantage of the principle of surface tension in that the sulphides, after oiling, are quickly deposited in a thin sheet-like form on the surface of the froth, with a minimum chance of being wetted by the solution. They also travel with the current at all times. In addition, the agitation is gentle, and full advantage is therefore taken of the selective properties of the flotation oil. Machines are treating lead-silver, molybdenum, and graphite ores successfully.

CHAIRMAN COLLINS: This conference is now adjourned.

EDUCATION AND PUBLIC SERVICE CONFERENCE

American Mining Congress

THURSDAY, NOVEMBER 18, 1920, 10 A. M.

Mr. F. A. Thomson, Dean of the School of Mines, University of Idaho, at Moscow, Idaho, presided.

THE CHAIRMAN: It becomes my duty to call this meeting to order, and ask you to elect a chairman and secretary for this meeting. That will be the first business of the meeting, and when that has been disposed of we can take up the program.

Thereupon it was duly moved, seconded and carried that Mr. F. A. Thomson be elected chairman of the meeting.

THE CHAIRMAN: I think the next business is whether we desire to proceed with a permanent organization of the American Mining Congress. The main subjects to which this organization will be devoted are the study of the State Bureaus, State Geological Surveys, State Mining Inspectors, Commissions, and Commissioners of Mines, and so on, all of whose duties are similar—but nearly all of which have different names—to the Public Mining Service. The question then arises whether it is the wish of this meeting that we proceed with the permanent organization of a section known as the Public Mining Service of the American Mining Congress. If that is so, I presume a motion to that effect is necessary.

MR. LUNT: I believe that there is room for such a section of the Mining Congress, and I, therefore, move that the section as outlined by the Chairman be formulated and instituted.

The motion was thereupon duly seconded and carried.

THE CHAIRMAN: I presume the next order will be selection for a permanent organization, which will be composed of a chairman, vice-chairman, secretary, and two members of the executive board. I understand that this is the typical organization of the American Mining Congress, and we might take care of that from the floor, but it occurs to me that it is a little simpler to appoint a nominating committee, and have that committee report after luncheon this afternoon. If that coincides with the will of members I will be glad to entertain a motion authorizing me to appoint that committee.

Thereupon it was duly moved, seconded, and carried that the chairman appoint such a committee.

THE CHAIRMAN: I think that for the time being, unless there is some other business to be disposed of, we are ready to go ahead with the program which Mr. Lincoln was largely instrumental in arranging for

us. It was the thought of the organization committee that part of the first meeting might be devoted to certain subjects in the curriculum of mining schools. We thought that as a means of having this discussion we would ask representative men to present briefly their views on certain phases of the curriculum such as English, mathematics, chemistry, and metallurgy, and then have a brief discussion following each paper. The first paper on the program is a discussion of 'The Correct Use of English' by H. H. Stoek, Professor of Mining Engineering, University of Illinois. Professor Stoek was unable to be here, but sent his paper to be read, and I have asked Mr. Arthur J. Hoskin to read it.

[Thereupon Professor Stoek's paper was read by Mr. Hoskin, and appears on page 449 of the Proceedings.]

THE CHAIRMAN: It always seemed to me that the proper and correct use of English is as indispensable a tool to the engineer as the slide-rule or transit or knowledge of assaying. It is absolutely essential for

Correct English an Essential

the equipment of any intelligent man. There is only one suggestion I might make in addition to what Professor Stoek has so well said, and that is, I wish that every engineering student might have occasion some time during his career to edit copy and read proof. I do not know of any training in the use of English that is comparable to editing copy and reading proof.

I am sure many of you will have some suggestions on Professor Stoek's paper.

MR. H. F. LUNT: While not actively engaged in instructional work at all, a thought that comes to me in connection with Professor Stoek's excellent paper which might well be emphasized, that is, as has been stated, the correct use of English is part of the equipment of every intelligent man. Many young men take the engineering course and do not follow engineering. Possibly their technical training may be of little use to them in the business that they eventually follow, but if they are well trained in English, such will be of great assistance to them in whatever line of work they may take up. There is no profession in which it is not of advantage to a man to be able to express himself clearly and concisely. If one comes in contact with big men, I think that they are impressed with a man who can express himself well; he always has the advantage.

MR. JOHN D. CLARK of New Mexico: The Engineering Faculty at the State University of New Mexico, with which I am connected, has definitely taken up this matter, and intends to do its best to correct conditions as they now are, and we are taking it up rather forcibly. We have put into the senior engineering curriculum a three-hour course and one semester course. Students have to take it, have to pass it and get their degrees; and they recognize that there is yet waiting for them a course in English in their senior year. For example: those students who

have been through our department will have time for one hour in that English course, possibly two hours, and I will cover with them in the presence of the professor of English—that is, the instructor in English—

Regulations at University of New Mexico

such portions of their chemistry in which they have shown a deficiency in handling the language. Specifically, I find that while students will say, "Oh, very well, we understand the theory of English," they have the greatest difficulty in saying things clearly, and before they graduate they must show the English Department that they are proficient in this matter.

DR. FULTON: It might be of interest to the gentlemen assembled here to know that about two years ago, at the Case School of Applied Science the curriculum of Applied English was taken up with the Cleveland Engineering Society, a large and strong institution, which has headquarters in a great industrial city. An arrangement was made for a conference between the Faculty of the Case School and a Committee of the Engineering Society. They formally discussed what might be added or subtracted from the curriculum of the Institution so as to make it of the most value to engineers going out into the field—that is, to students graduating from the engineering schools—and the meeting finally resolved itself into a discussion on the subject of English. The engineers felt that technical subjects were fully taken care of, but there was one subject in which the Institution seemed to be weak, and that was English. Actually, the Institution was not weak in English, as it had two or three hours more English in its curriculum than most technical schools. The interesting fact is that many of the engineers were graduates of the Case School, and of course many others from institutions from surrounding States, and they thought strongly that the training of engineering students was vitally deficient in English. Just how that deficiency is to be remedied is quite another question. As had been stated, students rebel at English, believing that as they have had it in high schools, and as they have a knowledge of how to speak their native tongue, they view it as an obstacle placed in the way of accomplishing their object; but the Faculty at the Institution took up the matter, and is endeavoring to remedy it. Yet, the feeling outside, among engineers themselves, is very strong on that point.

DR. DAVID WHITE, Chief Geologist U. S. Geological Survey: I am very glad that the Association is discussing this question. The importance of good English in technical training has been much under-estimated in many of our schools.

Experience of the Geological Survey

The engineer who goes into private work, or consulting, or is attached to some corporation, is not called upon for productions of high order in English composition. I think that the requirements on the educational provisions are much more stringent, and we, in the Geological

Survey, have all experienced and come to appreciate it as of high importance. We must confess, however, that on our staff the reports of several able men who are geologists, are likely to take a considerable time over someone else before they are put into print. This uses the valuable time of another geologist or engineer, and lastly often delays the publication.

We have gone so far in recent years in Civil Service examinations to call for an essay, and on that, which covers a scientific topic, of course, depends in part the rating of a man's English. Practically before any appointment is made to Geological Survey staff the essay is carefully read—not only as to the ability as a geologist, but his ability to write clearly, and in good English.

MR. D. A. LYON of Washington: I am not a teacher now, but as a result of my experience since having been in the business, I find that one of the greatest drawbacks that we have to contend with is the lack of English, and that engineers are not able to express themselves clearly. This being the case, I feel that English should be taught first, last and all the time. I think that every course which is taught in a university should embrace a training in English; it does not make any difference whether mathematics, physics, or what not. I think that if this is done a lot of men who are not able to express themselves at the present time would be helped, and that as Dr. White says, the Government Bureaus have capable men who are not able to get ahead and be advanced, because of this lack in writing or expressing themselves as they should.

MR. C. H. CLAPP of Montana: I think that Mr. Lyon hit the nail on the head; it should be a matter for the whole school to consider. We want to put the fundamental of English into our engineering courses. We, as engineers, should take a vital interest in it as taught to our students, and say that the English Department is going to co-operate with us rather than to let them turn our students over to an English Department to attempt to instill into them an appreciation of the cultural phases of English. As a matter of fact, many of our students 'buck' against that type of instruction, necessary as the cultural phase of English is to the engineer, who will get that as he more appreciates the elements of the subject.

THE CHAIRMAN: I remember years ago publishing a resume of the percentage of time devoted to different subjects in the various mining schools. I asked one of our men a little while ago to bring that down to date by a study of the college catalogs. All of you know what a mystery the average college catalog is, therefore how difficult it is to extract accurate information from the catalogs of other colleges. The work is brought down to date pretty closely, and I think you might be

Time Devoted to English in Certain Colleges

interested in the percentages of some of the schools giving the mining courses. There are probably some errors in this table, but not many.

Tabulated Percentage Distribution of Various Studies in Curricula of 22 Schools Offering Undergraduate Mining Degree.

School.	Course.	Mining.	Metallurgy and ore dressing.	Geology.	Chemistry.	Physics.	Mathematics.	Mechanics.	Surveying.	Drawing.	Mechanical and Electrical.	English and Liberal arts.	Foreign languages.	Economics.	Thesis.	Electives.
California (University of).....	Mining.....	11.0	7.5	15.1	8.9	8.2	8.3	6.2	8.2	4.8	8.2	...	...	2.7	2.7	8.2
Case (School Applied Science).....	Mining.....	12.2	9.8	8.9	11.3	7.3	9.3	4.3	6.9	6.3	8.1	5.8	5.9	2.4	1.5	...
Colorado (School of Mines).....	Mining.....	8.7	9.2	8.2	11.3	8.8	8.2	1.5	6.2	5.1	2.0	2.0	...	2.6	...	26.2
Colorado (School of Mines).....	Coal mining.....	10.8	6.2	7.2	11.8	8.7	8.2	1.5	6.2	5.1	2.0	4.1	...	...	...	28.2
Idaho (University of).....	Mining.....	7.3	11.0	11.7	13.9	5.9	13.2	7.3	7.3	4.9	2.2	4.4	...	2.2	1.5	7.3
Illinois (University of).....	Mining.....	7.4	11.8	6.6	9.6	6.6	13.2	9.5	4.4	5.9	5.9	4.4	5.9	2.2	...	6.6
Illinois (University of).....	Coal mining.....	9.0	10.9	11.4	9.5	7.1	14.2	9.9	4.3	5.2	7.1	7.6	...	5.9	2.2	6.6
*Iowa (State College).....	Mining.....	10.3	9.7	12.4	10.4	6.9	10.3	6.9	4.8	5.5	2.8	6.9	6.9	4.8	1.4	...
Kansas (University of).....	Mining.....	8.2	9.3	17.0	9.4	7.0	8.8	5.3	5.8	2.9	10.5	5.3	3.5	7.0	...	29.4
Lehigh (University).....	Mining.....	5.4	2.8	7.4	8.1	4.5	12.6	4.4	11.3	3.9	8.1	2.1	...	...	...	3.9
Michigan (College of Mines).....	Mining.....	16.4	17.9	12.5	9.2	3.9	9.6	10.1	4.4	6.3	5.8	...	...	1.3	3.6	...
Minnesota (4-year course).....	Mining.....	16.5	16.5	11.6	9.4	3.6	12.0	8.5	4.0	5.8	7.2	...	...	1.1	...	25.2
Missouri (School of Mines).....	Mining.....	5.3	6.7	10.9	13.7	6.2	8.4	5.1	7.9	3.9	...	5.6	...	0.6	...	9.0
*Montana (School of Mines).....	Mining.....	10.1	14.4	17.6	12.5	4.8	12.3	5.9	8.7	6.2	4.8	2.1	...	2.1	...	9.0
*Nevada (University of).....	Mining.....	6.2	13.9	13.2	9.7	9.7	11.1	5.6	5.6	3.5	6.2	4.2	...	...	2.0	...
*Ohio (University of).....	Mining.....	12.0	17.3	9.4	7.3	4.0	13.3	5.3	2.7	7.3	10.0	4.0	5.4	...	...	0.5
*Oregon (Agricultural College).....	Mining.....	6.5	19.4	13.4	12.9	4.8	12.9	4.8	5.9	3.2	5.9	4.9	...	4.8	...	0.5
Penn State.....	Mining.....	12.4	8.7	9.3	7.2	3.6	10.8	8.4	6.0	3.6	7.2	8.4	5.4	7.2	1.8	...
South Dakota (School of Mines).....	Mining.....	10.4	12.1	17.4	13.8	5.7	9.9	4.7	5.2	4.2	7.4	4.0	...	3.0	2.2	...
*Texas (University of).....	Mining.....	8.6	18.6	15.7	11.4	5.0	6.4	5.0	5.0	2.9	5.7	5.0	4.3	6.4	...	...
*Utah (University of).....	Mining.....	7.5	10.3	11.7	11.7	7.0	14.0	8.0	6.5	5.6	11.7	2.3	...	3.7	...	6.3
Washington (State College).....	Mining.....	11.8	12.5	12.5	8.6	6.3	9.4	6.3	6.3	3.1	3.1	6.7	...	2.7	2.7	3.3
Washington (University of).....	Mining.....	7.6	14.7	14.7	12.0	8.1	8.1	3.3	3.3	4.9	13.0	1.6	...	1.6	2.7	5.4
Washington (University of).....	Coal mining.....	12.5	11.4	8.7	10.3	8.1	8.1	3.3	3.3	4.9	18.0	1.6	...	1.6	2.7	5.4
Yale (Sheffield Science School).....	Mining.....	4.8	10.4	11.3	9.0	7.6	11.2	8.2	6.8	6.2	7.6	10.1	...	6.8	...	...

*No metallurgical option offered.

You will notice the variations, and also for a number of institutions the marked standing of the record of no English whatever in the mining engineering course.

A DELEGATE: Have you an average on that?

THE CHAIRMAN: No, but I think it is small, between four and five.

MR. R. D. HALL of New York: The matter is one that has been brought to me very forcibly a number of times. I have met technical men who, unfortunately, have heard rumors that engineers could not spell nor write, and there is a general disposition to remain satisfied, to feel that they could not be expected, and that a man was not to be judged wanting in any way if he did not have the power of technical expression. This affects us seriously in the matter of publishing journals, and the National Conference of Business Paper Editors has recently taken up the matter of improving the general English in technical trade papers. It is interesting to know that there are journals—I do not know how many of them—where the technical editors are not supposed to include English in the articles submitted to them; they are simply to judge them from a technical point of view; and it is necessary to employ a man whose judgment is on the grammar rather than on the technical side, to endeavor in the short time allotted him to improve the English and make it more direct and forcible. It is necessary that the engineer should have the ability and power to express technical ideas in forcible and simple English.

Valuable Book on Good Style

The members of the Geological Survey who have spoken here have been able to tell the facts as they really are, and it remains for me as an outsider to say that the best book on English I have seen is that prepared for instruction of the staff of the Geological Survey. It was written by Mr. H. McL. Wood. I think that if they who are teaching technical English could use this book they would be able to assist students in writing excellent technical English. I believe that English is a very important matter, and it is most unfortunate that a number of technical men think it is unnecessary that they should be able to express themselves in the fullest possible language. Only those who can express themselves plainly are able to put over ideas that have been fruitful in their own brains.

DR. WHITE of Washington: I would like to add a word to the remarks of Mr. Hall. The suggestions by Mr. Wood for authors of geological papers and technical papers were not written for general consumption, but were conceived, I must confess, as I understood, in getting the composition of reports creditably written in our own organization. It was found that geological students coming from universities were, in general, so poorly trained in English, and in the course of their professional work so much work devolved upon the editor, that Mr. Wood felt it would be helpful to prepare this book to be circulated in our own

organization in the hope it would inspire someone to do better. It has had good results, and it is a tribute to Mr. Wood's own mastery of English as well as a devotion to good writing in general that the publication has been in considerable demand outside. I am not sure that it is in stock sufficient to withstand a general demand on the part of technical engineering schools, but I believe there are some on hand, and as far as the issue is available it is at the service of editors who desire copies. We are now preparing a small book of simple instructions, explanations,

Another Book Being Prepared

and suggestions for the guidance of geologists primarily, but it will be useful for all technical men in engineering work, in the preparation of their illustrations, in forming a scale of any design for reproduction and so on, suitable and practicable for purposes for which they are to be used.

MR. HENRY LANDES: In the college faculties I have found that the teaching of English is the most thankless subject ever given to the human being. Every editor of English eventually gets 'nutty,' and in our State [Washington] he either goes to the insane asylum or resigns. So disagreeable is this task in the English Department that every new man entering is hazed for the first year in that he is required to give from one-half to two-thirds of the time to the work in composition, and the English Department now threatens open rebellion, insisting that all of this work should go back to the high school where they say it properly belongs. Not only is that true, but from a student's standpoint if he is ever tempted to evade a task it is to avoid themes in English. We attempted to remedy that by paying good prices for a good theme. But there are serious disadvantages; nobody likes to write, and just as quickly as students get out they slump back again, further than where they were at the beginning.

I think that the Geological Survey has done a wonderful service in the preparation of the book which Dr. White refers to. We found out that there was such a work, and when we have a man on our Survey, the first thing he has to do is to get a copy. Every time he prepares an article he must use it. Before this rule was made there would be sentences without subjects, some without a predicate, some a mere jumble of words. I hope that the U. S. Geological Survey will get out a revised edition of Mr. Wood's book—if such is necessary—that they will list it permanently as one of their publications. This would make it valuable not only for those who are connected with mining schools and geological surveys and who are writing along those lines, but for the use of everybody who has to write English.

Recently, Mr. T. A. Rickard of the *Mining and Scientific Press*, published a little book on technical writing, and I am so imbued with its importance that I require every senior to purchase a copy.

THE CHAIRMAN: That is a good suggestion. I think that Mr. Rickard stands out among our technical journalists as the man who

has rendered to the mining and geological professions the greatest service which has been rendered in this generation in the matter of calling attention to and insisting upon a correct and precise use of English.

I think this discussion could continue indefinitely, but I fear we must pass on to other parts of the program.

MR. C. E. NEWTON of Oregon: There has been a great deal stated this morning with regard to English, and the methods of teaching it in the colleges. There is an old saying, "You cannot teach an old dog new tricks." Now, these people who come to us in college have been speaking so-called English for a number of years. It has been my experience that it is a pretty difficult matter to do much for some of these people. The place where this must begin is in the grades and in the high school. It is my information, and I think I will be fairly well backed up, that our high schools are running down the hill. They are not living up to what they did 15 or 20 years ago, and it seems to me that the thing for the people of the colleges to do is to try to have a clearer and better co-operation with the high schools.

THE CHAIRMAN: I wish we had a high school teacher here to reply to that.

Shall we continue this discussion in English, or had we better pass on?

MR. L. S. GRANT of Colorado: I would like to say a word in regard to the percentages in the table submitted: In the Colorado School of Mines at Golden, English is being taught. That has not been done in the past. In addition to this, no member of the Faculty is required to accept a 'quiz' or examination paper unless the same is well written. It cannot be slovenly written, nor accepted if it is not readily understood, and the style approved by the school must be maintained. This applies

Written Papers Studied for Style

throughout all courses in the school. Consequently, English is being studied not only in the English Department, but every one in the Faculty who receives any written work is required to see that the work is kept up to style. All monthly quiz papers pass through the hands of Dr. Alderson. He has not time to read them all, but he has time to look over their style and writing. This is merely a device to check the English throughout the school, which we all agreed has been sadly neglected. This probably is being done in other schools, so that the percentage of actual hours reported as given to any one subject might not be a fair representation of the amount of English given in that school.

Professor Thomson also mentioned another thing, which devolves largely upon members of the Faculties of various institutions; that is the enigma of the college catalog. It seems that there is room for simplifying such publications.

THE CHAIRMAN: If there are no more remarks on this vital subject we will proceed to the discussion of mathematics. No meeting on a

section devoted to mining education would be complete without representation from the better engineering schools. It is unfortunate that Professor Robert Peele, Professor of Mining, School of Mines, Columbia University, will not be able to be present, but he has sent a paper entitled, 'The Place of Mathematics in the Training of the Mining Engineer,' which will be read by Mr. Illinski of New Mexico.

[Mr. Illinski then read the paper of Professor Peele, which will be found on page 453 of the Proceedings.]

THE CHAIRMAN: This paper is before you for discussion, gentlemen,
Mathematics for Engineers

MR. LYON: While I think we all appreciate what the paper says, it did not tell how to teach mathematics. It strikes me that the point is not how to teach mathematics, but how to get the student to care for mathematics. I hope somebody here will explain Professor Landes' method of teaching mathematics.

MR. LANDES: I would like to leave it to Dean Newton, he was on our Faculty there.

MR. NEWTON: I was connected with the University of Washington in the Department of Engineering, and it became a sore point as to how we were to get these young pupils along. One of our greatest troubles was, as we found it, in the use of trigonometry. So, to make a long story short—and it was a long story for several years—we tried for various reasons to have the Department of Mathematics come down to the School of Engineering, or vice versa, to find out what the latter school wanted. So we had little or no co-operation, or little or no success. When Mr. Moore stated that there were about five sections beginning in the freshman class, he asked, "Will you allow me to experiment on one section of this freshman class as regard to the application of mathematics?" The Faculty granted the request. The section was chosen at random. Mr. Moore did not see the section assigned to him, but simply took that which was drawn. At the end of the year, or nine months, these freshmen so-called, were given precisely the same examination in mechanics as was handed to the juniors, and the former, yet without college trigonometry, geometry, and calculus, easily beat the juniors in time and in accuracy.

THE CHAIRMAN: I will have to interrupt a second and ask to be excused, and will ask Professor Morrill to take the chair.

MR. NEWTON, continuing: The work was carried on in this way: All mathematics were put on a laboratory basis, three afternoons a week, with no study at home. The problems were put on the blackboard, and the students were placed at each end of the table, and were graded upon their method of approaching the problem, upon their accuracy, and upon their intelligence and consistency of the paper. This clearly demonstrates to me in a way that a large part of the mathematics already in college is all right for mathematicians, but if you will excuse the

slang, "Damn poor work for engineers." (Applause.) I wish that Mr. Moore were here. His successful methods were used in the Army, and it was he who was instrumental in placing the methods at Camp Humphreys.

THE CHAIRMAN: I notice that this matter of teaching in colleges has been a problem at the University of Texas.

We have classes of two kinds, one in which the engineer takes up specific work, and the average course in which you find a great deal that is absolutely foreign to the work any student is trying to do. If an engineer is to use calculus after he leaves college, why not give him calculus in college? I believe that entirely too much mathematics is given to mining engineers in the college courses. I do not mean to say we should not teach calculus to the mining engineer, but as already stated by Mr. Newton, the chances are not one man in ten who takes a mining engineering course will use calculus once in ten years. That does not minimize the value of calculus, and I do not believe in mathematical subjects in our institutions unless taught by engineers as a working tool, and not as a subject to worry a man in his college career.

MR. ILLINSKI of New Mexico: I am not a mathematician, yet the question strikes me as not so much one of method in teaching mathematics, but how much you teach mathematics. I feel that we teach too much mathematics, or have it taught from the wrong viewpoint just as we do English; and we can teach too much English and teach it from the wrong viewpoint. I feel, however, that mathematics is absolutely essential in the engineering courses, and I shall discuss this matter before the meeting. Then the question arises as to what you consider an education.

Many Subjects Desirable, but Time is Limited

We have a general tendency in all the schools—high schools, universities, and mining schools—to place in our curricula many subjects that ten or fifteen years ago were not considered at all. I remember the question of economics was thoroughly discussed last year. There is no question in an engineer's mind that economics would be a grand subject to put in and teach to engineers. The same is true of a good many other subjects—English for instance—and the same is true of trigonometry. The question is, where is the student to secure the number of hours per day or week in order to take care of all of these subjects. You must have, for instance, three afternoons a week for trigonometry.

There is no doubt that the laboratory is best. But when we get up and lecture to the classes, some get it and some do not. I think that the 'quiz' method brings out the best in the student. Columbia University solved its problem by making it a five-year course. Then the question arises, will men go to school for five years to get an engineering education? That is a question I feel I would like to have really answered. That question comes up with us particularly, and includes factors, chiefly the type of high school graduates you get. That is a point I would like to have discussed to a certain extent. Just how are you going to put

them in, and where is the student going to find time to study? I feel that mathematics is essential not only from the fact you use it as a tool, but also for its mental training. That brings you back to the question of what you consider an education. What is an education? I have this feeling, if you give an engineer a good fundamental training in a four-year course, requiring him to live up to the standard, and not have too many subjects, that you really educate him, and from that point he can spread out wherever he wants to.

MR. NEWTON: In regard to teaching mathematics at the University of Washington, remember that the proposition is this: that at the end of the third year, or the junior year, the junior was better qualified to solve problems in mechanics than the freshman was. Therefore, he saved two years.

Mathematics Essential only for the Particular Problems Taught

Just one word about the method that I omitted, the method of teaching these mathematics. We did not teach trigonometry. When a man wished to solve a problem that required trigonometry then we taught him this, the trigonometry that was necessary to solve that problem. He was given such mathematics as were required to solve the problems. We did not teach analytical geometry. It was not given in a three-hour course; I think it extended over a period of three weeks each morning for a total of three hours.

A DELEGATE: I would like to ask Mr. Newton, was mathematics continued in the sophomore year?

MR. NEWTON: No, Professor, I am sorry to say it was not, but for what reason I do not know.

MR. J. H. CLAPP: I think the whole course has been thoroughly threshed. Apparently the difficulties of getting this into the curriculum, is due I think, largely to the attitude of the mathematicians themselves, their self-satisfaction and prejudice as evidenced by their own reports. As you know, they made a report that mathematics should be taught by a professor of mathematics as an independent science, not as a tool of the engineers, and not as a tool by engineers. That is their expression as to why mathematics should be taught in engineering schools. Another great difficulty is that of the unwillingness of engineers to assume the burdens of elementary teaching.

Mr. Newton stated that the trouble with English is the unwillingness of the person to spend the time and the trouble necessary to teach composition. I did it myself for a couple of years. Nevertheless, we realize that this is a serious problem. The freshman and sophomore go to the engineering school, and are discouraged from the fact they are taking subjects not related to engineering. As a result, they become dilatory and wander outside of their work. They lack the vim and enthusiasm necessary for a student to succeed, and I think that the only solution is for those of us who have some direction of the administration of the

curriculum is to see that mathematics is taught by engineers and not by teachers of philosophy in pure mathematics.

DR. FULTON: The question of mathematics is an extremely old one. I have attended many meetings and heard these same questions discussed, and I think that we will continue perennially to discuss the topic.

Some Students Lack Ability in Mathematics

It is undoubtedly true that we look upon the freshman as he enters school as an average man. There is no doubt that the ability to take up mathematics is more or less of a gift, just as natural as it is to take up a language, and there are men in the engineering schools who have no ability along mathematical lines. I will go as far as to say that the matter of teaching those men makes practically no difference whether they are taught by a doctor of philosophy in mathematics, or if they should be taught by an engineer in mathematics, the ultimate results would be practically the same. I think that if we would recognize this fact a little more clearly than we do, we would not criticize teachers of mathematics so improperly. That, I think, lies at the bottom of it.

Secondly, I think, that it is a question of orientation. I heard Professor Mann's report mentioned a little while ago. It is an excellent report, but there are many of us who do not agree with it fundamentally as a matter of education. We can go back to the methods pursued at the University at Cincinnati, Ohio, not applicable to all types of engineering courses, but to mechanical engineers and electrical engineers—that is, making the man familiar with what he really is to study. Such is fundamentally the object of that system of training, which in the last analysis is merely a question of orientation. If you take a high-school student and put him into a class in mathematics at college, he is confronted with problems that he had done in high school before in a sort of a mechanical way, but when he gets into college mathematics he is absolutely unorientated. He does not know what either trigonometry or calculus are for. The fundamental function, I think, of the teacher of mathematics at the very start is to orientate his students, and prove to them that there is some value to his stand in mathematics. If he does that he will have an excellent start, and he will be surprised to see what a number respond. Out of those who are capable of responding, I think there will be perhaps 40% that will be very efficient, while the remainder will go through the course just as they do now, without any efficiency or practical results.

Orientation in Study

That question of orientation, I think, is the real serious one, and all of this matter of teaching the person the so-called practical problems is directly in that line. It is not so much its practical value as it is the orientative value of the practical problems. Personally, I do not believe in going too far on the practical side, because it confines a man's men-

tality too closely; but there is a certain value to it, and I think that in the method itself there is great value.

Dr. Moore's method is undoubtedly excellent, but it devotes a much greater amount of time to it. You work with a student in the laboratory for three hours, and that, of course, is bound to get good results.

A DELEGATE: I do not believe that Dr. Fulton has the right idea of this thing. As I understand you teach mathematics in connection with some other courses you do not consume any more time.

DR. FULTON: I tried to make that clear. The point is this: we do not teach trigonometry as trigonometry, and we do not teach analytical trigonometry, but this one class we had was in such shape at the end of nine months that it did better work in all respects than the classes which had been to the mathematical department for two years, and at the same time had been nine months to the engineering department.

MR. LUNT: There is one point that I think Professor Fulton had in mind, only it occurred to me in a little different form, that is: at the time of the education as to the inability of the student in after life, when he gets up against actual problems, to find out or obtain information that he wants, to teach him where to obtain it. It is impossible in any of the college courses to teach a man everything he is going to know. What he is taught is the methods of obtaining any information he might need, and it seems to me that this Moore method, which has been outlined, brings that out essentially. As I understand it, you put a certain definite, concrete problem up to the student, and from the training he has received he knows how to solve it, although he may never know he is using trigonometry, analytical geometry, or anything else, but knows how to work out the basic principle he needs to solve the problem. Isn't that the case?

DR. FULTON: Yes.

MR. LUNT: It seems to me that is the particular value of this problem. A man can read in geology, or anything else, and can read all the works on geology, and he is familiarized along several lines of what has been written. He knows that the Geological Survey has published a number of reports and by studying them he can get information on any specific fact or circumstance. Isn't this method on mathematics along those lines? It teaches him how to solve problems without burdening his mind with a lot of abstract work, which is, as several speakers have remarked, of no particular use to him.

DR. FULTON: I think I can explain it to you, and I won't talk again. The proposition is this: It was taught in a room of about 24 students. There were three instructors in the room—Mr. Moore and two assist-

How Students are Instructed

ants—who were there to be called upon when the students needed help. When the student required help, they did not help him by doing it for

him, but they would ask him, "What is the trouble? why can't you get any further? why did you do this here? and why did you do that over there?" and "If you did that back there, and if you thought that was right, why can't you go on? If you understand what you did there, think a little bit further and see what will happen." The sum and substance of the whole thing is this: he has the handbook before him that he is going to use when he gets through college: he has the slide-rule before him; he has a chain and square and triangles to work with, and pencils. He has everything to work with, and what are you going to do? You are going to prepare him to work in an office or any other place to solve the engineering problems with which he will be confronted.

MR. EAMES: All of the subjects are valuable if not essential in the work of the engineer; the difficulty is to find a stimulant.

I remember one time giving a kind of an educational course in chemistry and in geology. Now, simply to point out the importance in the matter of mathematics, unless a man has a natural orientation in that way it is useless to spend much time in getting him to work along wants to proceed along that line he is not afraid to take up the project. himself.

When I was a boy, we did not get the education you receive today in America, and most of the subjects that I am now familiar with, I obtained because I knew how to make a start. Therefore, I think it is important to make the man see that he wants to take mathematics; but do not follow it up as if you were going to make a specialist out of him as a mathematician, yet give him the fundamentals, so that if he wants to proceed along the line he is not afraid to take up the project.

The same thing is true in chemistry, the mining engineer is supposed to be a chemist, but he should be able to work out and follow any discussion or explanation on that subject.

Some Professions Overcrowded

I think that the great danger is that you have too many specialists to follow some particular line. That is not for the engineer. He may not be a mathematician, and may not require geology, but he is a great deal like the family physician, he should not only know the subjects pertaining to his profession, but if he feels there is any necessity or feels disposed, he should be able to solve any problem that may be presented to him.

THE CHAIRMAN: Unfortunately I was away during part of this discussion. There is one part in Professor Peele's paper to which I wish to refer. It seems to me he has taken the traditional attitude in regard to mathematics when he says, "It is unnecessary to go further in tracing the intimate dependence of engineering studies upon mathematics. Doubtless some practising mining engineers will feel, even if they do not say, that they have attained success in their professional careers without possessing a working knowledge of any more mathematics than is included in, say, arithmetic, algebra, and plane trigonometry. Others,

who have been engaged more in the business management of mines than on the technical side, may question the necessity of knowing any mathematics beyond arithmetic and elementary algebra. But, even they will acknowledge that engineering problems must be tackled and solved by some one, and the superintendent or manager who has insufficient engineering training, or whose mathematics have grown rusty, is obliged to engage the services of a technically-trained man to help him out; or, if the organization is a large one, the superintendent may have to rely implicitly on his engineering staff for everything connected with the technical operation of the property. Furthermore, men who adopt such a viewpoint are likely to have lost sight of the beneficial training they received from mathematical studies. The quickness of perception and mental acuteness developed by these studies may remain long after the details of rule and formula have been forgotten. It has been well said

Requisites of Engineers

that the engineer should be accurate in his calculations, thorough in his investigations, lucid and concise in his statements, and logical in his deductions. All of these qualities are fostered and developed by the study of mathematics. That view is not generally accepted among persons who have made a basis of studying the processes of education. Our specialists in psychology have rejected *in toto* that theory. Their dictum is that one study is of quite as much mental training value now as any other, provided it is equally well taught and equally well studied; and that no subject has value in the study of any other excepting there be elements in common between the two subjects themselves; so, unless mathematics can stand on that plane it cannot stand, and unless it be on a much firmer basis than that of mental training it is going shortly into the scrap basket. I think that the present traditional college courses in mathematics are somewhere between 25 to 75% unadulterated 'bunk.' I think we need mathematics from the same view that English is taught, namely, that it is the invaluable weapon of the engineer in his work, and that the rest of it which is retained there, because of its fancy traditional mental discipline, must be discarded. (Applause.)

DR. FULTON: I arise to defend Professor Peele; I am an old student of his. He holds the traditional views on mathematics, and I will advise that I also hold these views.

Engineering education, I think, must be looked upon somewhat definitely from education in general. I fully agree with the Chairman when he disclaims the advantage of mathematics in general for, say a woman's college, or a young ladies' seminary, but I will stand by it when it comes from the education of the engineer. Mathematics, of course, is a tool of the engineer. There is no question about that. The mining engineer, with whom we are particularly concerned, uses that tool not as much as other engineers do, but surely a mechanical or an electrical engineer uses it frequently. I know that from having seen them at work, and I know that my work has taken me into electrical engineering to a con-

siderable extent, and that I have had use for mathematics--and real mathematics.

Basic Subjects in Engineering

The fundamental subjects of any engineering course, as they were turned out some time ago, are, I think, mathematics, then physics, and then chemistry. When a student has those three, with a theory or knowledge of the language, and knowing nothing more than when he goes out of college than that he can become an engineer, and that the rest of it he can pick up without the slightest difficulty. Certainly physics and chemistry, especially the modern phases, are based on mathematics; and any student who has not that fundamental knowledge of mathematics is going to be hopelessly lost when it comes to the application of engineering subjects, whether that be power engineering with machines, or mining engineering, or metallurgical engineering. You cannot get half way through a problem and sit down and consider it solved. If you are to get results, you must stick by it. Such is mental training and discipline that I think no other subject is capable of giving. There is not an engineer worth-while without that training. The successful type of engineer that is going to do something in future years must have a rigid training, and be able to see whether he is right or wrong. He has to follow his analysis through to the bitter end, and there isn't anything like mathematics which gives that training. Physics or chemistry without mathematics is not physics or chemistry.

A DELEGATE: I do not feel I can leave this meeting without saying that I feel that mathematics is absolutely essential from a point of view of mental training. It is immaterial in the outcome of the engineer, provided, of course, he becomes successful, and I just want to present this idea. We know it is a fact, and it has been proved to be so, that you can take a child and by giving it a series of exercises you can develop, if you know how, every individual muscle of its body, and as it grows up, each muscle, depending upon certain specific exercises, will be

Development of the Brain

developed to its maximum. I hold the same idea in connection with the brain of the child. I believe that you can, by giving it certain lines of training, develop what the medical profession will tell you is the "gray matter of the cerebrum," and so train that child's growing cells, or groups of brain cells, so that ultimately it will be a finished product, and coming over to an educational institution that child is capable of being a success in any line in which he cares to follow. My idea is that you can train them for certain lines satisfactorily.

To illustrate it I might say, for instance, it is mentioned in Professor Peele's paper, 'Descriptive Geometry.' Personally I think it is an essential study. I have seen isolated cases. I went to school with one man in particular who passed descriptive geometry, and made 100%, and actually in his work he could not pass in any other form of mathematics. Yet you will find another class of students that can pass all the other

subjects and are utter failures in descriptive geometry. I deduct from that point of view that there are some gray cells in that individual's brain which have not been developed to acquire that form of education. We must train each student so that when he goes out he will be a success in any profession.

THE CHAIRMAN: First of all I want to say that I concur in everything which Dr. Fulton has said. The point I am making though is this, that it is upon that basis which mathematics must stand, and not upon the basis of a mental discipline.

It is said that the man who is his own lawyer has a fool for a client; I think that is true. If a person wants engineering advice he should go to an engineer for it; if he wants a mine examined he should go to an engineer for it; and if he wants a geological report he should go to Dr. Ransome. (Laughter and applause.)

THE CHAIRMAN: May I take the liberty of announcing the nominating committee? I would like to name C. E. Newton of Oregon, S. H. Worrell of Texas, and Henry M. Landes of Washington.

(The meeting adjourned at 12.30 P. M., for luncheon, to meet again at 2 P. M.)

Afternoon Session—2 P. M., Thursday, November 18, 1920

THE CHAIRMAN: The first business of the afternoon session is a report of the nominating committee, of which Mr. Newton is chairman.

MR. NEWTON: The nominating committee is going to announce the following:

Dr. Fulton, of Missouri, chairman; Mr. Illinski, of New Mexico, vice-chairman; Mr. Thomson, of Idaho, secretary; D. A. Lyon, Washington, D. C., and Mr. Clapp, of Montana, executive committee.

I may say a word as to why these men were chosen: They were chosen primarily on two counts, one in the interest of the movement, and second, location. You will notice that we have a wide distribution of places where these gentlemen come from, and also most of them are intensely interested in the work.

THE CHAIRMAN: Gentlemen, you have heard the report of the nominating committee, what are you going to do with it?

Thereupon it was duly moved and seconded that the report of the committee be accepted.

THE CHAIRMAN: It has been moved and seconded that the report be accepted, and that the secretary cast the unanimous ballot of this body for the committee.

Thereupon, being put to a vote by the chairman the motion was unanimously carried.

Thereupon^o Dr. Fulton, the newly-elected chairman, took the chair to act as chairman of this meeting.

THE CHAIRMAN: Gentlemen, you have heard the report of the nominating committee and the reason why the choices were made, first because of the person, and second because he is located at some place. I disclaim the first one, I will serve willingly though because I come from Missouri. (Laughter.)

They say being further east I have some Eastern friends, and that I might have some influence on my Eastern colleagues to induce them to become a little interested in this matter, and I assure you I will do my best on that at the next Congress, and we may see people from east of the Missouri River if I have any influence and work hard enough to get them out here.

Moving Pictures to Show Mining to the Public

The next paper or speech that is on the list is 'The Place of the Moving Picture in the Mining Industry,' by Mr. M. F. Leopold, Safety Engineer of the U. S. Bureau of Mines.

[Mr. Leopold's paper will be found on page 492 of the Proceedings.]

THE CHAIRMAN: The subject is a live one, as to the value of moving pictures for general educational purposes and in technical schools, and I think that some expression of opinion would be interesting to the meeting. Is there any discussion at all on this subject?

MR. THOMSON: We have heard about these pictures from time to time, but they remain a long way from us, and we in the Northwest would like to have them come closer. I notice that all of the colleges mentioned by Mr. Leopold were within 100 miles of Pittsburgh, and I think the radius of activity might be extended a little farther. The institutions in Washington, Oregon, Montana, and Idaho are long distances from Pittsburgh, and I think it would be a good thing to organize a circuit, and have the pictures passed around. Much the same thing might be done with a group of institutions in the Mississippi Valley. I am wondering whether there is anything specific that Mr. Leopold sees this section might do to expedite this work.

MR. LEOPOLD: The only thing I would suggest is that one of our stations, Reno, for instance, be supplied with a complete set of films, and distribute them from that point. The cost of production after the first film is small, and if funds could be provided to make a distributing point west of the Mississippi, it would be a good thing.

DR. WHITE: I wonder whether it would not do good if a number of institutions in a group of States, say Montana, Washington, Idaho, and Oregon, got together and syndicate, so that a general request might go

to the Bureau of Mines, and the films go to those States in the order named, thus saving time, and with a definite schedule, which would take much correspondence out of Mr. Leopold's hands, and assure them of getting before the largest number of classes in the shortest possible time.

THE CHAIRMAN: I think the suggestion of Dr. White is an excellent one. I suppose the only reason the films have not gone as far as the West is that the subjects are not as illuminating to the West as they are to the East.

MR. LYON: There are a few that pertain to Western operations. I think some such scheme should be carried out, and have a distributing point in the West. The matter of distributing the films has been a big one, they being sent out from Pittsburgh.

PROFESSOR GRANT: It occurred to me that we have a chain of schools throughout the West—the country west of the Missouri River—and it seems that they could be sent from one school to another—from South Dakota to Arizona, New Mexico to Colorado, and so on.

MR. LEOPOLD: I might suggest that the films, after they are loaned to one school, do not come back to the Pittsburgh office. We will say they are loaned to a school in Missouri, and if the University of Illinois wants them we ask the school at Missouri to send it to the school in Illinois. I would suggest four or five gentlemen from the Western States get together, and we will put the film on a chain of schools, and see how it works out. The films need repairing, and must come back to the Pittsburgh office to be cleaned and repaired after being shown 8 or 10 times.

THE CHAIRMAN: Is there any further discussion on the subject of motion pictures? If not, I think it will be desirable to go on with the other matters.

Is Mr. Edwin Higgins present? Mr. Higgins has for his subject, "Mining Code in California."

MR. HIGGINS: I suppose you would like to know of the code of mining regulations in California. I think it was in 1913 that Mr. H. M. Wolfen, a mining engineer of the U. S. Bureau of Mines, went to California under a co-operative agreement with the State, whereby the State paid half of his expenses and the Bureau the other half. His work was to familiarize himself with conditions in Californian mines and, to formulate mine safety rules for the State. He spent two years in investigating the mines, and made a report to the Bureau. A committee was then appointed to formulate rules. The members consisted of four engineers representing the California Metal Producers' Association, three secretaries of as many miners' unions, Mr. Wolfen, and the three Commissioners of the Industrial Accident Commission of California. Eventually the Mine Safety Rules were compiled and published.

Mining Regulations in California

It had been my observation that a great many mine inspectors did not fully enforce the law. On taking up the work of administering the Mine Safety Rules in California, I made up my mind that I would not send out a corps of inspectors with this little book in their hands, to tell the operators to follow the Rules. I felt that if I should go easy with the Rules during the first year, I could get the co-operation of the managements, and would get much better results than by arbitrary demands, and directing them to follow the Rules to the letter.

I felt that there were too many rules in the book. There is still some difference of opinion in the State as to whether it is best to have few rules, or whether it is best to have a great many rules to cover every many details. Portions of the Rules have been found objectionable, and have been amended.

I am somewhat of a crank on the subject of the personal element, and I felt that I could do something in the office that was not in the book of rules. I felt that if I could get the miners to believe in me that I could do more towards preventing accidents than I could with the book of Rules. I still feel that way. Accordingly, I organized the "Miners Safety Bear Club." A series of letters was sent to all miners in the State. They contained heart-to-heart talks with the miner, telling him what he was up against, and of his responsibility to his employer and family. I notified all of the men who wanted to join the Safety Bear Club to send in their names to me. The number of members grew until in 10 months we had 10,000 members out of 12,000 miners in the State. I got them to write their experiences about safety work, and I really think that the plan did a great deal to prevent accidents.

Now, there are many details of these Rules I could talk over, but I do not know in what particular one you might be interested. They cover every detail of mine operation. Possibly it might be more interesting to you if you want information on them to ask about them.

MR. THOMSON: Mr. Higgins, would you care to go further in an expression of your opinion as to the desirability of detailed rules versus discretion for the inspector?

Moving Powder in Mines

MR. HIGGINS: Well, I could mention many cases where specific rules do not make for greater safety. For instance, there is a rule in the book providing that only one day's powder supply may be kept in a mine. In some of the mines there are several magazines underground, and it would be much safer to store several days' supply in them safer than to carry the powder through the mine every day. There are other rules that do not fit all cases. On the other hand, there is a special clause under which operators may secure exemption from any rule which does not fit the case, or which may work a hardship. I feel the Rules are a little top heavy. I would greatly prefer fewer rules with inspectors who know the business and who have some discretion,

A DELEGATE: The personal element enters into the co-operation between the mining company and the chief mining inspector.

MR. HIGGINS: I might say when I left the mine inspector's office I took a position with the California Metal Producers' Association. Mr. Wolfen returned to California to succeed me. This Association embraces all the large properties throughout the State. Its engineer has always been in close touch with the officials of the Industrial Accident Commission. This has been a factor in maintaining pleasant relations.

PROFESSOR GRANT: Mr. Higgins, you might state how this worked out. I know, as I was an operator in California when those Rules were formulated or drawn up at least, and at the present time I believe the engineer of the Association acts practically as the mining inspector, does he not? That is, his recommendations are accepted by the mining operators throughout the State as being necessary. Am I correct in that?

MR. HIGGINS: Well, to a certain extent. The engineer of the Association goes around, and from his familiarity with the rules he can point out defects. His suggestions are usually followed.

There is one thing I did not tell you: When I went into office I had 3 deputies, and I said, "Boys, here is a book of Rules; take it along with you, but when you go to the mines, find out at each mine what is hurting and killing the men. Get after those things first and remedy them." I said to them, "We will work that way the first six months, and not look so much at the Rules." There was one law I did enforce, and that was the one requiring a second exit from deep mines.

THE CHAIRMAN: The next subject is the paper by Dr. David White of the U. S. Geological Survey, entitled, 'The Place of Geology.'

[This paper will be found on page 456 of the Proceedings.]

THE CHAIRMAN: We would like to hear from the Washington State Geological Survey.

MR. HARRY LANDES: Our Survey is divided into three parts. One co-operates closely with the Federal Survey in the preparation of topographical maps, as outlined by Dr. White. It is costing the State \$22 per

Cost of Surveys in Washington

square mile for this work, compared with \$12 for that done throughout the whole country by the Federal bureau. For 10 years the State has not failed to make an appropriation, but this has not increased with the rise in costs. The co-operation scheme has been very successful, especially in stream measurements. We are allowed to choose where the maps shall be made. Local pressure—from mining men and irrigationists—is frequently a problem. Regarding strictly geologic work, while there is no formal agreement between the State and Federal Surveys, there is an understanding as to what work shall be done, so that there is no serious duplication. We are collecting a lot of valuable data, which are often

consulted by the public. A State survey should have such information available, as much waste time and money is avoided.

THE CHAIRMAN: The next subject on our program is 'Geology and Metal Mining With Particular Reference to the Work of the U. S. Geological Survey,' by Mr. F. L. Ransome.

[Mr. Ransome's paper will be found on page 407 of the Proceedings.]

THE CHAIRMAN: Gentlemen, I know you consider it a privilege to have heard from Mr. Ransome. Everybody knows him in the West, and of his services to the mining industry and economic geology.

The meeting then adjourned.

NOVEMBER 19, 1920, 9.30 A. M.

Mr. Illinski of New Mexico, presided

THE CHAIRMAN: The meeting will please come to order. In the absence of Dr. Fulton I will act as the temporary chairman of this Association. Mr. G. B. Morgan, State Geologist of Wyoming, will give us a talk on the geology of that State.

[Mr. Morgan's paper will be found on page 471 of the Proceedings.]

MR. THOMSON: I wonder if Mr. Morgan might make it clear the amount of support the Geological Survey receives, or was your statement that it was a one-man organization intended to convey the idea that what you have in Wyoming is a State Geologist with a salary for such and nothing more? or whether you plan on asking for a further appropriation for the office?

MR. MORGAN: The statute simply gives the Governor the power to appoint a State Geologist, and he is given an appropriation each biennial period to work with as he sees fit. He may work up the routine of the office and such publicity, and also work for the State Land Board. But, what we are trying to do is to get the Legislature to enact laws creating the office of an Assistant State Geologist.

MR. THOMSON: Does the statute provide for the appointment of a State Geologist by the Governor, and define his duties?

MR. MORGAN: It does to some extent, and then there are later laws that define the duties.

MR. THOMSON: But in none of these laws is there authorization for more than a one-man job, is that the size of it?

MR. MORGAN: That is its status. Although we employ a field man, it has to be done under the direction of the State Geologist, and there

will be no title for this office; the man would have no title except Field Assistant. He has no regular employment as Assistant State Geologist; it is simply temporary work. We want to change that, and have a State Geological Survey with a director and assistants, and State Geologist with an assistant.

MR. THOMSON: Is there any connection, local or otherwise, between the State Geologist and the State University?

MR. MORGAN: No, except that the State Geologist has supervisory power over all State lands—all mineral lands and those including the University lands as well—and it is his job to see that these lands are properly handled from a mineral point of view, and get the best revenues, and see that the best interests of the State are served. The last Legislature enacted that law as a particular piece of legislation requiring the State Geologist to take over and take control of all State lands. It is an important piece of work, you can see, because of the immense wealth in those lands; and the State Geologist might be able to increase the revenue of the State to a great extent, and save a lot of money.

MR. THOMSON: As I understand it, the lands of Wyoming have turned out similarly as was the case in the lands of Minnesota. In Minnesota it turned out to be iron-ore land, and in your State it has turned out to be oil-bearing, that is true, isn't it?

MR. MORGAN: Yes, both school lands and University lands have turned out to be very good. Those lands were first selected by farmers and ranchers for the purpose of leasing. Then they had the University and the State select the lands primarily for their own purposes, after which they were released to the University. Some were down in the valleys, the Platte Valley, for instance; and while others were in the Big Muddy field, Rock Creek, Salt Creek field, and other places, which turned out to be very valuable oil lands.

MR. THOMSON: Is there any idea of what the range of probable value of University lands is, as evidenced by their underlying oil-bearing strata?

Oil-Bearing Sands of Wyoming

MR. MORGAN: I do not think that has ever been estimated. Some are very valuable in the Big Muddy field, where they are getting another production from the second Wall Creek sand, which they have in Salt Creek. The sand is thick, and recently they brought in heavier production from their wells, and eventually they will produce a lot of oil. As I said, after they reach the second sands they have a fine production, and in the Salt Creek field it is hard to foretell what it will amount to. The Rock Creek field, in which the State lands are involved, show evidence of long life and large production. This is worked upon a royalty basis, and the moneys that are coming in are all put into a permanent fund; only the interest can be used at the present time. It is not helping much, but eventually it may do so.

DR. WHITE: This has been a very interesting statement of responsibilities and of plans and opportunities that are really unrivalled, and it seems to me that the psychology of the economic situation all favor the success of Mr. Morgan's undertaking and hopes. The outline that he presents reminds me to interject a question that is aimed not merely at the work of the State of Wyoming, nor is it intended to criticise in any way the plans of the State Mining Bureau, which are so largely represented here: I get the idea, which accords with the spirit of the times, that these Geological Surveys and Mining Bureaus of States west of the Mississippi—there are no Eastern men here I believe—are given almost entirely to utilitarian geology. I am not criticising at all. It is a condition, not a theory that confronts us, but I would like to enter just a question as to what real scientific work is best, and what has been contemplated by Mr. Morgan. Has any work been planned by any of these powers in paleontology, working geology, general tectonics, the history of the earth's movements, the question of faulting, and all other scientific studies relating to geology? I want to know if we have to carry the bag for all of the States west of the Mississippi, or whether some of you will give us help on it? Some of you have some money, and have the best chances to get all you want. Are any of you making plans for a historical geology? I may say that paleontology boys or graduates are very scarce,

Shortage of Paleontologists

they are picked up by the oil companies, and the scarcity of workers in paleontology is a great drawback. We are having our difficulties, we cannot secure money for all the scientific work that we would like to do. If we have to do it all—and it is all left for us to do—it is going to make much slower progress than it should. You will be confronted after a time in areal work and paleontology. We are glad indeed to help in a determination of fossils, or any determination of minerals, and that is one of our reasons for being here. But, we have a situation in paleontology that is difficult, and the young men who are in training are hard to get. If in some of these Western surveys where money is relatively easily secured, geological research is a stock in trade, and if capital is the germ on which economic geology is to live, if you do not get busy you are going to run out and have to depend upon the services of others. At some future meeting I should like to have the matter considered of the geological research is a stock in trade, and as capital is the germ on organization of a board on paleontologic work. Paleontological work must be done under State organization. University men cannot give us any great assistance in doing this, and the State and the Federal Surveys must carry on the historical work in geology, so I commend it to your consideration and should like, if at some time we could hold a conference of all State Geologists and heads of the different Mining Bureaus. I think that geologic history can be better done than we can do it alone. This would include examination of fossils from oil-wells. The fossils sent in by oil companies are taking up a large part of the time of the regular systematic work of the Department. We are trying to develop

specialists, but it will take a large number of men to cover the field in paleontology.

THE CHAIRMAN: Gentlemen, are there any representatives of the State Geological Surveys who will respond to Dr. White's question?

DR. WHITE: Mr. Chairman, that was merely my view rather than to interject a new thought into the discussion.

THE CHAIRMAN: Dr. A. F. Fischer of the Philippine Islands is here, and he will discuss the education of foreign students in the United States.

The gist of Dr. Fischer's remarks are as follows:

Being in an administrative position as Director of the Bureau of Forestry, also Dean of the School of Forestry of the Philippines at Manila, I receive Filipino students returning from the United States with many degrees, and working in this Bureau. Naturally, the people there

Result of Orientals Studying in America

look up to those returning Filipinos. We have to recognize a little political pressure and give them responsible positions. In a way these men are Orientals with a European viewpoint and think that a diploma is the acme of education; but they have fallen down in their work. Government officials do not blame the Filipinos, but they blame the institution and country in which the education was received. It would appear that the Faculties of colleges and universities have sympathy for foreign students, and grant them diplomas, although the required study has not been accomplished. Such students never attain the standard of the average American student. When they return to the Orient they fail. Chinese students from Philippine schools have proved superior to those trained in America. They should be made to reach the proper mark as is done in the Philippines.

A discussion followed these remarks, but, by motion made, were ordered left out of the record.

THE CHAIRMAN: Gentlemen, we must get on with our program as we are short on time. We have with us today Mr. D. A. Lyon of the U. S. Bureau of Mines, who will read us a paper on Federal co-operation by the U. S. Bureau of Mines.

MR. LYON: I have not any set paper at all, and as the Director is here I think we had better hear from him.

DR. F. G. COTTRELL, Director of the U. S. Bureau of Mines:

I have seen so little of your proceedings that I think there are other people here who could give you a much better idea than mine, but I want to say that we will be glad to be of any service, and will try to develop a co-operation of work. I think I had better leave the details of the subject to Mr. Lyon.

The gist of Mr. Lyon's remarks is as follows:

Most of you are familiar with the organization of the Bureau's Experimental Station work. The Bureau does not carry on much research work in Washington; in fact, it has practically no laboratory there at all. The first station was established at Pittsburgh. Most of its work is devoted to coal mining. Of the money invested in the mining industry the greater

The Bureau of Hines Stations

proportion has been put into coal mining. Pittsburgh is not what we call a co-operative station. The first work along that line was with the University of Illinois. Denver got the next station. It is called 'The Rare Metals Station,' it being a place for the study of radium-bearing ores. Then followed Dr. Cottrell's work on smelter fume in San Francisco. The first co-operative work with a State University was in Utah in 1913. This was largely through the efforts of Dr. Merrill. I was appointed to take charge and remained there three years. Then Congress passed the Foster Bill, creating 10 stations, of which eight are now established in various parts of the country. Each has its particular problems, such as coal at Pittsburgh, mine fires and mine subsidences at Urbana, ceramics at Columbus, petroleum at Bartlesville, low-grade iron ores at Minneapolis, low-grade complex lead and zinc ores at Salt Lake City, low-grade copper ores at Tucson, miscellaneous, but especially non-ferrous metallurgy at Berkeley, coal, ceramics, and electro-chemical metallurgy for the Northwest at Seattle, and lead and zinc ores at Mississippi Valley. The Birmingham station will probably deal with coke, iron ores and ferro-allöys.

The Federal Bureau is co-operating with the State Bureau of Mines and Geology of Oregon, also similarly in Idaho. Funds for the 10 stations were only \$25,000 per annum, but with the co-operative funds from the States we are able to manage. At present there are in all 10 main stations, twelve at educational institutions and eighteen with industrial concerns, a total of forty. The amount of money expended in this co-operation, as given from the outside, is \$512,800 per year. We are desirous of joining with a State in any problem. Perhaps the most active work is that being done at Salt Lake City. Generally, we aim to secure data that will be of help industrially as a whole, rather than endeavor to work too precisely. At Bartlesville, the work largely concerns waste at oil-wells, getting the water out of them, etc. At Boulder, Colorado, we are studying oil-shale, also at Salt Lake City. Colorado voted \$10,000 for this investigation, and Utah, \$12,500.

THE CHAIRMAN: Gentlemen, I believe we all would be interested in hearing a few remarks from Dr. Merrill.

DR. MERRILL: Through a special bequest we have now a laboratory fund to support this research work. We conceived the idea the best way to get State funds was to appoint 'Fellows' to go into the metallurgical and research department, and become assistants of the Director. We did not have laboratory facilities to support the work; but fortunately

a bequest of \$50,000 was made to us about that time, and we use the income entirely from that to support the laboratory work.

MR. LYON: I might say that the one thing we have been up against in the Western schools is the laboratory. We cannot carry on research work unless we have a good laboratory, and I have an idea that we have been very fortunate in getting one that meets our requirements. I must say that I think some of our Eastern schools lack laboratories.

THE CHAIRMAN: Gentlemen, if there are no more questions to be asked on the subject we will hear from Mr. A. L. Murray of the U. S. Bureau of Mines, who will read a paper that has been prepared by Mr. C. A. Allen, Mining Engineer of the Bureau and Chief Mine inspector for the Industrial Commission of Utah, on 'Mining Welfare Work in Utah.'

[Mr. Allen's paper will be found on page 477 of the Proceedings.]

[The papers of F. W. Huels and Joseph Hyde Pratt will be found on pages 481 and 488, respectively.]

THE CHAIRMAN: There being nothing further to come before this meeting we will now adjourn. Thereupon the meeting adjourned.

JOINT MEETING OF COAL AND METAL SECTIONS STANDARDIZATION COMMITTEE

The American Mining Congress

MONDAY, NOVEMBER 15, 1920, 11 A. M.

Carl Scholz, Acting Chairman of the Coal Section; Chas. A. Mitke, Chairman of the Metal Section, presided.

The following were in attendance, including those who registered after the session started:

- BARNHARDT, G. W., Marion Steam Shovel Mfg. Co., San Francisco, California.
- BAYLES, L. C., Ingersoll-Rand Co., Phillipsburg, N. J.
- BOOM, B. P., Westinghouse Electric Mfg. Co.
- BREWSTER, T. T., vice-president Mt. Olive & Stanton Coal Company, St. Louis, Missouri.
- BRIGHT, G., Westinghouse Electric Mfg. Co., Denver, Colorado.
- BRODEN, CHARLES E., Hazard Mfg. Co., Wilkes-Barre, Pa.
- BURGESS, GEORGE K., with U. S. Bureau of Standards and also American Engineering Standardization Committee.
- CARROLL, FRANK, Ingersoll-Rand Co., Los Angeles, California.
- COTTRELL, J. G., Director U. S. Bureau of Mines, Washington, D. C.
- CURRY, J. E., Arizona Chapter of American Mining Congress.
- DOUBLEDAY, F. E., Doubleday Coal Co., Fort Scott, Kansas.
- EBE, J. A., consulting mining engineer, LaSalle, Ill.; and manager of Mining Department of Illinois Zinc Co., Peru, Illinois.
- GOLDEN, JAMES, Mining Inspector, Fourth District, W. Va.
- GRENSFELDER, N. S., Hercules Powder Co., Wilmington, Del.
- HALL, R. D., *Coal Age*, New York City.
- JOWETT, J. H., Ingersoll-Rand Company, New York.
- KASEMEN, G. A., president Albuquerque & Cerrillos Coal Co., Albuquerque, New Mexico.
- KIDDIE, JOHN, superintendent Mining Department, Arizona Copper Co., Clifton, Arizona.
- KIPP, ERNEST B., local representative Hazard Mfg. Co., Wilkes-Barre, Pennsylvania.
- KISER, A. V., superintendent Electric Equipment Coal Co., Pittsburgh, Pennsylvania.
- LAMPINEN, E. O., Kavehills Coal Co., South Dakota.

- LARSON, C. W., engineer Mining Dept., General Electric Co., Erie, Pa.
- LONGYEAR, ROBERT D., E. Y. Longyear Co., Minneapolis, Minn.
- LUNT, H. F., State Commissioner of Mines, Denver, Colo.
- MARKS, J. B., Colorado Fuel & Iron Co., Denver, Colo.
- MILLIKEN, JAMES, president Industrial Car Manufacturers Institute, Pittsburgh, Pa.
- MITKE, CHARLES M., consulting engineer, Bisbee, Arizona.
- MORRISON, A. CRESSY, National Acetylene Assn., New York City.
- MOTT, CHESTER, district manager, Sullivan Machinery Co., Denver, Colorado.
- McKEEHAN, D. C., Union Pacific Coal Co., Rock Springs, Wyo.
- McKINLEY, C. S., Denver, Colorado.
- NEEDHAM, JOHN, Mining Department of the Chicago, Milwaukee & St. Paul R. R., 63 E. Adams St., Chicago, Ill.
- NORMAN, FRED., The Alleghany River Mining Co., Kittanning, Pa.
- NOTMAN, ARTHUR, superintendent, Mining Department, Phelps Dodge Corporation, Bisbee, Arizona.
- OFFICER, C. H., Sullivan Machinery Co., Chicago, Illinois.
- PARKER, RICHARD A., representing the Mining and Metallurgical Society of America, Denver, Colorado.
- RAIT, E. M., Arizona Mining Co., Clifton, Arizona.
- RICHARDS, J. W., assessor, Denver, Colorado.
- RICHARDS, P. J., coal analyst, Denver, Colorado.
- RISDON, W. W., State Mine Inspector, Gallup, New Mexico.
- ROBINSON, HARRY W., attorney-at-law, Denver, Colorado.
- ROBINSON, —, General Electric Co., Denver, Colorado.
- ROWE, W. A., American Blower Co., Detroit, Michigan.
- SCHOLZ, CARL, JR., Raleigh-Wyoming Coal Company, Charleston, West Virginia.
- SCOTT, R. A., Denver Rock Drill Mfg. Co., Denver, Colorado.
- SMITH, C. D., Goodman Mfg. Co., Chicago, Illinois.
- SMITH, ROY F., Empire Zinc Co., Denver, Colorado.
- THOMPSON, G. S., Fuel Department, Colorado Fuel & Iron Co., Pueblo, Colorado.
- UHLER, A. S., Ingersoll-Rand Co., New York.
- VICTOR, A. F., Lake Superior Motor Co., Duluth, Minnesota.
- WALSH, H. G., Sullivan Machinery Co., Chicago, Illinois.
- WATTS, C. E., Berwind Coal Co., Windber, Pennsylvania.
- WILSON, H. M., general manager The Associated Companies, Hartford, Connecticut.
- CHAIRMAN MITKE: Mr. Scholz and I have decided that instead of

taking up technical matters this morning, we will confine our discussion to subjects of general interest to the Coal and Metal Sections.

The method of procedure adopted by the Metal Section of the Standardization Committee, is as follows:

First, a general committee, consisting of a chairman and six members was appointed, each of the seven being in turn, chairmen of the Sub-Committees. Seven Sub-Committees, were then appointed, the personnel representing practically every mining State in the Union.

Meetings not Suitable; Work by Correspondence

Owing to the fact that our Committee members live so far apart, frequent meetings were out of the question, and all the work must therefore be carried on by correspondence. In order to provide a working base, questionnaires have been prepared by the various chairmen and sent not only to Committee members, but to operators in district not represented by them. Upon receipt of these questionnaires, properly filled out, the information thus obtained is tabulated and then sent out to the Committee members for their study, comments, and suggestions. By this means it is hoped that valuable deductions may finally be evolved, which will prove of material benefit to the mining industry. This is the plan of the Metal Section. Mr. Scholz, who, in Colonel Roberts' absence in Illinois, is acting chairman of the Coal Section, will give us an outline of the manner in which that Section is functioning.

MR. SCHOLZ: Colonel Roberts has been in charge of this matter and will make a report later on, showing how effective his work has been. Unfortunately, I have not had time to give the subject the full consideration it deserves. I am sure, however, that the Committee is going to do a lot of good.

The Committee of which I am chairman—on Mining and Loading Machinery—is an important one. We feel that with the high cost of labor, mechanical mining and loading is more in demand than ever. Our idea has been to standardize certain general equipment on which we could agree. We found that there were more differences among the manufacturers than we felt should exist. Of course, we realized that every manufacturer has certain professional secrets which he keeps himself, which we should approach with more or less consideration and care; but I do feel that we ought to get closer together than we have, in order to simplify the question of repairs and maintenance and other matters, although equipment matters are such that we may not be able to do much with them at this time. Of course, we do not care to standardize such things as miners' houses, because it requires a diversity; but as far as equipment is concerned, when we sample the parts in the interest of the manufacturers, it will enable us to test machinery that otherwise would be barred, because every company operating far from a manufacturer knows what a tremendous amount of money it requires to secure a stock of repair parts. The detailed reports I understand will be read at some later meeting. The present object is to get acquainted and see what we could agree upon as to a plan of action.

MR. MITKE: Has anyone any suggestions about the general plan of investigation that we should adopt, or anything whatever to offer?

MR. G. BRIGHT: I should like to bring up something in connection with the Committees on Coal Mining and Metal Mining. In many instances the work is entirely different. Some of the Committees on the latter have subjects to consider which do not concern coal at all, and I

Merging of Committees on Parallel Subjects

understand there are other Committees that are almost parallel. I think that it would be somewhat advantageous for those Committees—for instance, Underground Transportation—to work together; otherwise, if they work entirely separate, it looks as if they may come in with recommendations that are rather far apart, and it would be rather difficult for the American Mining Congress to issue these recommendations to the public when they do not agree at all; while if these Committees worked together, they could no doubt come to some definite agreement on which the same standards could be reached. Conditions are different in coal and metal mining; on the other hand, there are some conditions on which the same standards could be reached.

MR. MITKE: Your idea is that transportation is transportation the world over?

MR. SCHOLZ: So is drainage.

MR. BRIGHT: Of course, ventilation and some problems like that are similar.

MR. A. V. KISER: Underground equipment and underground transmission are parallel, and we should not bring in a recommendation which we think is not concurred in by the Metal Mining Committee.

MR. MITKE: The Sub-Committee on Coal Transportation and the Sub-Committee on Metal Transportation might get together, and compare and correlate their reports.

MR. KISER: Yes, after their Committees agree on the reports.

MR. BRIGHT: When it comes to the final meeting, at the end of next year [1921], we are hoping that we will have something that is really worth-while, but in the meantime they can exchange their reports, long before that, and have them pretty well discussed.

MR. MITKE: That is a good suggestion. In fact, I understand some of the reports of the Committees of the Coal Mining division are ready for publication and distribution now.

MR. SCHOLZ: I wish to hand in the report of the Coal Mining branch of this Committee to be read, if the time affords.

MR. MITKE: I believe it would be better to defer that until the meeting of the Coal Section tomorrow morning.

Mr. Notman has some suggestions about the progress in carrying out the investigation which might be helpful in facilitating matters more or less, especially in arranging details.

MR. ARTHUR NOTMAN: I have given the matter quite a little thought, but I do not know whether my ideas will agree with the other members of our Sub-Committee or not. I am on the Sub-Committee on drilling machines and steel, and I received with interest the questionnaire from our chairman, Mr. Braly, who, unfortunately is not here, but I was unable to complete it before leaving Bisbee. We have been engaged in an investigation on the subject during the past six months, and I have a report which I hope to be able to present to Mr. Braly in person, but with Mr. Mitke's permission I will present it at the meeting of the Metal Section tomorrow afternoon. It occurred to me, that in order to expedite matters, it might be advisable to have an inner circle, covering this Sub-Committee—which I understand has a membership of about forty—and discuss the question in detail, and have them, with Mr. Braly, go over the questionnaires, and any detailed reports that may be presented here, and summarize—as our Chairman has suggested—all that information.

Question of Procedure

Then there could be at least one meeting of that smaller group, prior to the next annual convention of the Mining Congress, early enough so that their resolution or report to their chairman could be referred back to all the members of the Sub-Committee on drilling machines and steel for their criticism and suggestions, in advance of the Mining Congress meeting. As Mr. Mitke has pointed out, it is extremely difficult for the mining industry, particularly because we are so scattered, to get any representative number together and discuss a question like standardization, which is almost entirely a matter of detail, and in order to accomplish something, we must have a few men who can get together.

I have three copies of my report which I would like to give to representatives of drill manufacturers in advance of the meeting tomorrow, so that they might have an opportunity to digest it and discuss it at that time.

MR. MITKE: I shall now read a report sent by Colonel Roberts, concerning the meeting of the General Correlating Committee of the American Engineering Standards Committee, held in New York recently:

The report states that, in accordance with a call sent out by Mr. P. G. Agnew, secretary, a conference was held in New York on November 11, 1920, with representatives present from each of the five national organizations and societies to whom the call was sent, namely, the (1) American Institute of Mining and Metallurgical Engineers; (2) American Mining Congress; (3) Mining and Metallurgical Society of America; (4) National Safety Council; and (5) U. S. Bureau of Mines.

These had previously named the following as their representatives on this general correlating committee:

(1) Howard N. Evanson and Graham Bright; (2) Charles A. Mitke and Col. Warren R. Roberts; (3) B. B. Gottsberger and E. S. Berry; (4) J. S. Williams and F. P. Sinn; and (5) O. P. Hood. The following were present in person or by alternatives: (1) P. E. Barbour; (2) Colonel Roberts; (3) B. B. Gottsberger; (4) F. B. Sinn; and (5) O. P. Hood.

The Minutes of the first conference of this general correlating committee, as hurriedly prepared by the secretary of the American Engineering Standards Committee, are hereto attached. These minutes represent substantially the work accomplished and the agreements reached at this first conference. They are signed by Colonel Roberts.

Report of Correlating Committee

"The minutes of this conference should state that Mr. A. A. Stevenson, chairman of the American Engineering Standards Committee, and Mr. P. G. Agnew, secretary of this Committee, were unanimously selected as temporary chairman and temporary secretary for this first conference of this General Correlating Committee, it being the sense of the representatives present that the permanent chairman and secretary should not be selected until the next conference of the committee, when it was hoped a fuller representation of the societies would be present.

It should be noted that the representatives present for some of the societies did not feel disposed at this first conference to bind their societies to any definite program, and wished to refer the matters back to their society for formal approval. However, it was their personal judgment that their program of correlation, as tentatively agreed upon at this conference, would be approved by their societies.

Colonel Roberts, representing the American Mining Congress, advised that it was very important that some such general program for correlating the standardization work, which was being carried on by the various organizations and societies named above, or which they might wish to enter upon, should be agreed to at this conference, for the reason that the American Mining Congress would expect its representative at this conference to report at the first National Standardization Conference, to be held in Denver, November 15 to 19, inclusive, whether any such program had been agreed upon, and if so, the substance of such program. It was for this reason that the temporary chairman of the meeting urged upon the representatives of the various societies that they reach, at least, some tentative agreement, which was done as outlined in the minutes of the meeting above referred to.

Your representative at this conference advised the representatives of the other societies present, that the general correlating program, as tentatively agreed upon, met with his personal approval, and that he would so report at the first National Standardization Conference of the American Mining Congress and recommend the acceptance of such program by our Congress.

All Organizations to Outline Their Activities

As indicated in the first paragraph on the last page of the minutes of this conference, the representative of each organization present agreed to prepare a brief outline of the activities of this organization on standard-

ization work as applied to the mining industry. Such presentation of the work of our Mining Congress on standardization can better be prepared at a date after our National Convention.

The conference adjourned subject to call of the chairman or secretary of the American Engineering Standard Committee. It was, however, tentatively agreed to by the representatives present that the next conference should be held in New York City about the middle of December (1920), at some date to be mutually agreed upon by the representatives of the various organizations. At this next conference it was expected to complete the organization of this general correlating committee by selecting a permanent chairman and secretary; and it is also hoped that at this next conference the representatives of the various organizations will have secured the approval of their respective societies to the tentative program as outlined above in this report, which will enable this committee then to prepare a definite program for correlating the standardization work of all these organizations and societies."

MR. GEORGE K. BURGESS: Speaking as a member of the American Engineering Standards Committee, I might say that I was sorry not to be able to be at that meeting of November 11, but in general I think that the long view ahead, as mentioned in Col. Roberts' report, was of great importance. The program as outlined by your chairman earlier in the meeting is all right—there is no question about standardization being good—but the function of the American Engineering Standards Committee is not to make standards; the function of that committee is to supervise the methods, the fundamental idea being that all interests concerned in any given standardization project or industry, will be representative.

Interlocking of Organizations

That, however, does not prevent—on the contrary it leads to the encouragement of active work on any particular unit representing either a large portion or any portion of the industry in question. In the mining industry there are several bodies interested directly—some of them indirectly,—in standardization methods. Therefore, before a standard is promulgated as an American standard,—that is, representing decisions which are subscribed to by the whole country—some process as indicated in Col. Roberts' report of the November 11 meeting, is inevitable, namely, that we must not only get together in this organization, but you are to join with other similar organizations working on the same problem. Therefore, the proper way to organize this standardization work is to go ahead with your own committees, at the same time tying up with other organizations. I think if that policy is adopted, it will lead to greater, more definite, and efficient progress than by any other procedure.

MR. N. S. GRENSFELDER: Has it been decided definitely about that meeting in New York mentioned in Col. Roberts' report?

MR. MITKE: It is to be some time in December, 1920.

MR. A. C. MORRISON: Is there any objection to reading the tentative agreement, or is that to be postponed until some other meeting? Mr. Roberts refers constantly to a tentative agreement which had been reached, and he recommends its adoption, but the agreement is not before the meeting.

MR. MITKE: I have not read it yet as it has just been received, but will now do so. It is signed by the secretary, P. G. Agnew.

"The meeting was called to order by Mr. A. A. Stevenson, Chairman of the American Engineering Standards Committee, at 2:30 p. m.

Those present were Percy E. Barbour, representing the American Institute of Mining and Metallurgical Engineers; Warren R. Roberts, the Mining and Metallurgical Society of America; F. P. Sinn, the National Safety Council; O. P. Hood, the U. S. Bureau of Mines; A. A. Stevenson, chairman, American Engineering Standards Committee, and P. G. Agnew, secretary, American Engineering Standards Committee.

It was announced that the following gentlemen who have been designated as members of the Committee, representing their respective organizations, were unable to meet with the conference. They included Messrs. Evanson, Bright, Mitke, Berry, and Holbrook, and others.

In view of the absence of several members of the Committee, it was decided not to proceed with the election of a permanent chairman, and upon motion by Col. Roberts it was voted that Mr. Stevenson be requested to act as temporary chairman. Mr. Stevenson consented to serve. The Secretary of the American Engineering Standards Committee was requested to serve as secretary of the meeting.

The Mining Congress and Standardization

Methods of co-operation. Col. Roberts briefly outlined the work of the American Mining Congress. The Congress was to hold its annual Convention in Denver the following week, and one of the principal features of the Convention would be a general conference on standardization in the mining industry. It was very desirable that some agreement be reached as to the general method of co-operation, and to be followed in correlating the standardization work of the various organizations, in order that the work might be finally approved by the American Engineering Standards Committee. The Standardization Conference in Denver should be apprised of the methods to be followed.

Mr. Hood briefly outlined some of the standardization activities of the Bureau of Mines, and pointed out, by use of illustrations, the importance of clearly defining the relation of each of the co-operating organizations to the American Engineering Standards Committee.

In the frank and rather full discussion which followed, it was recognized that the main function of the present Committee would be to work out the methods of correlating the standardization activities of the various organizations concerned, in order that specific parts of the work should receive final approval of the American Engineering Standards Committee after clearing through the mechanism of co-operation to be agreed upon.

It would be first of all necessary to work out a general policy and plan to be followed in the work. The Committee would then have to apply this plan to specific projects, acting as technical advisor to the American

General Plan

Engineering Standards Committee in the mining field. It was recognized that in the application of the general plan there would be involved such work as:

(1) Delimiting specific projects which might be most advantageously handled as units.

(2) Recommending the order in which the various projects should be taken up in view of the needs of the industry.

(3) Make recommendations as to what bodies should act as sponsors for specific projects, and as to what bodies should be represented upon sectional committees.

It was agreed that the members should recommend to their respective organizations the following as a general plan for co-ordinating the present standardization activities of the different bodies and placing the work under the rules of procedure of the American Engineering Standards Committee.

(a) If an organization has a standardization project practically completed or well under way, the organization should be recommended as sponsor (either as sole sponsor or as joint sponsor, with another organization, according to circumstances).

(b) If the organization has a committee organized and working on the subject, the make-up and representative character of the committee in sponsor (either as sole sponsor or as joint sponsor, with another organization, adequately representative, it could become the sectional committee.

If found not to be completely representative, the committee in question, or a portion of it, could serve as the nucleus of a more broadly representative sectional committee.

It was felt that this sectional plan would fit in with the procedure established by the American Engineering Standards Committee, and would not interfere with the progress of the work now in hand.

Relation to Safety Code Program: The relation of the work to that of the National Safety Code Committee was briefly discussed. It was voted that the Secretary be instructed to write to the National Safety Code Committee, informing them of the organization of the General Correlating Committee, and apprising them of the desire of the General Committee to co-operate with the National Safety Code Committee.

The Safety Code Program

It was further voted that the Secretary be instructed to prepare a brief outline of the history of the Safety Code Program, and of the work of the National Safety Code Committee, and circulate it to the members of the General Committee.

Information on standardization activities of the organizations. It was agreed that each member present should prepare a brief outline of the activities of the Organization which he represents, which bears on mining standardization, and forward it to the Secretary who would circulate the information to the members.

Circulation of minutes. It was voted that copies of the minutes should be sent to the Secretaries of the five organizations, in order that each organization might have in its central office a file for the information of its members.

The meeting adjourned at five o'clock p. m., subject to the call of the chair.

Mr. Mitke: In this connection I would like to say that in arranging the general program of the Metal Section, we have endeavored to make the adoption of standards just as difficult as possible, in order to prevent any one man's ideas being forced upon the mining industry, unless it has first withstood the criticism of the majority. This measure has been adopted as a safeguard, and for the protection of both the manufacturers and the mining industry at large.

The meeting then adjourned until the following day.

NATIONAL STANDARDIZATION CONFERENCE

The American Mining Congress

WEDNESDAY MORNING, NOVEMBER 17, 1920

Chas. A. Mitke, chairman of the Metal Section of the Standardization Committee, presided.

CHAIRMAN MITKE: The First National Standardization Conference will please come to order.

In the absence of Mr. Scholz, who is unfortunately unable to attend, I will open the meeting by reading a paper on 'The Relation of Standardization to Mine Management.'

[Mr. Mitke's paper appears on page 772 of the Proceedings.]

MR. MITKE: We are very fortunate in having with us Mr. P. G. Agnew, a man who is interested in the working out of national standards.

[Mr. Agnew's paper appears on page 211 of the Proceedings.]

Address by Colonel Roberts

Next follows the address 'Standardization and Efficiency' prepared by Col. Warren R. Roberts:

When the founders of the American Mining Congress, in keeping with custom, selected a motto, they chose one that would indicate to the public the purpose for which this Congress was organized, and also the ideals toward which it would strive. No other words could better have expressed these objects than "Safety, Efficiency, and Conservation."

SAFETY has been one of the watchwords of our Congress from the beginning. Not only have the officials of our Congress improved every opportunity to promote safety as applied to the mining industry, but they have been among the first to conceive ways in which improved and safer methods and practices could be brought before the mining industry.

In confirmation of the above statement, we remember that when the U. S. Bureau of Mines was in process of formation by its Director, he had no more ardent supporter and efficient adviser than our honored secretary, Mr. James F. Callbreath, who has since, together with his other officials, always extended a helping hand to the Bureau. Those of us who are familiar with the work of this Bureau, know that it has been the greatest agency in the land for the promotion of safety in the mining industry.

Our Congress has also co-operated at all times with all other agencies promoting safety as applied to mining, and at the present time working

together with the National Safety Council and similar organizations so far as their efforts are directed toward the mining industry.

EFFICIENCY, the much abused and often misapplied expression, has never been misunderstood by the officials of our Congress. If we would gain the confidence of others, and thereby secure influence with them, we must first be able to show that we have applied intelligently to our own affairs the advice we offer them. The conduct of our work through our own efficient organization has always been an example of efficiency to the mining industry. In the years that I have been connected with this organization, many times I have heard prominent men in the mining industry make the above statement. Due to this fact our Congress has had much influence with the mining industry in promoting efficiency added to safety.

CONSERVATION is a most popular expression with those who seek to gain public influence. We talk flippantly of the conservation of our national resources, while we continue to waste them. It is an acknowledged fact that the American people is the most extravagant and wasteful nation on earth. Such extravagance is not applied only to their personal resources, but to those of their cities, their states, and their nation. We were so greatly blessed with the great natural resources of our broad acres of fertile land, with our limitless forests and our unbounded mineral possessions, that we have for generations gone on exploiting these resources in the way that were bringing us the most immediate results with very little thought of conserving those wonderful possessions.

But as our lands were gradually occupied, and as our forests disappeared, and the richer of our mineral resources were exhausted, we began to take account of our wastefulness. The wiser and more patriotic of our citizens began to plead for conservation of these great resources and then I say, this word became very popular with many persons who are always ready and waiting to ride into public favor on the crest of some friendly wave. Such use of any national movement like conservation naturally creates much prejudice with our people, and this must be overcome by the industrious and wise efforts of those who are seeking to promote real conservation. Our Mining Congress has been diligent in its efforts to conserve the energies, the capital and the resources of the mining industry, thereby living up to its motto of "Safety, Efficiency, and Conservation."

Standardization an Economy

When this excellent motto was adopted by the founders of our Congress, they were not familiar with another great force in national economy. This other important factor was not then generally recognized, even by the engineering profession, which is always among the first to point the way in all matters pertaining to safety, efficiency, and conservation. There were those, however, in this profession who did have the vision to recognize that standardization of methods as applied to production, whether it be applied to mining, manufacturing, or otherwise, was

the real basis upon which should be built up the three structures of safety, efficiency, and conservation. Those of us who are familiar with this movement, which has now reached national proportions, even international scope, can verify the above statements. However, while the foundations for this new movement have been intelligently laid, no material progress had been made up to the time when our Nation was rudely awakened from the complaisant tenor of its ways of peace, and found it necessary immediately to reorganize our entire national life to enable us to meet this great crisis which was endangering our very existence. It took even such a crisis as this to awaken the American people to a realization of our resources and of our capacity as a Nation, but we did find ourselves, so to speak, and we were a surprise to all the nations of the earth as well as to ourselves.

We were proud then, and we are now, to recount the inventions, the creations, and the accomplishments of our people when as a united force they went about this great task.

But the bulwark of our strength at that time was the almost unlimited capacity of our engineers, scientists, and professional men generally, to meet this great emergency by inventing new things and new methods, and applying other things in more scientific and practical ways and otherwise helping them to organize our resources on the most productive and economical basis.

Concentration During War Years

When the call came for more ships, and when these could not be built fast enough to meet the ever-increasing demand for our shipments to Europe, a way must be found to make the vessels we had carry greater cargoes. Then again, our scientists and engineers were called upon to meet this new demand. We must find a way they told us, to concentrate and condense our cargoes. This demand was met by putting into practice the theories of those who had advocated standardization of packing, boxing and baling of all products for transportation, either by land or sea. We cannot go into detail at this time as to how this was accomplished, but can only state that a surprising increase in shipments was readily made by applying methods of standardization as above outlined.

Another call was for increased production from our factories for every article needed to carry on the war. Again, standardization of methods and of equipment very greatly facilitated, not only production but again transportation of the articles thus produced. We could go on multiplying examples to illustrate how standardization made for efficiency in every department of production and transportation during the period of the war, but this brief statement will suffice to indicate to you that any agency which was the basis of the greatest economics that we wrought during this period, must have value which should be applied to the same industries and to others in times of peace.

We have not forgotten the lessons we learned during the strenuous time of the war when necessity drove us to accomplishment. We have, therefore, been diligent in trying to apply to our industries as now re-

organized, the benefits to be derived from standardization in methods of production and of manufacture.

The American Mining Congress immediately after the war undertook to organize a division to promote standardization of mining methods, mining equipment, etc., for this industry.

Result of Conferences on Standardization

This work soon gained such prominence that other national organizations interested in the mining industry, and more particularly in this movement of standardization, suggested that a conference be held with the object of co-ordinating the work of these various national societies and organizations. These conferences have all borne fruit, and this work of co-ordination has already been accomplished through an organization set up especially for this purpose, namely, the American Engineering Standards Committee.

The way has, therefore, been opened, the trails blazed and it only remains for those who are promoting this important work to carry it forward to consummation, thereby bringing to the mining industry through standardization, Safety, Efficiency, and Conservation.

May we not hope also, that progressive men in other industries, seeing the economies we shall work through standardization, for the mining industry, will be encouraged to 'Go thou and do likewise.'"

MR. MITKE: Mr. T. T. Brewster will speak to us on 'Standard Mine Accounting.'

[Mr. Brewster's paper will be found on page 818 of the Proceedings.]

MR. MITKE: Mr. Brewster has given us an interesting talk, and those of you who are interested in this subject can obtain copies of the report; also copies of the paper Mr. Agnew brought for distribution.

We have with us Mr. James Milliken, president of the Industrial Car Manufacturing Institute of Pittsburgh.

In presenting the attached report Mr. Milliken made the following explanatory remarks:

Gentlemen, this report is not nearly as formidable as it looks. The time for adjournment is about here, and I am not going to detain you very long. I did write a short address and I will turn it over to the Secretary and you can read it in the Proceedings.

I want to compliment you on what has been done this year in the matter of standards. It represents a good piece of work, and I would like to emphasize first a few remarks that I made yesterday to the Coal Mining Section, because I think it applies to all standardization work.

Standards in Railroads

First is your method of procedure—the correlation of your committees. It is one thing to prepare standards, and another to get your members to adopt them entirely. You can make all the standards you want, and unless your members will actually agree to use them, you might as well

not have any standards. My experience has covered a good many years in railroad service, and you probably all know that the railroads, in their car construction, have done a great deal in the way of making standards. Although they started in 1872, the full standard car is not yet being built. However, the parts of cars that wear out are standardized and are interchangeable, so that if a Pennsylvania car in the East wears out a wheel, or something of that kind, either here or in San Francisco, the repair man there puts on a piece from his own stock. In that way, the cost of repairs has been materially reduced.

I would like to suggest that instead of making standards as you start out, you make recommended practice. I think you will find it will be accepted by your members much more readily than if you tried to force a standard onto them. I think the best way to accomplish that is to submit all suggestions to members individually in the way of a recommendation; then you will ascertain completely whether your recommended practices will be suitable, and after such practices have been in use for a few months, or a year or two, they can readily be advanced to standards.

The Committee that I am connected with, known as the Industrial Manufacturers Institute, is trying to standardize industrial equipment. Outside of a standard coach for railroads, there are really no standards. We have been in operation about 1½ years, and have adopted a large number of recommended practices, the items that you are particularly interested in being mine-cars. We have adopted recommended practices, covering all kinds of materials used, such as bolts and nuts, castings for malleable iron, gray iron and steel, general pipe-unions, welded pipe, rivets, screw-threads, structural steel, and so forth.

Variety in Mine-Cars

It is really remarkable how few standards there are in the building of mine-cars. This Commission that I am connected with can do a good many things, but we cannot do it all. It is up to you gentlemen to establish standards, and then the car manufacturers will be only too glad to build what you want. But they do not want to have to build a different type of car for every mine, and there certainly is not any occasion for that.

At the present time we are trying to standardize treads and flanges of wheels. Your present flanges and treads of wheels shows a wide range, resulting in a tremendous amount of waste material. There is certainly one correct tread and flange for an 18-in. wheel, and there is one correct weight for your different capacity cars. If you adopt one standard flange and one weight for capacity, if you will get the best engineering talent, if you will get the best designed wheel, you will not be carrying around excess weight, neither will you have a wheel that is too light for the service.

The same thing applies to practically all the details of cars. I am not going to mention them all, but I would like to mention Turner bearings. You have five or six different capacities, from one to five tons—a few half

tons. The majority of them have roller bearings that are rather expensive to make. There are some 18 or 20 different sized Turners for those four or five capacity cars. Some of them are $1\frac{5}{16}$ in., and another is 2 in., and another is $2\frac{1}{16}$ in.

It costs money to have three size of roller bearings made, where one size can be made in three times the quantity, and for that reason you will get them for considerably less price. There are really many advantages in standardization, and I want to assure you that the Industrial Car Manufacturers Institute is only too willing to co-operate with you, with your operators, mine superintendents, and with your engineers, and wherever we can be of service, we will only be too glad to do it.

The meeting then adjourned until the following morning.

THURSDAY MORNING, NOVEMBER 18, 1920

Carl Scholz, Acting-Chairman of the Coal Section, and Chas. A. Mitke, Chairman of the Metal Section, presided.

CHAIRMAN MITKE: This is a continuation of yesterday's meeting, and is the final meeting of the Standardization Conference. The first speaker is Mr. G. K. Burgess, a representative of the U. S. Bureau of Standards, a man whom you have heard before, and who will give us an intelligent view of the work of the Bureau.

[Mr. Burgess' paper appears on page 794 of the Proceedings.]

MR. SCHOLZ: I have been requested by Mr. Mitke to read the following resolution, which will be passed without discussion to the Resolutions Committee:

"WHEREAS, it is desirable that standardization in the mining industry be carried out on a national scale, in so far as it is possible to do so; and

"WHEREAS, it is the desire of the American Mining Congress to co-operate in the fullest measure with other bodies working to the same end; be it

"*Resolved*, That steps be taken, under such arrangements as may be mutually agreed upon by the bodies interested, through the General Correlating Committee for Mining Standardization, upon which the Congress is represented, to assure that the working standardization committees may be recognized as sectional committees of the American Engineering Standards Committee, in order that the standards prepared may receive final approval as American Engineering Standards."

Reports of All Committees to be Correlated

I might add that arrangements have already been made by the American Mining Congress to have a permanent secretary stationed at Wash-

ington, who will correlate the reports of the various committees. As acting-chairman of the Coal Section, I would like to say, for the benefit of the Metal Section, that the Coal Section meetings created a great deal of outside interest, so much so that one meeting extended over 3½ hours, and it was hardly completed then. A number of the Committees that had submitted reports were so impressed with the work which had been done, and with the work to be done, that they asked that their reports be returned so as to be revised and put into new form. Perhaps a number of our Committees were not quite aware of the final matters to be accomplished and we discovered that in many cases practices were referred to rather than equipment; and it may be necessary to augment that Committee by a committee on practices, rather than on equipment as we now have. We are much gratified with the interest that has been developed, and we hope that we will be able to do a great deal of good for the profession as well as for the manufacturers interested.

MR. MITKE: Right in line with what Mr. Scholz has said, I have an announcement to make:

As you are aware, the standardization of mining equipment is closely allied with the standardization of operations, and it is most difficult to standardize on one branch without standardizing the other. It has, therefore, been decided by the American Mining Congress, to enlarge the scope of all the working committees of both the Coal and Metal Sections to cover operations as well as equipment.

Mr. T. O. McGrath, auditor for the Shattuck-Arizona Copper Co. of Bisbee, will now address us on the subject of 'Standardization of Metal Mining Accounting.'

MR. McGRATH: I would like to say that this is nothing more than a preliminary presentation; it is not a detailed application to any one particular instance, it is a general discussion preparatory to taking up the matter in detail.

A Regulation Favorable to Mines Not Taken Advantage of

When I was at the Tax Conference here the other day, I talked to one of the men connected with the Tax Department, and I was much surprised to learn that one of the most important provisions in the last regulations had not been complied with or had not been taken advantage of, except by only one or two mining companies in the United States, so I thought I would mention this to you, because the last regulations make provision whereby these companies which had a large value as of March, 1912, saved themselves thousands of dollars, and in the case of larger companies, hundreds of thousands of dollars. The article is 844 of the Internal Revenue Department. I was told that there were only two or three companies that had taken advantage of it. That is not only interesting of this year, but it is particularly so in the fact that the Department has not finally settled any of the tax returns since 1917; in other words, your tax reports for 1917, 1918, and 1919 are still in abeyance. As I say, for some of the larger companies it amounts to hundreds of

thousands of dollars. If you wish later on to have me explain this article, I will be glad to do it.

[Mr. McGrath's paper will be found on page 806 of the Proceedings.]

MR. HANSON SMITH: In relation to Article 844—

MR. McGRATH: It would only take a minute to explain it: Article 844 allows you to depreciate and deplete the amount of your capital charges, not only in the amount of your investment in capital assets, but up to the amount of your value as of March 1, 1913; they allow your asset charges or capital charges, right up to the value of that date, which is appreciation. You take that up on your records. Then when you deplete those asset charges, you not only deplete the investment charge, but you deplete the appreciation value that they allowed to you, and set it up here as depreciation and depletion. Now, when you do that, Article 844 tells you that if you will divide your depletion charge—if your value was greater than the investment, and also your depreciation charge, if you wrote it up—if you divide it into depletion of investment and depletion of appreciation, you can use the amount of realized appreciation, for invested capital in making your return. And you can do that since March 1, 1913, or practically seven years. And in the case of some mines where they had a very large appreciation as of that date, that additional invested capital will amount to millions of dollars, which you will be allowed to use in figuring up your excess profits tax, and in some cases that will amount to hundreds of thousands of dollars.

MR. MITKE: Mr. Lawrence K. Diffenderfer, treasurer of the Vanadium Corporation of America, has sent an interesting paper on general methods of mine accounting, which I will ask Mr. McGrath to present in Mr. Diffenderfer's absence.

MR. McGRATH: This is an individual presentation of the application of mining principles to a mine, and probably will be very interesting to anyone who would like to see the system applied in an individual case. It brings up two good points: one is being very well versed in the operations; another, equipment records.

Two Papers Presented

[An abstract of Mr. Diffenderfer's paper appears on page 803 of the Proceedings. There were 13 typical forms of reports (including cash, timekeeper, payroll, storekeeper, supplies, purchasing, depreciation, and costs). but it was found impracticable to reproduce them.]

[Mr. Joseph F. Merrill, Director of the School of Mines and Engineering, University of Utah, representing the World Metric Standardization Council, presented a paper on the use of the metric system in place of the present method of weights and measures. The organizing members of this Council are the Foreign Trade Club of San Francisco, American Metric Association, London and Manchester Decimal Association, American Chemical Society, and American Wholesale Grocers' Association.]

There are on file in Washington 100,000 petitions, urging gradual adoption of the metric system in America. Of 58,226 petitions received under one questionnaire, there were only 426 opponents to the suggestion. The advocates included many prominent men, in science, education, and commerce. Mr. Merrill stated that its advantages were simplicity, economy, and universality. The remainder of the paper consisted of quotations from public men who were in sympathy with the movement.]

COAL MINING SECTION, STANDARDIZATION COMMITTEE**American Mining Congress****NOVEMBER 16, 1920**

Mr. Carl Scholz, Jr., presided.

CHAIRMAN SCHOLZ: Gentlemen: According to the program, Colonel Warren R. Roberts, who is chairman of the Coal Section, was to preside and present his report, but unfortunately he could not attend, so has asked me to present his report and act in his stead. The report is as follows:

Report of Colonel Roberts

The Coal Mining Branch of your Standardization Division of the American Mining Congress presents the following report as representing the progress made during the year since our last annual Convention.

This report is rendered by the General Committee directing Standardization for the Coal Mining Branch, and on behalf of the seven Sub-Committees having in hand the work of improving the practice and standardizing the methods and equipment for the coal-mining industry.

The first report of this General Committee presented at our last annual Convention indicates that this work was, at that time, only fairly begun; that is to say, the General Committee and the various Sub-Committees had been organized and had held a series of conferences just prior to the annual Convention, at which time they had developed and agreed upon a general program of standardization to be applied to coal-mining practice, equipment, etc. The Conference also developed arrangements whereby the work to be performed by the several Sub-Committees would be co-ordinated through the General Committee.

A comparison of the report rendered by your General Committee a year ago, and one herewith presented, suggests to your Chairman impressive facts, which he should call to your attention before entering into the more detailed subjects contained in our report.

We are impressed first, with the wisdom shown by your Committee in those first conferences, when the whole broad subject of standardization was discussed and conclusions reached covering the general scope which this work should assume, as well as the limitations that should best be applied to give the final results which would commend them to the industry, and thereby secure their adoption in general practice.

Good Work Accomplished

The several reports presented by the Sub-Committees which are attached to and form a part of this brief report of your General Committee, deserve special mention. Even a careful study of the reports of

these Sub-Committees would not indicate to you the vast amount of earnest discussion and careful consideration which has been required of the members of the Sub-Committees to reach the conclusions contained in their condensed reports. Your General Committee, therefore, wishes to commend to you the excellent work that has been done by all of these Committees with the exception of two, and for whom extenuating circumstances seem to offer ample excuse.

Our members generally, not being familiar with the work of our Standardization Division, it may be well to outline briefly the organization which is carrying on this important work on behalf of the mining industry. This Division is composed of two branches representing Metal Mining, and Coal Mining. The work of each of these branches is directed by a General Committee, composed of the Chairman of each of the Sub-Committees having direct charge of the Standardization of practice and equipment in their respective classifications of the work. The purpose of the General Committees is to review and co-ordinate the work of the several sub-committees.

The Chairmen of the two General Committees assist in organizing and directing the work for their respective branches and finally co-ordinate the work of the two Branches.

Standardization Attracts Attention

This work of Standardization, as carried on by the Mining Congress during the past two years, has attracted much attention from other national organizations and societies interested in the mining industry. Certain of these national organizations are interested in this work of Standardization, and in the campaign of safety as applied to the industry. This community of interest resulted in the calling of a conference of representatives of these various national organizations and societies, which formulated a program for co-ordinating the work in which they were mutually interested. After a thorough discussion of the subject by representatives in conference from all of these organizations, it was decided that the co-ordination of this work of Standardization could best be carried on through another national organization set up especially for this purpose, namely, the American Engineering Standards Committee.

A separate report will be presented to the Standardization Conference on this subject, and we will therefore only state that your Standardization Division is in hearty sympathy with this movement for co-ordinating and giving a national character to this work of Standardization for the mining industry.

Invitation has been extended by the Chairmen of your two General Committees to all the national organizations and societies interested in Standardization of mining methods and equipment, to attend the first National Standardization Conference, and to participate in the discussion and work generally of the conference. We are pleased to advise that representatives have been sent to our conference by all of these organizations and societies.

This work of Standardization has now been put on a truly national

basis, and the American Mining Congress may have a just pride in the part it has had in helping accomplish these results, which indicate a final consummation of this important constructive work for the mining industry.

A Comprehensive Program

We must bear in mind that while a great deal has been accomplished as set forth above, that we must not slacken our efforts, in fact our energies must be multiplied to meet the growing requirements of the comprehensive program we have undertaken. We believe that the final benefits will fully justify all the labor and patience required by those having the vision to see the final results to be accomplished. In presenting the reports of our Sub-Committees—all of which are attached hereto—we recommend a careful review of these reports by our General Committee at its first session of the Standardization Conference. Such review of these reports will indicate the necessity for the co-ordination of their recommendations. To illustrate: referring to the reports of the Sub-Committees on Mining and Loading Equipment, and the Committee on Underground Transportation, we note that the track gages adopted by these two Sub-Committees do not agree. The General Committee, therefore, in conference with the representatives of the Sub-Committees should harmonize such features of their reports. This is only one illustration of several that could be mentioned indicating the necessity for the very careful review of these reports by the General Committee.

The General Committee should also, in reviewing these reports, consider carefully each and every one of their recommendations to the end, that we should not suggest standards for adoption by the industry which shall meet with general opposition. We must always bear in mind that standards require general adoption by the industry to make them of value.

We recommend further that the General Committee refer to the General Conference on Standardization all subjects on which they believe that a general discussion by the conference would be beneficial.

It will be found on reviewing these reports, that many important questions justify a very broad and full discussion before final recommendations should be made by our General Committee to the Conference for adoption.

Procedure

After the adoption of these reports as revised by the General Committee, or by the General Committee in conjunction with the Standardization Conference as suggested just above, we then recommend that these final, approved reports be submitted to the Standardization Conference for approval and adoption.

MR. SCHOLZ: I will call on Mr. Thomas T. Brewster, chairman of the Committee on Cost Accounting, National Coal Association.

MR. BREWSTER: I have not prepared a set address, but have brought

with me 150 copies of the report of the National Coal Association, which was presented to that body at its annual meeting a year ago. That report has found favor with the Treasury Department, also with public accountants; and a number of the coal operators throughout the country have adopted this form of accounting. What I propose doing later is to make some remarks introducing that report, referring to its salient features, and then distribute the copies mentioned.

[An abstract of Mr. Brewster's paper appears on page 818 of the Proceedings.]

MR. SCHOLZ: The Committee would like to have a written report from all the Chairmen. It need not necessarily be long, but they should give some of their thoughts for discussion. Standardization work is not simple; in fact, it is a difficult problem, because we meet opposition from **Committees Include all Technical Men**

the most unexpected quarters. In selecting my committee I included three coal operators, three mining engineers, and the remainder is made up of representatives of the manufacturers. For instance: Mr. A. V. Kiser is chairman of the Committee of Underground Power and Transmission, and that Committee has made a voluminous report, perhaps the best report of any of them. They are evidently composed of workers and men who know things, because they have surprised me with a number of facts which I did not know existed. I will be glad to have Mr. Kiser give us a resumé of the salient points of his report.

MR. KISER: I might say that we experienced serious difficulty in getting men to work on these Committees. We found that many of them whom we wanted gave as an excuse that they were too busy, and we concluded in the event that we required assistance in the future, that we would get someone who was in an official position with the American Mining Congress, to write the president or vice-president of these companies, and put the case before them, and tell how urgent it was that their engineers get in on this work.

[The joint report of the Sub-Committees on Standardization of Underground Power Transmission and of Power Equipment appears on page 688 of the Proceedings.]

MR. SCHOLZ: Are there any other remarks in connection with the report of the Committee on Underground Power and Transmission? If so, now is the time to present them.

Report By Mr. Scholz

The report of the Committee on Mining and Loading is short, and was written by myself. It is as follows:

The Sub-Committee on Mining and Loading Equipment submits the following report on its activity during the past year:

1. The increasing cost of coal production, coupled with the difficulties in obtaining efficient and sufficient labor for hand mining, makes the

adoption of mechanical means for mining and loading coal more important than heretofore, and it is recommended that manufacturers and mine operators, with their engineers, co-operate more freely in the use of equipment now available, with the view of developing methods by the use of which better returns be obtained from such machinery as it now on the market.

2. We recommend that in the construction of machines, the size and speed of motors, gears, drive-chains, and other parts be standardized as far as possible, so as to simplify the repairs and renewals of machines.

3. We recommend that the award of the Bituminous Coal Commission, with reference to the use of labor-saving devices, be given the widest possible publicity, thereby encouraging the installation and use of labor-saving devices, particularly in those districts where such machinery has heretofore been opposed by the United Mine Workers organization.

4. We recommend that the Standardization Committee of the American Mining Congress request mining schools and similar institutions to co-operate with this Committee, and through them, with the manufacturers of mining equipment, and coal operators in the development of mining methods to enable the greatest possible extraction of coal.

Following is a brief of the discussion on the Report of the Subcommittee on Standardization of Mining and Loading Equipment by the Chairman of the General Committee:

Machines for Rapid Development

Mr. James Needham, general superintendent for the St. Paul Coal Co. and Republic Coal Co., said that the entry driving and loading machine is perhaps the only solution for the rapid development of a coal mine, but he believes that these machines require perfecting before they can be considered entirely satisfactory. He stated that the long-wall mines in northern Illinois are perhaps in as great need of mechanical loading appliances as any other mining field, but it has been found difficult to develop a satisfactory machine for long-wall mining, especially with the present excessive cost of operation. He hopes that a satisfactory machine for these mines may be developed, as present conditions are very discouraging.

Mr. W. D. Brennan, who was connected with the Hannah property of the Union Pacific Railway, explained to the Conference how loading machines were used in a coal seam 35 ft. in thickness and on a 17° pitch, where the rooms were driven along the strike. He stated that they had many difficulties in adopting these machines to this service, but stated that after a number of years of experimenting they now had machines in continuous operation which were giving them a production of from 800 to 1000 tons a day, with only 12 men actually used in the operation of these shovels. Additional men, of course, were required for handling of cars to and from the shovel, etc.

Mr. Scholz urged that for loading machines we should adhere to 220 volts for alternating and 250 volts for direct current. Experience had taught him that these voltages were preferable and most economical.

Mr. Kiser stated that the large operators of western Pennsylvania took exception to this recommendation by Mr. Scholz and considerable discussion on the matter followed. One of the recommendations of this Committee being that the size of motors, gears, drive-chains, and other parts be standardized so as to simplify the repairs and renewals of different makes of machines, a considerable discussion followed as to the possibility or desirability of carrying out this recommendation.

Mr. Ebe added that if it had not been for mechanical appliances it would have been impossible for his company to mine 400 or 500 tons of coal daily.

In reply to a query by Mr. Kaseman of New Mexico, whether it was the tendency of inventors to devote their attention to such devices as the steam-shovel for large veins, or for low veins, Mr. Scholz said that he believed most of the machines were for relatively thick seams—from 4 to 8 ft. Some shoveling or conveying machines will operate in coal as low as 5½ ft.

It seemed to be the consensus of opinion, however, that progress could be made along these lines and that small differences between the manufacturers on certain details could be avoided and in time that with the co-operation of the manufacturers very considerable improvement would be made which would work for economy in the maintenance of such machines.

With intelligent and conservative requests by the operators through their Standardization Committees, it is fully believed that the manufacturers will end such co-operation and that we shall finally progress much further along these lines than at present would seem possible, especially to those who have not given a great deal of thought to the matter.

CHAIRMAN SCHOLZ: The next matter on the program is the report of the Committee on Standardization of Outside Coal-Handling Equipment, of which Col. Roberts is chairman, and will be presented by Mr. Needham:

Report on Outside Coal-Handling Equipment

The Chairman of this Sub-Committee has had such time as he could spare from his regular duties almost entirely occupied with the work required as Chairman of the General Committee of the Coal Mining Branch, consequently the work of this Sub-Committee has not received proper attention. We therefore suggest that the General Committee select a new Chairman for this Sub-Committee. The present Chairman will very gladly serve as a member of this Sub-Committee, but hopes that the General Committee will select from this Sub-Committee, as at present constituted, someone else to act as Chairman,

It was the sense of this Sub-Committee, as indicated in its report to the General Committee at our last annual Convention, that each Sub-Committee should first concern itself with the more general and important matters relating to the designing and installation of equipment included under their sub-division of Standardization and Mining Equipment. To this end it was recommended that each Sub-Committee should make a careful study of present practice, as related to the work of their Sub-Committee, and include in their first work the improvement and standardization of the general practice and methods relating to their sub-division work, and that this work should then be followed by a study of equipment included in their sub-division of work, and endeavor to improve and standardize such equipment.

Following this general and comprehensive program, this Sub-Committee has taken under consideration, and begs to report suggestions and recommendations for the consideration of the General Committee as follows:

The study of present practice as related to the designing and building of coal tipples, head-frames, etc., indicates that one of the first and most important duties of this Sub-Committee is to try and improve and standardize the present practice which relates to the safety and economy in the operation of this unit of a mining plant.

Railroad Clearances

A study of present practice indicates that there is no uniformity in the clearance either horizontally or vertically for railroad tracks passing beneath tipples. This lack of uniformity and good practice in the various coalfields, has compelled certain railroads to promulgate regulations governing such clearances. In some instances, these regulations seem to be adequate and reasonable, and in other instances, they seem to be unduly conservative and impose on coal companies providing new facilities, expense that even good practice and safety would not require. Your Committee, therefore, after careful consideration of this matter makes the following recommendations regarding clearances for railroad cars:

A standard practice should be adopted, which would provide for a lateral clearance between the widest cars passing under such tipple, and the nearest tipple support, or any support built in connection with the tipple structure, of at least 18 inches.

That no support should be placed between railroad tracks passing under a tipple structure except between the two outside tracks, namely, the usual dump track and the one adjacent, except where the requirements make it absolutely necessary to insert supports between other tracks.

That the clearance between cars on tracks where no supports are inserted should not be less than 2 ft.

Referring to the vertical clearance above railroad cars passing under tipple structure, it has been difficult for your Committee to reach a satisfactory conclusion on account of the varying heights of railroad equip-

ment, and especially due to the fact that certain railroads have regulations regarding the passing of engines under tipple structures. However, your Committee recommends that this matter be taken up for discussion at our coming Standardization Conference, with the object of trying to secure suggestions from our members which your Committee will then take under further consideration.

We believe that this question of railroad clearances under tipple structures is of sufficient importance to warrant its most careful consideration with the ultimate object of trying to secure more uniform and safer practice.

To secure these results it may be necessary, after definite conclusions have been reached—which are satisfactory to the more progressive element in the industry—to enforce safe requirements regarding clearances by State legislation in respective districts where this may be required.

Clearances for Over-Wind

A study of present practice indicates that there is not sufficient importance given to providing adequate distance between the point of dump in tipples, and the first obstruction in the tipple above the point of dump.

When slow-speed hoists were in general use, so much importance did not attach to the question of proper clearance for over-wind. However, even in the past, properly designed tipples always provided a few feet of clearance above the highest point reached by the cage when dumping, and the nearest obstruction in the tipple or head-frame above.

With the present extensive use of high-speed electric hoists, this matter of clearance for over-wind becomes an important one, and a safe clearance should always be provided, taking into account the speed of the cage when entering the dumping horns, and also considering all devices to be installed both in the tipple or on the hoist to prevent over-winding.

Your Committee has not reached definite conclusions in this matter, and therefore wishes to refer it to the Conference for further discussion and suggestions.

It also seems reasonable that automatic stops should be provided to prevent or control over-wind in high-speed electric hoists.

Your Committee would be pleased to have this question discussed and to receive your suggestions.

Fire Protection

There is a great lack of uniformity and safe practice as regards the building of structures over or near mine openings. Certain States have laws requiring that only fireproof structures may be built over or within a certain specified distance of any mine opening. In other States, where such legal requirements do not make it necessary, unsafe practice largely prevails.

Your Committee therefore recommends that good and safe practice, as provided for by the mining laws of certain States, regarding fireproof structures over or near mine openings, should be adopted, and an effort made to have such practice adopted in other States.

Even in the States where laws have been passed for such protection, the laws are not always sufficiently definite and controversy arises between the State Mining Board and operators who wish to economize.

We believe that a careful study should be made of the requirements in States having such protective laws, with the object of recommending to the State Mining Boards what we would consider good and safe practice. We fully believe that these Boards would welcome such suggestions and recommendations from our Congress.

We further believe that a careful study of the ultimate economy secured by providing fireproof structures over and adjacent to mine openings would fully warrant the expenditure necessary to secure such protection. Frequent fires at coal mines, at the most inopportune time, when production is required, indicate that a reasonable expenditure to prevent such fires, is an evident economy in the life and operation of a mine.

It would seem that only persistent education carried on through such agencies as our Congress, and other organizations of like purpose, is necessary to secure these beneficial results.

Standardization of Merchandizing Machinery

It would seem to your Committee, after careful consideration of the matter, that considerable standardization could be accomplished in certain standard equipment and machinery as now provided by manufacturers of such machinery.

In making this suggestion it is not contemplated that requests should be made on manufacturers to produce uniform machinery for certain purposes, but only to provide such machinery with as nearly as possible standard and uniform connecting parts.

We believe that the manufacturers will co-operate with us in our endeavor to standardize such parts, and thereby obviate the great diversity of such connections as now appear on machinery made for the same purpose.

Your Committee therefore recommends that this matter be fully discussed, and that special inquiries should be made from the manufacturers' representatives present at our Standardization Conference, to obtain their views, and if possible, their co-operation in securing the beneficial results from the operators' viewpoint from such standardization.

Cages, Skips, and Dumps

We believe that a careful study of the cages and skips used for hoisting men, coal, and materials, will indicate that there is opportunity for a vast improvement in the safety devices applied to such equipment.

It would not seem feasible to endeavor to secure the adoption of any standards for such devices, so far as their uniformity is concerned, but it would appear practical and highly beneficial to make a study of all such devices with the object of adopting and recommending those which would comply with good, safe practice for the various equipment to which they would apply, and to endeavor to secure the adoption of better and safer devices on such equipment as now marketed and which is not provided with safe appliances. Your Committee therefore recommends a more careful and extended study of this subject.

We believe that there is so much room for general improvement in present day practice, especially among the lines that we have mentioned above, that little opposition would be encountered from the industry in securing the adoption of our recommendations if we will keep them within conservative lines.

We also believe that having secured the adoption of certain improved practices and standards by the industry, that it will naturally follow that further improvement and standardization can be recommended, and will also be adopted. This process of education and improvement go hand in hand, and is a line along which all progress is made in any industry.

Following is a brief of the discussion of the Report of the Sub-Committee on Outside Coal-Handling Equipment by the Chairman of the General Committee:

Discussion of Sub-Committee's Report

Mr. Wilson stated that he was greatly impressed with the valuable contributions in this report, especially those relating to safety, and suggested that the discussion be taken up in the order of the recommendations made by the Sub-Committee.

Mr. Scholz, acting-chairman of the Conference, stated that the first recommendation of the Sub-Committee referred to clearances for railroad cars under tipple structures, and that the Committee made definite recommendations regarding horizontal clearances, but had found it difficult to decide on the vertical clearance due to the varying height of railroad cars.

In this connection Mr. Scholz stated that the Virginian Railway was using 120-ton coal cars, which he believed were 10 ft. 6 in. high, while the Western roads used not only smaller cars, but cars of much less height for the reason that they were of the gondola type.

Mr. Needham did not believe it practical to recommend a standard vertical clearance, on account of the great diversity in the height of railroad cars.

Mr. Wilson spoke at considerable length regarding the necessity for providing proper vertical clearance above loading platforms, and advised that certain Workmen's Compensation Acts require insurance men to de-

termine certain standards of safety in this connection, and he asked the co-operation of the American Mining Congress and others in this direction.

Highest Railroad Cars Determine Clearance of Tipples

Mr. Kiser suggested that his understanding of vertical clearance would be the difference between the fixed tipple structure and the highest railroad cars that would visit a particular mine.

The Chairman of your Committee, in reviewing this discussion, agrees with the latter conclusion, and believes it possible to recommend and adopt a minimum vertical clearance which it would be assumed should be the clearance, as Mr. Kiser suggests, above the highest railroad cars delivered to any particular mine.

Regarding the horizontal clearance, Mr. Wilson stated that he thought the recommendations of the Committee, namely, a minimum of 18 in. between any support under the tipple structure, and the widest railroad cars passing under such structure was insufficient, and it should be at least 20 inches. There seemed to be no adverse opinion to this suggestion and the Sub-Committee will therefore accept this recommendation.

Mr. Scholz stated that the next question for discussion in this Sub-Committee's report was 'clearance for over-wind.' He stated that this was an important matter, due to the adoption of high-speed hoists, especially at large mines, where the cages or skips were likewise of a heavy type, and for this reason a much larger clearance was required for safety than at mines where slow-speed hoists and lighter equipment were used.

Mr. Bright advised that he had visited mines where there was practically no clearance for over-wind allowed, or at best only a foot or two, which he considered a dangerous condition. He therefore considered it important that some reasonable safe clearance for over-wind should be agreed upon.

Mr. Larson was of the opinion that even with adequate clearance for over-wind safety would not be attained without the use of proper safety devices for slowing down, and for preventing over-wind.

Mr. Kiser suggested that such devices for slowing down and preventing over-wind were difficult to apply where the tonnage required at a mine was greatly taxing the hoisting equipment.

Summing up this discussion, your Committee believes that a reasonable minimum clearance for over-wind of at least 10 or 12 ft. is advisable, and will be an additional feature of safety notwithstanding any other safety devices that may be applied.

Mr. Scholz stated that the next subject recommended by the Committee for consideration was fire protection:

Fire-Resistant a Better Term Than Fireproof

Mr. Wilson believed that real fireproofing is a very much over-worked phrase, and is very badly applied in general. He had a great deal of

experience in this connection while in conferences with the National Fire Protection Association, and he advised that practically nothing in the way of building construction is fireproof, and therefore suggests that we would better use the term 'fire-resistant' and 'slow-burning' for another grade of construction. He believed that this important subject needed further consideration, and that it would be well to appoint a Sub-Committee from this Committee to make a careful study of this whole subject of fire protection for mine shafts, slopes, and mine bottoms.

There was considerable discussion of this subject, and it seemed to be the consensus of opinion that several types of construction being used to fulfill the requirements of mine laws for fireproof construction did not always answer this requirement, especially after such construction had been installed for some time, and might be damaged by accident or otherwise.

Your Committee therefore would sum up this discussion with the conclusion that no construction is fireproof if it is made up of combustible material, even though such material may be covered with a layer of fire-proofing, or fire-resisting material.

Your Committee also agrees with the suggestion that this is a subject of sufficient importance to deserve the further consideration of a special committee, which would make a thorough study of the subject and report back to this Committee.

Mr. Scholz stated that the next subject presented by the Committee for consideration was standardizing machinery.

The discussion of this topic seemed to be wide of the mark, and your Committee can only hope that on publication of the work, more careful consideration will be given to the recommendation by the Committee regarding standardization of certain parts of more or less standardized equipment and machinery.

Mr. Scholz stated that the last subject submitted by the Committee for consideration was cages, skips and dumps, a subject on which he could spend a whole day and then have much left to say. No further discussion was offered on the recommendations of the Committee that certain minimum requirements for safety should be recommended and adopted for cages, skips, and dumps.

MR. SCHOLZ: If there is no further discussion, we will pass to the next paper, which is the report of the Sub-Committee on Underground Transportation, of which Mr. Watts is chairman.

Following is the Report of the Sub-Committee on Standardization of Underground Transportation:

The adoption of standards is a matter of education and leads to safe and economical production and operation for both manufacturer and consumer of such apparatus and equipment as falls within the influence of its prescribed subjects. While we understand that this Committee was authorized to recommend standards covering transportation problems of underground mine operation, yet we believe in view of the experience of other organizations and associations similarly engaged in attempts to standardize certain matters in connection with their work, that better results will be obtained if at present we were to suggest a number of practices that would be known as 'Recommended Practices' rather than iron bound or fixed standards. We feel that when a standard of anything is adopted, it should be one that all of the members of any association could and would subscribe to.

The Sub-Committee undertakes to submit for the General Committee's consideration Recommended Practices on the following: (1) track gage; (2) minimum track curvature; (3) wheel-base—coal mine-cars; and (4) maximum outside length of car-body; and, in addition to these, to outline the work in connection with details of car construction, which it has in view for early attention.

Track Gage (Recommended practice, 42 inches)

It is well recognized by the Committee that at the present time track gages vary by almost inches from 24 to 48 in. with standard-gage track occasionally in use. They recognize also that 36, 42, 44, and 48-in. gage tracks predominate, and we have ascertained that in installations recently made and contemplated, about 80% of the track to be installed is of 42-in. gage. The Committee realizes the actual necessity of making one gage of track as a Recommended Practice if we are ever to accomplish anything in the way of standards. We realize that mine developments are becoming larger, heavier cars are being used, larger locomotives are required, higher speeds are necessary, all of which tends to economy, and after material deliberation we have decided to make the definite recommendation for a 42-in. gage track, because on this gage can be constructed a standard car which is capable of containing any tonnage from 1 to 5 tons of coal.

Minimum Track Curvature

Recommended Practice—for rooms, not main haulage, 28 ft. radius based on No. 2 track-frog, having an angle of $28^{\circ} 04'$. Having recommended a definite track gage the Committee feels the necessity of recommending a minimum curvature of track. After giving this subject much consideration, and consulting with the manufacturers of track, we find that most consistent minimum curvature that could be established would be that of a 28-ft. radius, which is based on the use of a No. 2 track-frog having an angle of $28^{\circ} 04'$. The Committee realizes that this is seem-

ingly a large step in track construction. It has considered that there will probably be a little increase in cost in the initial laying of track with this curvature. We have, however, considered its relation to the 42-in. gage of track, and to the capacity of cars that must be hauled around the curves. There is, as all engineers realize, a direct relation between track-gage curvature and wheel-base of cars which will permit economy in operation of equipment, economy in track repairs, and a distinct lessening in car derailments, which are in themselves economies.

Wheel-Base of Coal Mine-Cars (Recommended Practice, Minimum 42 inches)

The Committee makes this direct recommendation, because there is a distinct relation, that must be adhered to, between track gage, curvature, and wheel-base. A wheel-base equal to track gage is (1) theoretically correct and practically permissible; (2) it eliminates derailment; (3) increases speed; (4) lengthens the life of cars in service; (5) future operations tends to higher speed and larger capacity cars; and (6) while this is a radical departure from present practice since the early establishment of 26-in. wheel-base, it is realized that these short wheel-bases are fast passing from mines. New features, such as mechanically-handled cars at the face of rooms, the necessity of reducing the cost of operation, all tending towards the use of the larger car, which in turn necessitates the longer wheel-base.

Overall Length of Car-Body (Recommended Practice)

The maximum outside length of coal mine-car body measured over sills—not bumpers—shall be 126 in. In an endeavor to establish a fixed relation between the wheel-base and the length of the car-body, due consideration has been given to the results observed in deteriorating effects of mine-cars in service. It is generally considered that one of the principal channels of deterioration of coal mine-cars comes through the bending of the car-body bottom over the axles when the centers of axles are too close together. This results in the early destruction of the car, and therefore means a heavy repair expense because of this short wheel-base. Therefore it was unanimously agreed that the over-hang of a car-body should not exceed one-third of its total length. This in turn means that the maximum car-body length will be three times the wheel-base, and since the wheel-base has been fixed at 42 in., it is better to state this length of car-body in fixed terms of inches rather than relating it in any way to the wheel-base.

Couplers and Height of Coupler Center

The Committee discussed the advisability of recommending practices for couplers and the height of coupler centers. The discussion developed that the Federal Government had already thoroughly cared for the subject of safety appliances for railways through the Interstate Commerce Commission, and that it was possible in the future that the Government might establish more or less safety appliance standards for mine equipment, so it might be well if the American Mining Congress could anticipate any

action that the Government might take regarding safety rules in mine-car equipment. It was therefore recommended by this Sub-Committee that an automatic coupler should be considered, also that the height of center of couplers, based on 16-in. wheels, shall be 10 in. above rails. A variation 1 in. above and 1 in. below will be allowed to accommodate 18 and 14 in. wheels, respectively. This provides for placing the drawbar under the car-floor instead of above, as is the present general practice.

These subjects will be considered, and final recommendations made by this Sub-Committee at an early date. There are many items involved when considering the height of coupler center before a standard truck can be decided upon, such as wheel diameters, thickness and height of flanges, size of axles, size of boxes, etc. These points should be considered and established in conjunction with the question of type of coupler and height of coupler center.

Industrial Car Manufacturers' Institute (Recommended Practice)

This organization, which is an association of industrial car builders, having already established certain Recommended Practices bearing on the practical as well as theoretical construction of coal mine-cars, has given our Sub-Committee a memorandum of its Recommended Practices that have so far been adopted. It is our understanding that these practices will be enlarged upon from time to time, and will include recommendations covering practices for treads and flanges of wheels, weights of wheels for carrying capacity of cars, diameter for axles, and journal bearings, types of couplers, and so forth.

As the time of this Sub-Committee has been occupied by the disposal of the above definite recommendations, the practices of the Industrial Car Manufacturers' Institute have not been discussed in detail at any of our meetings, but they will be carefully considered by the Members of the Sub-Committee, with the idea of discussing them at the next meeting. For the information of members of the American Mining Congress, a copy of the Industrial Car Manufacturers' Institute's 'Recommended Practices' for mine-car construction is attached to this report.

DATA ON COAL-MINE CARS

Bolts

In construction, bolts of $\frac{1}{2}$ and $\frac{3}{4}$ -in. diameter only are to be used, and lengths shall not vary in multiples of less than $\frac{1}{2}$ inch.

Capacity

Weights of coal to be used in computing size of car-bodies:'

Coals.	Cubic Feet per ton of 2,000 lb.	Pounds per cubic foot.
Gas	42	47.6
Low volatile.....	35	57.1
Anthracite	35	57.1

Car-Bodies (Widths)

The outside width of car-body bottoms (measured inside of belt shall be 6 in. less than track gage.

Factor of Safety

For running gear and under-frame a factor of safety of not less than four to be used.

Irons (Square and Round)

Square and round iron will be limited to sizes varying not less than 1/8 in. thickness or diameter.

Irons (Car-Body)

All kinds of flat irons, including binders, belt braces, and braces, vertical braces, box braces, drawbars, etc., shall be made in sizes varying not less than 1/2 in. width, nor 1/8 in. thickness.

Lumber Sizes

Where specifications and prints do not definitely state the requirement, it should be considered that sizes given are for sawed material.

If finished material is called for, it is recommended that material furnished shall be of the nearest standard finished size to that called for.

Rating

To determine size of bodies, to be 'water-level full with top of sides.'

Questionnaire for Coal Mine-Cars

(This form approved by the Industrial Car Manufacturers' Institute.)

Questionnaire No..... Date.....

Capacity Bushels..... Cubic feet.....

Gage of Track..... Wheel-Base..... Size of Axles.....

Wheels Diameter..... Style..... Size of journal.....

Length Inside of car.....
Center line coupling link.....
Over bumpers.....

Height Car side above rail.....
Rear end above bottom.....

Brake Is brake wanted?..... Style.....
Single or double.....

Brake Lever Handle On which side standing at rear of car?
Does it pull to right or left?
Show rough outline on sketch on back of sheet.

Bumpers Style.....
Diameter of holes—Top..... Bottom.....

Door-Latch Style..... On which side standing at rear?

Drawbar

Type.....
 Size of coupling holes..... Make sketch

End Gate, If Required

Lift or swing type.....

Hitching, if required:

..... (Describe)

Track Curvature

In order that cars will operate most satisfactory in ore and coal mines, the following information for elevating the outside rail of track on curve, which is considered general good practice, is given to members to be used when they are called upon to suggest types of track construction. This information is taken from the 'Coal Miners' Pocket Book.'

Degree of curve.	Radius of curve, feet.	Elevation of outer rail, inches.
1	5,729.6	$\frac{1}{3}$
2	2,864.9	$\frac{1}{4}$
3	1,910.1	$\frac{5}{16}$
4	1,432.7	$\frac{7}{16}$
5	1,146.3	$\frac{9}{16}$
6	955.4	$\frac{11}{16}$
7	819.0	$\frac{13}{16}$
8	716.8	$\frac{7}{8}$
9	637.3	1
10.0	573.7	$\frac{11}{8}$
12.0	478.3	$\frac{15}{16}$
15.0	383.1	$\frac{15}{8}$
18.0	319.6	$\frac{115}{16}$
20.0	287.9	$\frac{25}{16}$
60.0	100.0	$\frac{41}{6}$
112.9	60.0	$\frac{41}{2}$
180.0	50.0	$\frac{41}{2}$

It is not generally advisable to elevate the rail more than $4\frac{1}{2}$ in., as it is not good practice to attempt to run trips around sharp curves at a high speed. The rule for standard-gage roads (4 ft. $8\frac{1}{2}$ in.) on surface and for speeds of 25 to 35 miles per hour, is to elevate the outer rail $\frac{1}{2}$ in. for each degree of curvature. An approximate rule often given for narrower gages is to make the elevation proportional to the gage based on the amount given for standard gage. Thus, for a 36-in. gage, the elevation would be about two-thirds of the elevation for a $56\frac{1}{2}$ -in. gage for the same speed and curve.

The elevations of the outer rail given in the table correspond to the middle ordinates of the respective curves for a chord of 20 ft. Hence, a common rule to determine the amount of the elevation of the outer rail, for a speed of 15 miles per hour for a 3-ft. gage, is to measure the middle ordinate of a string 20 ft. long, stretched as a chord on the gage-line of the outer rail. For higher or lower speeds, make the length of the string proportional to the speed; thus, for a speed of 12 miles per hour use a 16-ft. string; for 9 miles per hour a 12-ft. string, etc. Also the elevation should be proportional to the gage; thus, for a 30-in. gage, use five-sixths of the above elevation, etc.

The general rule is to begin to elevate the rail a short distance before the curve begins, this distance depending on the amount required. It is, however, not always practicable to do this in mine work.

Track Gage

For new track construction and for use of equipment wherever possible, the 36, 42, 48 and 56½ in. (4 ft. 8½ in. railroad standard).

Wheel-Base (Length of)

Wheel-base variations to be between 24 in. minimum and 40 in. maximum, and the variations be not less than 2 in. or multiples of 2 inches.

The following wheel-base computation should be followed: The radius of curves over which cars must travel, given in feet, when multiplied by two, gives most desirable wheel-base in inches.

Wheel Diameters

Wheels of the following diameters only to be used: 14, 16 and 18 inches.

Wheel Mounting

In mounting wheels on axles, the wheel gage, which should be measured from throat of flange to throat of flange on opposite wheel, should be ½ in. less than track gage.

Following is the address delivered to Joint Sections of Metal and Coal Mining Standardization Sections of the American Mining Congress, by James Milliken president of the Industrial Car Manufacturers' Institute.

At the request of Colonel Warren R. Roberts, chairman of the Standardization Committee, Coal Mining Section, of the American Mining Congress, I prepared a paper to be read before this Congress. Since attending several of the Standardization Committees' conferences I have been impressed with the necessity of our doing a number of things in a consecutive order, so that the standardization of mining equipment may become an established fact. If you will bear with me for a few moments I want to emphasize a number of necessities of the case.

Standardization Means Economies and Efficiency

You appreciate the real value of standardization. It means economies and efficiency. In order that standards may be actually realized, it is first necessary that we convince the mine operators that the proposed standards are correct, and that real economies will result. In order to do that, in the first place your several Committees must make the same recommendations. Unless this is done, no real standards can be set. This is, I believe, the first real Standardization Congress that has been held,

or in which real reports have been presented, and it will be noted that some of the Sub-Committees' reports are not in line with each other. I want, therefore, to suggest the necessity of having all individual Committee's or Sub-Committees' reports considered by a General Committee before being presented to the Congress, in order that single definite recommendations can be made.

It is not difficult to make recommendations for standard practices, but it is going to be hard to convince all of the members of this organization that the standards recommended are correct, and will result in economies. It is one thing to make standard practices, and another to get members to agree to follow them, and unless this is done there is no value in establishing standard practices. It has been the experience of a large number of associations that the best way to educate men to the use of standards is to introduce them as recommended practices. This has two advantages: The practice is not compulsory until it is proved correct. When once the correctness of a principle is established and understood, there will be no difficulty in getting members to subscribe to it. It is, therefore, earnestly recommended that all of the suggested standards be adopted first as Recommended Practices, and in order that you may know that members are willing to agree to follow them, it is further recommended that each Practice be submitted to each member in the form of a letter ballot. If your Recommended Practices are correct, your ballots will all be voted for, and when your members vote for them then will they be willing to agree to them.

Mine-Cars Easily Standardized

I am pleased to talk about the practicability of standardizing mine-car equipment for two reasons: (1) because of my association with the Industrial Car Manufacturers' Institute; and (2) because I personally believe thoroughly in the economies of standardization.

The Industrial Car Manufacturers' Institute is really a get-together association of a number of the manufacturers of industrial cars; to procure economical results; promote a spirit of co-operation among its members; provide means for interchange of views effecting industrial car building interests; to provide means for discussion of live topics; to preserve equitable conditions not only in the workshop, but in selling practices; and to standardize designs and specifications and bring about a uniformity in method of inspection, purchase, etc.

Much of the work that has been accomplished by this Institute is the adoption of Recommended Practices in industrial car construction, which will eventually lead to real standardization in construction. About the details of that I will tell you more a little later. Whenever large work is undertaken, or a multiplicity of interests are combined, standardization follows, which inevitably results in many economies. The Master Car Builders' Association was formed about 1872, and a great amount of work has been accomplished by it in the way of standardizing freight-car equipment for interchange throughout the United States. At the present time, practically all of the parts of freight-cars requiring extensive renewal or

repairs are standard throughout the country for the several types and capacities of cars. The result of this is that if a Pennsylvania Railroad car needs a new pair of wheels, or a new coupler, or a new journal bearing, when the car is in Denver or San Francisco, the repair-men at that point make the necessary renewal of the same sizes and kinds of materials that are being used by the owning road. It can be readily realized what it would mean to keep freight-cars running over all this country if every railroad had to keep repair parts for every other company's cars which come into that particular territory. I talk particularly of cars, because they seem to be more apropos of the coal mine-car problem.

Standard Sizes of Steel Products

The question of standardization, however, applies to practically all modern business methods. It applies to steel production, and to the manufacture of almost any article that is generally used throughout the country. Where would we be if pipe sizes, fittings, and treads, were not standardized? We must all acknowledge it would be very inconvenient if electric-light bulbs were not standardized throughout the country. Large department stores have their standards; many order-houses have theirs; and in fact in almost any walk of life standards of one kind or another have been adopted and are in daily use.

While the question of details for freight-cars has been generally standardized, for the construction of industrial car equipment, particularly when gages other than that of the standard-gage railroads are considered, there are really no standards at the present time.

The Industrial Car Manufacturers' Institute is composed of members who build industrial cars. This membership is sub-divided into groups and one of these groups represents the builders of coal mine-cars. One of their particular desires is to standardize, just as far as possible, mine-car construction, for their own economies and in order to produce coal mine-cars that will give the best of service. At the present time there are many hundreds of coal mines in operation which could use cars of exactly similar design, where the operating conditions are practically the same. If a standard car can be adopted to give a maximum service, it will certainly of great advantage to the mine-car operator, because he gets the best car that can be designed, and because these cars and their parts can be made in larger quantities the cost is going to be materially reduced. At the present time there are scarcely any two car-builders or any two engineers who manufacture or design the same type of a mine-car wheel. There is certainly one tread, one flange, and one-weight wheel for a given capacity car that will give the maximum service. At the present time there are hardly any two alike. Some designs are good; some designs are bad; some wheels are too light for the service, and others are so heavy that unnecessary weight is being dragged around. This same feature applies to sizes of axles and journals, sizes and shapes of belts or binders, sizes and heights of couplers, etc., the manufacturer has to make innumerable patterns for castings, innumerable forms for making car irons of many shapes and sizes. In order to supply demands they have to

carry in stock quantities of these many different types and sizes. When these parts are all standardized, and by that I do not necessarily mean simply one standard for all kinds of service and for all operating conditions, but I do mean that there are standards that can be produced that will meet your operating conditions and that will give you many and lasting economies.

Recommended Practices Adopted

Up to the present time the Industrial Car Manufacturers' Institute has adopted Recommended Practices covering specifications for materials that will be used in mine-car construction; a factor of safety for these materials; they all compute the capacity of cars in the way; they all use the same weights for gas coals, low volatile coals, and anthracite coals, in computing the capacity of their cars; they have decided upon the proper size bolts and rivets, car irons, etc., which should be used in cars of varying capacities; they now use a standard specification or, called by a better term, a questionnaire for the purchaser of mine-car equipment; they are prepared to make recommendations covering the best practice for gage or track, curvature of track, wheel-base of cars, wheel diameters, and so forth.

You have a Committee on the Standardization of Underground Transportation which has made a report to this Convention. The members of the Committee had a number of meetings, and have devoted much time and thought to the question of standardization. They have made a few definite recommendations covering new installations. Some of you may have been startled by these recommendations, which are far-reaching. When, however, you consider the real inwardness of the report and the step that it is going to be, I trust that you will all give the several questions your mature consideration. When you do this I feel sure that the recommendations of this Committee will be unanimously adopted.

For the Industrial Car Manufacturers' Institute I can say that we will be glad to work along with your Committees, your operators, your mine superintendents, and your engineers, in the endeavor to establish standards in mine-car construction, which will give to the operators the most efficient and the most economical coal mine-cars that can be produced.

Following is the brief of discussion on the Report of the Sub-Committee on Underground Transportation by the Chairman of the General Committee:

This Sub-Committee was fortunate in having its Chairman present, who read the report and offered the following brief explanation regarding the work of the Committee:

Composition of Committees

Mr. Watts explained that his Committee was composed of men representing the operating branch of the industry, consulting mining engineers, and manufacturers, and that therefore his Committee was quite representative of the industry. He further advised that the Committee had many interesting meetings, and he had discussed at great length all the subjects covered in the report, and therefore the recommendations represented a great deal of earnest thought on this subject.

Mr. Ebe inquired whether the Committee in making the recommendations on track gages had taken into consideration the methods of mining by long-wall system in the northern fields, and Mr. Watts replied that their recommendations were applicable for that system of mining.

Mr. Milliken first called attention to the fact that different track gages were recommended in another Sub-Committee's report than those in the report under discussion, and in this connection pointed out the necessity for co-ordinating these reports. He made the additional suggestion that instead of at first adopting standards, it might be well to submit to the industry 'Recommended Practices,' and in this manner lead up later to standards. He also stated that he did not agree with some criticism that had been offered by others regarding the lack of co-operation on the part of manufacturers to improving and standardizing mining equipment, and he stated that the car manufacturers, and particularly those of coal mine-cars, are looking forward earnestly to an adoption of recommended practices which will eventually become standards. He stated further that the Industrial Car Manufacturers' Institute is divided into groups and one of these groups is devoted to the construction of mine-cars. This group has done a great deal of good work in the way of adopting recommended practices for a good many details. Mr. Milliken advised that if this Standardization Conference would adopt standards, or recommend good practices, the car manufacturers would be glad to follow them.

Work of National Safety Council

Mr. Hall, representing the National Safety Council, advised that the Council was interested in the safety of machinery as well as practices around mines, and that the Council had done a great deal of good work in trying to promote improved and safe practice. He stated that the Council felt it had not had proper recognition by not being given appointments on the Standardization Committees. He thought this was doubtless an oversight, or based on the presumption that the men in the National Safety Council were too busy to attend committee meetings.

He also advised that the Council had arranged with the U. S. Bureau of Mines to secure the services of Mr. C. E. Juraden, who would be detailed to the Mining Division of the Council's work, and are ready to co-operate with our Standardization Committees.

Mr. Kiser closed the discussion by calling Mr. Hall's attention to the fact that the American Mining Congress has a special committee on Safety Codes, which Committee is composed of one member from each of the Sub-Committees on Standardization, and that this Committee was appointed with the intention that it should act in a joint capacity between the various Sub-Committees on Standardization and the National Safety Council, or any other organization interested in this work of Standardization.

Replying further to Mr. Hall's suggestion that the National Safety Council was anxious to co-operate in this work, and to have representatives on our Standardization Committees, we have to advise that the Chairman of your General Committee has had conferences with Mr. Williams, chief engineer of the National Safety Council, on this subject, and advised him that we were anxious to have its co-operation. However, it seems that the pressure of other matters has prevented them from giving us much assistance so far. It is our earnest desire, however, to have such co-operation, and another effort will be made to secure it.

Recommendations Require Consideration

We wish particularly to call attention to the fact that this Sub-Committee gave first attention to improved and standard practices, and that many of their meetings were devoted to these broader subjects and that in their report they make a few recommendations which should have the earnest consideration of the industry.

The adoption of the practices recommended by this Committee in opening up of new mines, or the resuscitation of old mines would be of very great benefit not only to the industry but to manufacturers also.

MR. SCHOLZ: We will now have the paper on Ventilation by Mr. W. J. Montgomery. [He was not present, but Mr. Rowe of the American Blower Co, who disagreed with most of it, gave a resume. The report has since been revised somewhat.]

Following is the Report of the Sub-Committee on Standardization of Mine Ventilation, signed by Mr. Montgomery:

As Chairman of the Sub-Committee on Standardization of Mine Ventilation equipment, I am pleased to submit the following recommendations, with a view of establishing this important factor of the great mining industry on a higher plane where it rightly belongs.

The suggestions as set forth in this report have not been approved by the various members of the Sub-Committee, but they were taken from letters received from the members and other data compiled by your chairman. The general opinion was expressed that there is not much room to standardize fans when they must be built to meet every condition found in the mining field. However, we believe there is a large field before us in the way of presenting mine ventilation data with a view of impressing those in charge of this important work with the great necessity of providing large air-ways and keeping them free from obstructions throughout the life of the mine. This report will deal with recommendations as to fan installation, boosters, air-ways, and velocities.

The following is recommended for fan installations:

1. That for all gaseous mines there should be an auxiliary fan installed with drive complete.
2. That for all non-gaseous mines at least an auxiliary drive should be provided.
3. That the driving power for the auxiliary equipment should be from a different source than that for the main drive, especially so if electric drives are employed.
4. That all fans be made fireproof. No combustible material should be used for the installation.
5. That there be a maximum outlet velocity into the open atmosphere, varying with the water-gauge against which the fan is operating.
6. That there be a maximum inlet velocity to the fan varying with the water-gauge against which the fan is working.
7. That all fans for gaseous, and large non-gaseous mines be so constructed that they can be readily reversed.
8. That fans should not be reversed under any circumstances, unless conditions inside the mine are thoroughly known.
10. That in case of moderate to large capacity mines it is advantageous to the operator to install a permanent fan at the beginning of operation, and that where the fan is not too far placed from the boiler-house, a steam-engine drive is better adapted; this because it is more economical than an electric drive, and because the speed of the fan is more easily regulated. Where electricity is the power employed at a mine with a large fan, we recommend a slip-ring motor in preference to a squirrel-cage type.

11. That if a temporary fan is installed, it should be so placed that the installation of the permanent fan will not interfere with the operation of the temporary one.
12. That all fan installations be equipped with a regular U-tube water-gauge.

Booster-Fans

1. That they are recommended for use in mines where a section is so remote as to become insufficiently ventilated and where a permanent fan on the outside is in use, but we do not approve of the use of a booster fan as the only source of ventilation, that is a permanent fan should be on the outside.
2. That the brattice and booster fan installation be made absolutely fireproof.
3. That a by-pass door be made in the brattice of ample size to permit sufficient volume to pass without going through the booster.
4. That the by-pass door should always swing in the direction of the air current.
5. That the moter driving the booster-fan be provided with an automatic starter.

Air-Ways

With respect to the air-ways, we believe that no mine should be permitted to get into such a condition as to require a water-gage of over 3 inches to ventilate it properly, and as a means to this end we recommend the following:

1. That all air-ways be driven straight, and where changes in direction are necessary, they be made by long radius curves.
2. That an easement be provided at the bottom of the fan air-shaft to enable a change of direction with a minimum of shock.
3. That all air-ways be kept clean and free from accumulations of falls, mine-cars, old timbers, etc.
4. That where overcasts are used, the air-ways over the bridge be of the same cross-section as found in the entries and that an easement be provided on each side of the bridge.
5. That in the interest of both safety and economy the air be divided into several splits rather than forced to travel in one continuous current.
6. That all brattices and stoppings be made air-tight.
7. That the air shall not pass through old workings to new workings.
8. That wherever possible in a mine, air be brought in or discharged from openings at points remote from the fan.
9. That where labor and roof conditions permit, the multiple-entry system be used.

10. That a change in the laws governing crosscuts be enacted permitting parallel entries to be driven 200 ft. or more before a crosscut is made; the ventilation of these entries to be accomplished by means of small auxiliary fans and the air current carried to the face through tubing.

This method will ensure a copious supply at the face at all times, reduce the cost of making numerous cuts and building stoppings, prevent a vast amount of air leakage and short circuiting, and in turn greatly reduce the volume of air the permanent fan must handle with a corresponding decrease in power consumption.

11. That where stoppings are built, they should be constructed of masonry. Piling of gob material against masonry stoppings should be avoided. Stoppings should be inspected frequently.

12. That the splits should be made close to the intake, and the several branches united again close as possible to the outlet.

13. That there should be a free and unobstructed inlet and outlet for the air. Haulways and hoisting shafts offer too much obstruction.

Air Velocities

In respect to the velocity of air currents, the following is recommended:

1. That the velocity in the main entries shall not exceed 1000 ft. per minute.

2. That the velocity at face of workings shall not exceed 300 ft. per minute.

3. That the velocity in the air-shaft or drift shall not exceed 2000 ft. per minute.

General Conclusions

It is the opinion of your Chairman that a system of educational work should be started relative to the operation and duties performed by mine-fans. There appears to be a woeful lack of data and knowledge of the subject. Hundreds of mine-fans are condemned by their users as well as by many mine inspectors simply because the mine will not pass the air at a reasonable pressure. The fan may have a normal capacity of 200,000 cu. ft. at 3-in. gage, but the mine capacity is only 100,000 cu. ft. at 3-in. gage, hence only 100,000 cu. ft. is obtained at this pressure. The mine acts as a regulator on the fan, therefore, no matter how large a duty is specified for the fan, only 100,000 cu. ft. is obtained at 3-in. gage.

It is a fact that you find many large mines with not over 3 or 4 years' development offering 2-in. pressure for 100,000 cu. ft. The main object of the operator is to get out a big tonnage and the air-ways are often neglected. He will pay a high penalty in the future in the way of power bills and trouble to get sufficient air to the face of the workings. It is the duty of the mine inspector, and those in charge of this important work, to keep a watchful eye on the mine resistance, and demand that large air-ways be provided and maintained at all times. The whole trouble is

due to the fact that many operators think it is cheaper to purchase a new fan than maintain good air-ways. They do not realize that the new fan, which they contemplate purchasing, cannot produce any more air at the given pressure than the old one. The mine resistance is a characteristic of the mine and has absolutely nothing to do with the fan. The table below emphasizes clearly the importance of maintaining large air-ways at all times:

Size of air-ways.	Perimeter		Relative Powers Making Air-way 10 by 10 = 10 h. p.
	Perimeter.	Cube of area	
10 by 10	40	100	10.0
8 by 8	32	64	30.5
7 by 7	28	49	59.5
6 by 6	24	36	128.5
5 by 5	20	25	320.0

It will be noted from the table that if it requires 10 h. p. for an air-way of 100 sq. ft., it will require about 6 times this amount for an air-way one-half this size.

Following is a Brief of the Discussion of the Report of Sub-Committee on Standardization of Mine Ventilation by the Chairman of the General Committee:

The Chairman of this Sub-Committee not being present, the report of the Committee was presented by Mr. Rowe, one of the members of the Committee.

From a reading of the transcript of the proceedings of this session of the Standardization Conference, it would appear that Mr. Rowe did not read the report and then discuss it, but proceeded to take exceptions to the conclusions and recommendations contained in the report. We think that was an unfortunate way to present the paper, as it did not give the members of the Conference an opportunity to obtain a correct understanding of the report of the Committee, or even to understand properly the criticisms of the report made by Mr. Rowe.

Mr. Rowe states that he understood this Committee was to deal with ventilating apparatus, rather than the question of mine ventilation, whereas most of this report dealt with mine ventilation, air-ways, etc. It is only proper to state in this connection that the report of this Committee is in accordance with the general instructions issued to the Committee, and is also in accordance with the policy adopted by the General Committee on Standardization of mining practice and equipment at its first conference in St. Louis. While all Sub-Committees have not always adhered faithfully to this recommendation of the General Committee, it

has been the general policy, and still is the policy, to try to improve mining practice in the larger and broader sense of the term. When this practice is improved and made more uniform, that is Standardization in its best sense; then will follow standardization of equipment and machinery as far as it is practical to standardize such equipment. The report of this Sub-Committee is not only in accordance with the policy of the General Committee, but contains valuable and constructive suggestions, and deserved better attention than it happened to receive on account of the way in which it was presented. This misfortune seems to have prevented any discussion following by members of the conference.

We will close the review of this report by suggesting that the Committee should be organized, as the Chairman admits that he has never been able to secure a meeting of his Committee, and has had to prepare his report from information he gained by correspondence with the members.

Report of Sub-Committee on the Standardization of Mine Drainage, signed by George R. Wood:

In regard to Standardization of Drainage Apparatus for coal mining, I have written my Committee members as to their views, and regret to report an almost total lack of constructive suggestions as to possibility of any appreciable measure of uniformity in design, construction or application of such apparatus. This appears to follow from a belief that requirements are specialized to a degree, similar to ventilating apparatus. I have been able to talk personally only with Mr. Knight, of Kayford, W. Va., and the recommendations following may be taken therefore as our joint position in the premises:

Safety

All gears to be enclosed or completely guarded.

No projecting keys or set-screws to be used on revolving parts. Self-oiling bearings recommended wherever possible.

Enclosed motors preferred.

Motors up to 7½ h. p., a. c. or d. c., should be self-starting, with enclosed switch.

For larger motors, enclosed rheostats or compensators are preferred.

Voltage not exceeding 250 d. c., or 220 a. c., recommended for underground work, except for large motors (over 150 h. p.) where 440 a. c. is recommended, in which case, as with 500-volt d. c. system conduit wiring is urged.

All gears to be enclosed or completely guarded.

Design

In plunger or piston pumps, the only stock pumps manufactured appear to be small gathering pumps, usually 30 to 60 g. p. m. capacity, against varying heads not exceeding 100 ft. Each manufacturer, not unreasonably, objects to any modification of his design. We believe, however, that we should recommend that these pumps should be built as standard for 100 ft. head instead of 30, 60, etc. Motor horsepower should be double the theoretical horsepower of pump capacity. Pinions should be of fiber, leather, or paper to reduce vibration injurious to motor windings. We do not favor present tendency to large valve areas in these pumps to reduce friction, since the power consumption is usually negligible, and would prefer less area with higher velocity and higher valve-lift to ensure passage of solid particles through the pumps instead of stopping under the valves. This idea, however, is at variance with that of most designers, and needs discussion by those interested.

Construction

This detail does not seem to require our consideration, for the reason that there are numerous builders of satisfactory, efficient, and rugged pumping machinery of all required types, and we believe the (temporarily) obsolete law of supply and demand will again function to eliminate the unfit.

We would recommend merging this Committee with that on Ventilation, as a simplification of the General Committee work, and because of the limited field, as we view it, for standardization in pumping or drainage.

Review of Report by Sub-Committee on Standardization of Mine Drainage by the Chairman of the General Committee

I am constrained to make the following comments on the Report of our Sub-Committee on Mine Drainage for the reason that I disagree with the introductory paragraph in the report of this Sub-Committee. The members of this Committee seem to have an entirely wrong conception as to their duties. I draw this conclusion from their statement:

“And regret to report an almost total lack of constructive suggestions as to possibility of any appreciable measure of uniformity in design, construction, or application of such apparatus.”

This statement indicates that this Committee was endeavoring to simply standardize mine pumps instead of trying to improve the practice regarding mine drainage. Anyone who is familiar with the drainage of the great majority of coal mines in this country will appreciate that there is ample opportunity for such improvement. It seems to us that this Committee could find a large field of usefulness by preparing a constructive program for the drainage of coal mines. This program should include instructions for the drainage of the mine along modern and

economical lines, and should include all the general specifications required for the proper carrying out of such instructions. These specifications should cover in general the drainage equipment required, together with the proper method of installation, operation, etc.

The efforts which were already put forth by this Committee, as indicated by their report should follow such a program as suggested above, and not precede it, as the suggestions contained in their report relate only to details and not to the large constructive features of the improvement in standardization of mining methods and equipment. It would therefore seem to the Chairman of your General Committee that if this Sub-Committee does not approve of the method of approaching this work, as outlined above, that in order to harmonize the work of this Sub-Committee with that of the other sub-committees in the Coal Mining Branch, that this Sub-Committee should be reorganized with this object in view.

Adjournment.

METAL MINING SECTION, STANDARDIZATION COMMITTEE**American Mining Congress****PRELIMINARY COMMITTEE MEETINGS, NOVEMBER 14, 1920**

Mr. Chas. A. Mitke presided.

The meeting was opened by the Chairman presenting a brief outline of the possibilities of standardization in metal mining.

Inasmuch as the majority of those present were interested chiefly in the work of the Sub-Committee on the standardization of drilling machines and drill-steel, the discussion that followed was confined principally to this subject.

The question was raised by the Chairman as to whether, if the work of the Committee was directed towards investigating the limits of weights of the various types of machines that have proved most satisfactory to the majority of users, the results would prove of material benefit both to the manufacturers and operators. It was pointed out that at the present time there are a great many machines of each type on the market—such as Leyners, stopers, and jackhamers—with but slight variations in weights, the difference in some cases not being more than a few pounds, or in special cases not more than a few ounces.

In this connection some interesting statements were made. Mr. Leonard, president of the Denver Rock Drill Mfg. Co., mentioned that members of the mining profession probably do not realize the enormous amount of money a company must spend to perfect a new machine.

Cost of Placing New Drill on Market

Mr. Bayles, chief designer of the Ingersoll-Rand Co., remarked that it cost the manufacturers \$100,000 to perfect a new drill and place it on the market.

From the discussion which followed, it appeared that if the number of different types of machines could be reduced to a minimum, it would be of material benefit to the manufacturers as well as to operators.

One of the difficulties mentioned was the great variety of air pressures available in the different mines; also that certain companies demand that machines be built to conform to their own particular specifications. This procedure naturally results in a great variety of machines.

A discussion then followed on the possibilities of the operators getting together and standardizing their conditions; that is, classifying the various kinds of ground met with in metal mines, agreeing on uniform air pressure, systematic lubrication of machines, etc.

It was repeatedly pointed out that if hose connections, various minor parts, such as bolts, threads, etc., and possibly, chucks, were standardized, this would be of great convenience to the operator. Not only could these minor parts be interchanged on the various makes of machines, but if the chuck of the jackhammer were made to correspond with that of the stopper, steel would then become interchangeable.

Meeting of Sub-Committee on Drilling Machines and Drill-Steel

NOVEMBER 16, 1920

The general chairman, Chas. A. Mitke, presided.

MR. MITKE: We are fortunate in having with us Mr. Norman Braly, manager for the North Butte Mining Co., who has done a great deal of work in standardization, and as the Committee on Drilling Machines and Drill-Steel, of which he is chairman, is just getting under way, we would like to have him tell us something about the work that has been suggested and what the Committee proposes to do.

MR. BRALY: I suppose few of us realize that there is no machinery manufactured in this country which penetrates foreign markets as far as rock-drills. I say this because the work of standardization in rock-drills will necessarily be slow, and it would be a mistake to rush into this matter. That is the danger of standardizing this type of machinery.

Three Well-Known Types of Drills

During the last 20 years there have been three large drill-manufacturing companies in this country. Each one has carried its own standard weight; each one has a record of which it is proud; and I understand that it will be hard to get them to adopt all the standards. However, there are a few things that it would seem to me they could do to benefit the mine operator here in this country. It is understood that when a mine operator purchases a machine, he generally strips it of all trimmings, after which he puts on standards of his own, and send it underground, otherwise, if he gets it underground it will not fit. We have asked the Sullivan Machinery, Ingersoll-Rand, and Denver Rock Drill companies if it would not be possible for them to get together and create standard hose couplings and standard nuts on the machines, so that when they are sent underground they will go into place. As it is now, there is a great deal of lost time from men going underground and having no standard wrench to fit the machines, and they have to hunt all over the mine for a new part or something of that kind; and we believe that there are a few simple things that can be taken up at first and standardized, which will help us greatly.

Each of these drill manufacturers have consented to appoint a man to a committee upon which there will be three or four members of the Sub-

Committee of the American Mining Congress on drilling machines and drill-steel. This inner committee, consisting of probably eight members, will see if some standards cannot be worked out; also the other members of the drilling Committee—of which there are a large number—will also give us their co-operation. I believe this is the simplest way to go about it.

Mine Operators Can Not Design Drills

I do not believe that the mine operators themselves are capable of designing these machines, or even specifying exactly what can be done with them. I think we will have to leave that to the manufacturer. I really believe that if we leave this matter to the manufacturers they will work out this standardization, and in that way help the operators.

MR. MITKE: Mr. Arthur Notman, who is one of the members of the Drilling Committee, has prepared a paper which he will now read to us, after which a general discussion will follow.

MR. NOTMAN: Perhaps a word of explanation as to how we made this investigation might not be out of order: Just prior to the outbreak of the war, we had been engaged in an attempt to standardize on one size of steel—of one section—for use in drifting machines, plungers, and stopers; but during the war we had to abandon our experiments. As soon as conditions allowed, we started again. In the meantime we had made a great deal of progress, as we feel, in the matter of standardizing on methods of driving headings. In the matter of standard rounds, timbering, and so on, most of you who have seen Mr. Mitke's papers on those subjects have some idea of what was done in that respect at Bisbee.

Having partly decided upon methods, we felt the next step was to take up the matter of equipment, and for the past year we have had our engineering office engaged in this work, and this paper has been prepared under my direction by Mr. L. M. Cummings, one of the engineers in our office, who has actually been operating machines himself and has first-hand knowledge of the information included in the paper.

We have compiled a good many tables concerning sizes of bolts, nuts, pipe-threads, and so forth, which it would be hardly worth-while attempting to read, but I believe arrangements can be made whereby the members of the Committee and others who are interested, may read the paper in printed form later on.

[Mr. Notman's paper will be found on page 729 of the Proceedings.]

MR. MITKE: We are certainly indebted to Mr. Notman for working out such a complete paper, and it has opened a real field of discussion and thought. I feel quite sure that all of you who are interested in drilling will learn of a number of interesting things which will be worked out under Mr. Notman's direction within the next year or two.

Limits In Steel and Drill-Bit

There is something that I would like to ask, and that is just when may we expect to reach the limit in decreasing the size of the steel and the size of the drill-bit—that is, the limit at which speed will stop increasing, as it should, theoretically? I should like to call on Mr. Notman; I have heard so many different opinions, claiming that so far we have not as yet reached the limit, but as a matter of fact are a long way from it. I think that Mr. Notman's figures and his opinion will throw a lot of light on the subject.

MR. NOTMAN: The opinion that I started off with was that while reducing the size of the steel we should hope to obtain something like a theoretical increase in drilling speed, due to the smaller area of the round cut; but we discovered that the relative power of the machine and the size of the steel interlocked so that we did not get a theoretical increase in drilling speed, when you reduced the size of the steel for which the machine was probably designed. and I am not prepared to offer any information on that subject. The limiting factor, if any, so far as the operator is concerned, is the question of minimum size hole in which you can get sufficient powder to do the work. Of course, it is desirable to concentrate the powder at the bottom of the bore-hole as far as you can, and the inherent desire in the miner for a big hole, in order to get further down there, is pretty hard to overcome. They offer that as an objection to the use of 1-in. steel in drifting; but, on the other hand, they have never complained at all to the use of $\frac{7}{8}$ -in. steel in raising or stopping conditions, where the importance is not as great as it is in drifting. I think perhaps some of the drill-men could tell us about the proportionate condition of the drill and the size of steel. I would like to add that as a matter of fact, we have been using $\frac{7}{8}$ -in. hexagon steel with a small bit, for the stopers, and the work done by one of these modern high-speed stopers is just exactly as severe as it is in the case of a drifting machine. The foot-pound pressure is less, but the actual work done on the steel is a little more, I think, in the case of the newer stopers than drifting machines. They have been making exhaustive experiments on this point.

MR. BAYLES: We have found that it depends largely on the air pressure and hardness of rock with some of the present day drills. Steel becomes bent, and you cannot afford to have bent steel; drilling falls off often 30% by a slight bending of the steel. In fact, if some of the bent steel is examined you would not notice that it is bent; but if you tested it, it will fall short 20%. Line it up, and you find that it is bent. Take the same steel and straighten it out on the anvil and sharpen it, and you get 20% more drilling. I have never been able to understand why that should make steel drilling fall off so much; but it does, invariably.

MR. MITKE: Mr. Walsh, is it possible for you to give us just a brief summary of some of Mr. G. H. Gilman's ideas, or would you have to give practically the whole paper?

[Mr. Walsh then read Mr. Gilman's paper, which views the question from the standpoint of a manufacturer, appears on page 721 of the Proceedings.]

MR. JOHN KIDDIE: I might state that we made some tentative experiments in which we found that the amount of power necessary to drill the holes depended on the area of the hole, that is to say, the area of the bit. Mt. Notman seems to be of the opinion that you could reduce the size of the hole so as to get powder enough in there (perhaps, if necessary, using stronger powder), that is to say, you could get powder into a smaller hole to break the ground, provided you can drill it with the size steel, that is, by hand bit. It is not possible to improve the grade of the steel so that you could use a smaller steel and not have the successive break.

MR. WALSH: The point that Mr. Notman made was that they get better results in some cases with the bigger steel and bigger hole.

MR. KIDDIE: Yes, my notion was that perhaps the big drifting machines were too powerful for the size of the hole.

MR. WALSH: I would imagine with the bigger machine and the smaller gage and the smaller steel you could get more penetration, and it would affect your rotation so that you could cut down your drilling speed. Where you use the larger steel it would fit in to better advantage. Putting same energy into the same machine and using a lighter blow, with not so much penetration but a faster rotation, and you might get different results. As you said, you might use the wider machine with the smaller steel and get the same results.

MR. NOTMAN: We found that with the 18 Leyner, cutting down from the $1\frac{1}{4}$ in. to the 1 in., we got practically the theoretical increase in drilling speeds, but when we went to the heavier machines—the 248 Leyner, or the D. X. 61—you do not get that increase.

MR. BAYLES: There are two things that occurred to me which I wished to ask Mr. Notman: He speaks of including in the supplies a box-wrench to pull out the steel: Did he mean by that that the maker should carry 8 or 10 different types of chuck-wrenches, each with a different size box-wrench in it?

MR. NOTMAN: That is exactly what I meant. I did not intend to put the burden of the supplying of those wrenches upon the manufacturers. We make our own wrenches, and probably will continue to do so.

Use of the Box-Wrench

In saying that we wanted to use this box-wrench for pulling out steel, it often happens that a drill cannot be withdrawn readily when run down, and if a man had a box-wrench which would fit behind the steel, a slight turn of it would free that steel and he could withdraw it. The practice is to take a monkey-wrench and stick that behind it, and twist and pull at

the same time. It is not for extracting steel that is stuck in the ground, but simply steel that cannot be slipped out of the machine readily to withdraw it. I think such a wrench could be made to fit any one of these sections, either a big chuck-wrench or a smaller one. What we want is two double-ended wrenches to fit all the parts which are ordinarily used.

MR. WALSH: Mr. Notman's paper represents a lot of work, but there seem to be several things that perhaps do not agree. You talk about making side-rods and standardizing them at $\frac{5}{8}$ in. That may mean changing all drop forgings, and a changing of dies, which are extremely expensive; perhaps it means changing the G-bolts. While I am not attempting to throw cold water on the idea, these things are to be considered from the manufacturers' standpoint, on machines already in the field. It might throw a big burden on the manufacturer.

MR. NOTMAN: I think that is an important point. It would not throw the burden on the manufacturer alone, from the fact that all the users are equipped with drills which have been turned out, and not one of us can afford to scrap anything useful. It is something that we cannot hope to effect over night, but if it were a basis for future designing, I think we have accomplished a great deal.

MR. BAYLES: Mr. Notman suggests in one part of his paper that the nuts on the standard rods should be square, while in another he recommends a $\frac{5}{8}$ -in. bolt with a standard rod and hexagon nut. Is that correct?

MR. NOTMAN: I do not know that there is any particular choice in the matter; I believe that either one would be satisfactory.

MR. BAYLES: Being one so easy to get at, I think that a hexagon nut would be better on account of not having the sharp corners of the square nut. I think the hexagon nut is used today.

In Mr. Gilman's paper it is said that the minimum weight of a jack-hamer is 25 to 30 lb. on the ground. I do not think it is practical to manufacture a serviceable jackhamer much under 30 lb. There have been jackhamers on the market around 20 lb. for many years, but they do not appear to be successful, even if one foreign jackhamer that I have seen only weighs $10\frac{1}{2}$ lb. That, I think is rather light.

MR. MITKE: Yes.

MR. BAYLES: There was one of 19 lb. on the market for a while before the war—I do not know how it is since—and it was very good, but of course it would not compete with the bigger tools; but for its purpose it is very satisfactory. We have one of 20 lb. which has a big demand.

MR. NOTMAN: I think it is important not to lean backwards in attempts to standardize on designs. I think that is absolutely agreed. Any question of standardization that does involve details of design should be given careful consideration. I think that also applies to the question of weight of the machine. You can never tell until you have tried it

whether you can get by with a machine weighing a third less than the machine you are using.

MR. BAYLES: No; the natural law of supply and demand governs weight of machines, without our doing it here.

MR. MITKE: What weights of small machines are in greatest demand?

A MEMBER: There are more 40 or 45-lb. tools sold, though a 50 or 60-lb. tool will do more work.

A MEMBER: I think Mr. Notman's conclusions regarding the weight of the drill and stand-up answer that question very well.

MR. BAYLES: It would be foolish for us to determine the weight of the tools for certain work now, because we know that five years ago we had an idea that certain work required a 200-lb. tool, which today is performed by a 50 or 40-lb. tool, and two years from now somebody may be doing it with one of 10 pounds.

MR. MITKE: The changes are certainly remarkable. Take one mine where they considered that the 18 Leyner was the only machine to drill the ground, and today they just use the jackhammer and drill it the same as they did then. That change was made in an entire mine within a year or a year and a quarter, so we cannot help being conservative when we consider the future. Nevertheless, it is interesting to forecast as near as possible what might be the demand, and what the general trend will be.

A MEMBER: I think that the trend is more for light machines. The very fact that they are reverting to lighter steel means that they must place their holes in the proper position and get the powder distributed properly; rather than drill a few large holes, they should drill more small ones and get them properly placed. Such is the secret of the light drill, and that is why it is becoming more popular. I think it will be carried even further; the tendency is for a lighter machine.

A MEMBER: Though for shaft sinking, for instance, we will have to use a heavier machine.

MR. BAYLES: But still much lighter.

A MEMBER: I am wondering if the mining companies, in trying to get the results we aim at, and in placing so much burden upon the rock-drill itself, whether they are looking into the drilled steel and also their explosives. I think both should be studied. We can get more powerful explosives, and we can drill smaller holes—that will be increased efficiency all around—and also get a bit that will last longer.

MR. MITKE: I think that it is only a question of time now.

A MEMBER: Many times they make a comparison in different mines, but in some they do not take into account the condition of the drilling bits. They report so many feet drilled in a given time. Possibly the difference is entirely due to other than the machine itself. The Copper

Queen is the only mine that looks at a drilling bit to determine how dull it is.

MR. NOTMAN: In justice to the drill manufacturers, I would like to go on record as being of the opinion that the design of the machine, and the work that the machines are doing, have improved much more than the steel that is used in the machine, and the general routine of operations through which the machine is put. There is no doubt about that. Our activities should be directed not towards changing the designs of the machines, or attempting to dictate what the designs of the machines should be, but to see that the fittings which are used in the routine operation of drilling are so designed that the manipulator can use them to the best advantage.

Sub-Committee on Standardization of Mine Timbers

Mr. Chas. A. Mitke presided.

CHAIRMAN MITKE: Mr. Norman Carmichael, general manager for the Arizona Copper Co., and chairman of this Committee, has found it impossible to attend, but has sent his deputy, Mr. John Kiddie, superintendent of mines for that company in his stead.

[Mr. Kiddie explained that while considerable work had already been accomplished, such as the compiling of data from 17 large companies, the Committee did not feel that it was yet in a position to make a complete report; and it was the desire of Mr. Carmichael that more time should be allowed the Committee in order to investigate the subject more thoroughly and be in a position to submit a report at the end of the coming year (1921).]

Sub-Committee on Metal Mine Ventilation

Mr. Chas. A. Mitke presided.

The following members were present: A Stoddard, D, Rait, Robert Bell, and W. A. Rowe.

A preliminary questionnaire, to be sent to operators in order to obtain sufficient information to constitute a working basis, was presented to members by the Chairman, and the various points embodied in this questionnaire taken up and discussed.

It was agreed that the principal avenues to be followed by this Committee would be the investigating of conditions in underground working places, with the idea of establishing a standard mine atmosphere. It was also hoped that the Committee—which is composed of both operators and manufacturers—might work out a set of recommendations for different kinds of standard ventilating equipment, which would thoroughly ventilate the so-called dead-ends in drifts, raises, and stopes,

Sub-Committee on Mechanical Loading Underground

Mr. Lucien Eaton is chairman.

In the absence of Mr. Eaton no meetings were held, but the Chairman reported that a questionnaire is being prepared which will be sent to all Committee members, operators, and manufacturers of underground power shovels, in order to compile sufficient information to constitute a working basis.

Sub-Committee on Steam-Shovel Equipment and Operations

Mr. H. C. Goodrich is chairman.

In the absence of Mr. Goodrich, no meetings were held, but the Chairman reports that a questionnaire is being prepared, which will be sent to all operators and manufacturers of steam-shovel equipment.

Sub-Committee on Underground Transportation

Mr. Wm. B. Daly is chairman.

In the absence of Mr. Daly, no meetings were held, but it is understood that a questionnaire has been prepared which will be sent to all Committee members and operators in districts not represented by Committee members.

Sub-Committee on Fire-Fighting Equipment

The General Chairman, Mr. Chas. A. Mitke, presided.

CHAIRMAN MITKE: Mr. Connibear, chairman of this Committee, has found it impossible to attend the meeting, but on behalf of his Committee, has forwarded a preliminary report, which I will ask Mr. Guy Johnson, a member of this Committee, to read for our benefit.

MR. JOHNSON: (Reading the report):

A canvas is being made to ascertain the amount and variety of fire-fighting equipment that metal-mine operators are using. To obtain this information, copies of a questionnaire on Fire-Fighting Equipment were distributed. The length of time since the organization of this Committee was perfected has not been sufficient to reach operators in remote parts of the country.

The number of questionnaires that have been received by the Committee from the operators of copper and iron mines in the Lake Superior district is sufficient to present an adequate report of this district; but with this exception, but few reports have been received. Data is not available at present from the other important districts, due to the delay in transmission of the same.

Mine Rescue Apparatus.

The value of rescue apparatus in fighting mine fires, and especially when lives are in danger, is universally acknowledged. The activities of the U. S. Bureau of Mines have extended into all mining districts, and have demonstrated that oxygen rescue apparatus must be accepted as an essential part of a mine fire equipment.

At the present time, apparatus used in this country consists of four types; the Fluess, the Gibbs, the Paul, and the Draeger. The Draeger, however, is slowly but surely being replaced by the other types.

An attempt to standardize on a particular apparatus will not meet with the approbation of mine operators. Attention should be directed to the advisability of using an apparatus that meets with the general requirements as recommended by the Bureau of Mines in Technical Paper 82, pages 23 and 24.

Mine operators of the Lake Superior district have approximately 150 machines. A report of the conditions of these machines for the past two years, recently issued by the Bureau, indicates that action for improvement is recommended. This applies not only to the apparatus, but more particularly to the training of employes in the use of them.

Mechanical Resuscitation Devices

This apparatus is not now accepted with the high degree of favor as it was a few years ago. More attention is being given to manual methods. Not only is the effectiveness of mechanical devices questioned, but the probability of delay in obtaining a machine immediately when needed reduces the chances of resuscitating an unconscious person.

Fire Extinguishers

These are being installed underground—both the carbon tetrachloride and the soda-acid types. Objections have been raised to their use. Increased use of electricity as a motive power for haulage, hoisting, and plumbing has resulted in the adoption of the tetrachloride type for extinguishing electrical fires in incipient stages. Additional information is imperative before any conclusions can be deduced.

Fire-hose

Very few mines, compared to the total number operated in the metal districts, have adequate underground fire-hose equipment. In the questionnaires that have been returned, only one mining company has adopted this method in a comprehensive way.

Portable Blowers

There are mining companies that resort to the portable blowers as an effective method of fighting underground fires, but the Committee has not yet received information from those companies which are known to have made the most advanced strides in this direction. Many mines have blow-

ers installed to improve ventilation, and they report that they are available for fire emergencies. Adjustments are necessary, and the delay that will follow thereby is not known at the present time.

Bulkhead Material

Many companies report maintaining posts, planks, and sand for bulkhead purposes. Due to the large volume of humidity, which is common in the atmosphere of many mines, cement is not stored underground. Other operators report that substantial bulkheads have been provided in order to ensure the safety of mines in case an unexpected volume of water is encountered, and that they can be utilized to advantage in limiting a fire-zone.

Fire Protection at Collar of Shafts

The use of iron doors and spraying systems at collar of shafts have been adopted by a few operators; others report that steel head-frames and concrete shafts eliminate fire hazards, and that these agencies are not necessary. Most operators, however, have not recorded themselves relative to their value.

Stench System of Alarm

This system of alarming underground employees when a fire occurs has been adopted by several large operators, and its affectiveness is reported to be very satisfactory.

Conclusion

Additional information is absolutely necessary before the Committee can record its recommendations. This will require more time than was at our disposal this year. An effort will be made to enlarge the membership of the Committee so that further delay in obtaining desired information may be overcome.

PRESIDENT'S ANNUAL ADDRESS

By BULKELEY WELLS, President of The American Mining Congress,
Before the Twenty-third Annual Convention, Denver, Colorado,
November 15-20, 1920

It is altogether appropriate that a convention of the American Mining Congress is again held in Denver, for here 23 years ago the organization was created. From 1896 to 1907 its working force consisted of the secretary and one stenographer. In so recent a year as 1910 its income amounted to but \$5000, while in the past year its receipts have reached the substantial sum of \$150,000. This is convincing proof that the services it renders have earned the approval of its members and of the subscribers to its work. Its efficiency can and will be increased and its activities enlarged if funds are available, yet today its organization at Washington comprises in addition to the secretary, who is, in effect, managing director, seven divisions—respectively, mining economics, taxation, legal research, tariff and war minerals, precious metals, Interstate commerce and Federal trade and information service—each directed by a chief specially qualified to conduct the work of his department. An adequate force of clerks and stenographers renders possible the prompt and efficient handling of the organization's business, and commodious quarters furnish facilities for this purpose and for conferences of its members when in Washington. The *Mining Congress Journal*, with an income of \$40,000 a year from its advertising columns, conveys each month to the members of the Mining Congress summarized statements of all matters and occurrences of interest to the mining industry, and publishes special articles by men who are leaders in thought and activity in the industry. Weekly bulletins are issued to all members, and daily bulletins to subscribers to this special service. The bulletins give immediate and frequently advance information on matters of current and vital importance to the mining industry. The secretary and division chiefs are at all times available for

consultation and to aid members, as individuals or in groups, representing the various branches of the mining industry.

The American Mining Congress

If our organization has a slogan, it is that the American Mining Congress does not lobby. It simply endeavors to present in concrete and authoritative form statistics and arguments in support of the welfare of the mining industry. Because it has honestly adhered to this purpose it has gained and holds the confidence of members of Congress and heads of departments at Washington, and can, therefore, effectively further and protect the interests of its members. Much of its work is constructive; some of its work is (of necessity) destructive, in that it presents unyielding opposition to legislation unfavorable or unjust to the mining industry.

During the past year the Mining Congress has been particularly active in supporting the McFadden Bill for the relief of gold producers; in securing a more liberal application of the War Minerals Relief Act; in developing, through the labors of a special committee, the standardization of mining equipment; in seeking to obtain more favorable terms for the use in the mining industry of the flotation process; in studying and attempting to solve the transportation problem in co-operation with the National Shippers' Conference, and, above all, in undertaking in conference with other national organizations to develop a more equitable and less burdensome system of Federal taxation. To relate in detail the efforts expended and the results attained in these directions would too greatly encroach upon the time assigned for our general sessions, but full information on these subjects will be presented at the special conferences to which they relate.

The coal producers of this country have always been loyal and liberal supporters of the Mining Congress. They are today facing serious problems of production, distribution and marketing. They are our brothers in industry and deserve our willing co-operation.

The oil producers are almost too prosperous to require our present aid, but they subscribe generously to our work, and we must stand ready to respond to their call if need arises.

An effective and acceptable plan of co-operation with the American Institute of Mining and Metallurgical Engineers has been devised, and a joint conference committee has been organized to ensure the highly desirable results thus to be attained.

Labor Unions Should Incorporate for Legal Purposes

A year ago, at the St. Louis convention, I ventured to assert that labor organizations should be compelled to incorporate, to render them legally responsible for their actions, and that compulsory arbitration in labor controversies should be established quite in accord with the practice of our courts in dealing with all other matters in dispute. The record of organized labor in the past year has confirmed my views upon these issues. The number of strikes ordered or instigated in direct violation of existing agreements, and with little or no regard for public welfare, has lost organized labor innumerable friends and has retarded its development beyond measure. I believe sincerely in the organization of labor and in "collective bargaining," provided both parties to such procedure are equally and firmly bound. But agreements, once accepted and executed by duly authorized representatives, must be implicitly observed, and legal existence must carry with it legal responsibility. No man who honestly intends to fulfill a contract he has signed need fear the action of a court empowered to punish the violation of such a contract.

Quite apart from considerations of party politics, the recent election served notably to affirm the belief of our people in our form of government. It demonstrated that the vote of organized labor cannot be delivered in support of candidates of socialistic or more radical beliefs, and good citizens, Democrat and Republican alike, overwhelmingly voted down the socialistic and anarchistic enemies of our Government. But in the very indecisiveness of this victory there is grave danger that we allow ourselves to relapse into a state of fancied security. The sinister forces that seek to undermine and overturn our Government are at work ceaselessly day and night, year in and year out. They are well organized and strongly financed. Only through sustained effort, unending vigilance and grim determination can we hope to defeat them. In this issue and in dealing with other problems of our indus-

trial life of today individual effort is of little avail. Men of like beliefs, of like interests and of like needs must stand together in well ordered and wisely directed organizations. The American Mining Congress has actively and effectively aided the mining industry in the earlier stages of this period of readjustment and reconstruction. It can do much more if you will support and animate its organized efforts. You need the American Mining Congress—the American Mining Congress needs you.

GENERAL SESSIONS

Original Papers Presented at the Twenty-third Annual Convention
of The American Mining Congress, Denver, Colorado,
November 15-20, 1920

POWER FROM LIGNITE TO DEVELOP INTERIOR ALASKA

By JOHN A. DAVIS

Governor Alaska Chapter American Mining Congress, Fairbanks, Alaska

Any policy for developing the resources of Alaska, and particularly those of the interior, must, if it makes any pretence of being farsighted or comprehensive, give serious consideration to the lignite deposits of this region, because the utilization of these deposits is the keystone in the arch of future growth. The principal industry of this interior country lying north and east of the Alaska Range, and containing the great valleys of the Yukon and Tanana rivers, is mining, which will continue to be the mainstay for many years to come. In addition to Fairbanks, which is the most important camp, other mining districts are found at Hot Springs and Rampart, Tolovana, Bonnifield and Kantishna.

Since the discovery of placer gold on Pedro Creek in 1902 the Fairbanks district has produced something over \$70,000,000 in gold and silver. The production from the Hot Springs-Rampart district exceeds \$8,000,000, and from the Tolovana district \$3,000,000. The Kantishna and Bonnifield districts, which have been severely handicapped by the absence of any transportation worthy of the name, have produced nearly \$1,000,000. This gold has been won from the narrow and richer portions of the placer deposits, but there yet remain in the region many hundreds of millions of yards of gold-bearing gravels which still contain today many times over the total quantity of gold thus far removed. The winning of this gold in the future must be done, however, with modern, up-to-date machinery, for which power is a prime requisite.

Wood Used as Fuel

Up to the present writing, fuel for mining operations has been obtained from spruce and birch timber, which the early miners and prospectors found on the slopes and bottoms of the valleys, and which they used lavishly and unstintingly while it lasted. This is now gone, and wood is becoming more and more difficult to procure. In the early days of mining, wood could be purchased at \$5 to \$6 per cord, even in spite of the high costs then prevalent in the district. Today, however, the average cost of wood is over \$11 per cord, and prices of \$16 or \$17 are not unusual. Fuel is so scarce that several of the mines are using stumps and roots, which are torn from the ground and burned for fuel. Were it not for the fact that the Government railroad, now under construction, passes through the heart of a large lignite field lying on the north slope of the Alaska Range, along the Nenana River and its tributaries (about 50 miles from the junction with the Tanana River), the fuel situation in the older camps of the interior would be utterly hopeless within two or three years at most.

Water-Power

Nor can water-power, which plays such an important part in mining operations in Southeastern Alaska, supply the needs of the mining industry here. Climatic conditions in the interior, shut off as it is by the Alaska Range from the warming influence of the Japan current, are such that the smaller streams, having a sufficient gradient to furnish hydro-electric power, are frozen for six or eight months of each year, and consequently have such a greatly diminished flow that the development of water-power is impracticable; while the larger streams where there is a sufficient flow of water have such low gradients that the installation cost of hydro-electric development would be so unreasonably excessive as to be out of the question. Therefore, power for mining and other purposes in this region can be had only by utilizing the sole available fuel—the Nenana lignite.

The lignite occurs in many beds of different thickness distributed through a series of soft sandstones, clays and gravels, aggregating some 1200 to 1500 feet in thickness.

Twelve lignite beds are known to be of workable size, at least six of which average more than 20 feet. Stephen R. Capps of the U. S. Geological Survey examined the Nenana field in 1910, and made an estimate of the amount of lignite it contained.

Coal Reserves at Nenana

In considering the basin of Healy Creek, one of the tributaries of the Nenana River, as a unit, he reports that—

“A section near the mouth of Healy Creek, and another six miles above, showed 212 and 133 feet of coal, respectively, not including any beds less than 4 feet in thickness. As the field has its greatest width near the mouth of the stream, the mean of these two measurements, 172 feet, probably represents a conservative average thickness for the whole field. Calculated from this thickness and with an area of 20 square miles, the total lignitic coal content of the field would be more than 3,890,000,000 tons.”

Taking Lignite Creek, another tributary, as a unit, he states:

“An estimate of the coal tonnage of this basin was based on the average of the five incomplete sections measured, and is doubtless much less than the actual coal content. By using 62 feet as the average thickness of coal throughout the 80 square miles of the field, the coal content is then more than 5,700,000,000 tons.”

Since these estimates were made, prospecting and investigation have shown that the area of lignite-bearing strata in the Nenana field is much more extensive than that examined by Capps, and his estimate of the amount of lignite in the field could probably be doubled with safety, thus indicating an almost inexhaustible supply of fuel.

The conversion of the lignite into power may be accomplished in either of two ways. It may be transported to the mines and used to generate steam in individual power plants, or it may be burned in one central station located at the lignite fields and the power transmitted electrically to the various mining districts.

Transportation of Coal

The use of lignite at the individual mines involves at once the question of transportation. Even in the Fairbanks dis-

trict, which is served by the Government railroad passing through the lignite field, the delivery of the fuel will involve a railroad haul of 100 to 125 miles, combined with a wagon haul of from 1 to 20 miles over roads that at some seasons of the year are practically impassable. At the present writing, with the single exception of the electric-light plant at Nenana, none of the probable consumers of lignite are provided with railroad spurs which could be used to deliver the lignite in carload lots. Nor in most cases is it likely that such spurs will be constructed directly to the individual mines. The chief product of most of the mines is gold dust or bullion, and, even if this existed in the fabulous quantities popularly supposed in Alaska, it is quite safe to assume that freight cars will never be required to haul it away! Nor will the quantity of fuel and supplies to be hauled in justify the building of a spur track, except in possibly a few instances where the mines are situated a very short distance from the main railroad line. Therefore, the delivery of the fuel to the consumer will involve, in addition to the railroad haul, the cost of transferring it to wagons or sleds and hauling it for considerable distances.

In the Fairbanks district the distance varies from 1 to 20 miles. The Tolovana district is 60 miles across country from the nearest railroad point, and the connecting wagon road has yet to be built. The alternative route is about 200 miles by river, involving two or three transfers, with an additional 20 miles by wagon or sled. The Hot Springs district also requires a combined river and wagon haul, while the Kantishna and Bonnifield districts are practically without transportation. It will be seen, therefore, that no little difficulty will be experienced in delivering the lignite from the Nenana field to the mines in the interior of Alaska, and the cost of transportation will be a very serious item.

Size of Mine Plants

Nor would the use of the lignite at individual plants make it possible to lower the cost of power sufficiently below the present high price to afford any appreciable stimulus to the mining industry. The plants required at the mines are small—30, 50, 80 and occasionally 100 horse-power—and the equipment is usually of a temporary nature, designed for porta-

bility rather than efficiency. Such plants do not warrant the installation of equipment necessary to utilize the lignite to advantage or to secure the maximum efficiency. Mechanical devices for feeding the lignite would be cumbersome and unwieldy in addition to being too costly, while to install fire-boxes designed to provide radiant heat at the point where the lignite first enters the furnace, thus bringing it to combustion temperature as quickly as possible, would necessitate the purchase of entirely new boilers, the cost of which would also be excessive for the amount of power to be generated.

Actual steaming tests conducted by the writer with lignite at the Nenana electric-light plant, which is better equipped for burning this fuel than the majority of the plants at the mines, indicate that an efficiency of 40 per cent. may be considered very favorable with plants of this type. The tests also show that it will require at least a ton and one-quarter of the lignite to generate as much steam as that from a cord of spruce wood; so that although the lignite offers a source of fuel to replace the constantly decreasing wood supply, the low efficiency to be had from it in small and more or less temporary plants, combined with the cost of mining the lignite and delivering it to the individual mines, makes any great reduction in power cost highly improbable.

A Central Power-Station

But if the power requirements of the region could be centralized in one generating station, with electric transmission lines to distribute the power to the mines, the size and permanency of the plant would warrant the installation of properly designed equipment and machinery for converting the fuel into power with the maximum degree of economy and efficiency, and by erecting the central station in or near the lignite field the excessive local difficulties of transportation could be avoided. The requirements and details of such an installation have been determined by the Alaska Chapter of the American Mining Congress working in co-operation with the Alaska Station of the United States Bureau of Mines, and a summary of them was presented in a paper read before the twenty-second annual convention of the American Mining Congress one year ago.

Briefly, this plan contemplates the erection at some point

convenient to the lignite field of a central generating station having an initial capacity of 5000 horse-power, but so designed that it can be readily enlarged to an ultimate capacity of 20,000 horse-power to keep pace with the growing demand for power it will surely create. It is assumed that the best modern engineering practice will be followed in the choice of machinery to ensure the production of power as cheaply as possible. This will involve the use of furnaces properly designed to burn the lignite efficiently, mechanical feeding devices for supplying the furnaces, water-tube boilers for generating steam, and high pressure, condensing turbo-generators for converting the steam into electricity. Since reliability of service will be a prime requisite because of the great loss that would result from even a brief shut-down of the plant, especially during the short busy summer season, the power plant should be planned, not only in its initial installation, but also throughout all stages of growth, to carry the load for short periods with any one, even the largest, of its units out of commission.

The plan also provides for a system of electric transmission lines from the power plant to the various mining districts. This will include 110 miles of main line at 110,000 volts between the plant and the Fairbanks district, two secondary lines at 66,000 volts from a point about midway on the main line leading to the Tolovana and the Hot Springs districts, 60 and 70 miles distant; a secondary line at similar voltage leading from the plant to the Kantishna district, a distance of 70 miles; a line at 33,000 volts from the plant for 35 miles to the Bonnifield district; together with approximately 100 miles of branch lines and feeders at 33,000 volts in the several mining districts. In order to ensure uninterrupted service, the main and secondary lines will each carry two independent circuits.

Cost of Proposed Power-Plant

The cost of such an installation with its initial capacity of 5000 horse-power is estimated at \$4,750,000, making due allowance for the present cost of materials and supplies and the added cost of construction in Alaska, while the ultimate cost of the full 20,000 horse-power installation would be \$9,000,000. Such a plant could furnish power at a cost of

less than \$100 per horse-power year, as compared with \$800 per horse-power year, the average at the mines operating in the Fairbanks district during the present season of 1920. Power at one-eighth of the present cost would obviously give a big impetus to the mining industry of this great district, especially as power is becoming an increasingly preponderant factor in mining cost.

We have, then, the interior of Alaska, with an area of more than 150,000 square miles, comprising the main heart and bulk of the Territory and containing resources in mineral wealth to be estimated by hundreds of millions of dollars, awaiting only a systematic and broad-minded policy of development. In addition to mineral wealth the district contains the most extensive farming region in the territory. In the Fairbanks district alone there are more than 100 homesteads, with over 2000 acres under cultivation, which produced in 1919, 60 tons of wheat, 40 tons of oats, 10 tons of barley, 500 tons of hay, 325 tons of potatoes and 60 tons of other vegetables. The success during the last five years in wheat growing has induced the residents of Fairbanks to install a flouring mill to convert the wheat into flour. This industry is still very new, but the success obtained opens a broad vista of future possibilities. The realization of these possibilities, however, depends directly upon the development of the mining industry. For many years to come the farmer will be limited to local consumption for his market, because owing to remoteness he cannot hope to ship his products to the States at a profit. The source of local consumption can only be had in a population engaged in the mining industry or in the attendant commerce depending directly upon it. Without a growing and flourishing mining industry agriculture must fail through sheer inanition.

Factors Influencing Mining

The growth and development of the mining industry in the interior depends upon three factors: Adequate transportation facilities, lower cost of supplies, and cheaper power. The question of transportation is in a fair way to solution by the construction of the Government railway from Fairbanks to the coast, which upon its completion will afford an outlet to tidewater throughout the entire year, and by the extensive

system of roads and trails planned and now being built by the Alaska Road Commission. The high cost of supplies is nation-wide, if not world-wide, and is particularly onerous here, because gold is the one commodity the price of which has remained fixed. For it is manifest that, when all other values increase with respect to a standard and that standard happens to be, as is this case, the principal product of a mining industry, it must impose a grave handicap on the industry. While it is perhaps beyond our present ability to control the high price of supplies, the proposed premium on virgin gold (which is so ably championed by the American Mining Congress), if it becomes effective, will afford a great remedial compensation wherever gold is mined. And a satisfactory solution of the power question can be reached by an immediate installation of the central power plant and transmission lines just mentioned, the construction of which is essential to any comprehensive policy for the development of Alaska.

The Government of the United States initiated such a policy with the authorization of the railway from the coast to the interior, which is being built at a cost of some \$50,000,000. That this was merely the first step in the development of the Territory was recognized by every man of large caliber in the nation who was acquainted with the facts at the time the railroad was begun. The annual appropriations for wagon roads in Alaska, many of which serve as feeders for the railroad, are extensions of the policy. The passage of the Alaska Coal Leasing Act in 1914, opening the coal fields of the Territory for development, was another link in the chain. And now that not only the exploitation of the mineral wealth, but agriculture and all other development in the Territory, depend upon cheap power as one of the prime factors for their existence, is it not logical for the Government to invest the \$9,000,000 needed to build a plant to supply such power in order to make the hundreds of millions of dollars in mineral resources available as part of the national wealth, not to mention the possibilities of agriculture or the settlement and colonization of this vast interior empire? And the word "invest" is used purposely, because the entire cost of the installation would be repaid with interest at the end of 20 years. Any private enterprise having but a small fraction of the resources

of the United States and owning 98 per cent. of the land and resources of so great a country would not hesitate an instant over the expenditure.

Gold is the Chief Product of the Interior

There are other equally cogent reasons. The depletion of the gold reserve has reached serious if not alarming proportions. It is a problem that is engaging the attention of the best thinkers in the country, and is the fundamental reason for the proposed gold premium. Gold is the chief product of the mining industry of the interior. It is extremely important, then, that this mining be stimulated and developed in every logical way. But with or without the gold premium, the mining industry of the interior must have cheaper power. The situation is much more acute here because mining in frontier countries such as this cannot remain at a standstill. It must advance or decline, and once started the descent is more rapid than the proverbial one to Avernus. The World War destroyed almost fabulous quantities of other metals, such as tin, tungsten, copper, etc., all of which are found in this district, and which a healthy and flourishing mining industry would help to replace. And the colonization and development of the interior of Alaska, which would eventually accompany such an industry, would create a new empire—self-reliant, paying back with lavish generosity in much-coveted raw materials the dole of assistance now so urgently needed.

The mining industry must have power—cheap power—the only source of which is the lignite of the Nenana field. Hence it is that the whole future of this interior country is intimately concerned with the policy that may be adopted for the utilization of this fuel. If the policy is broad-minded, farsighted, comprehensive, and contemplates the logical and most efficient means of using the fuel, the growth of the country will proceed to perhaps undreamed of possibilities. If the policy is niggardly and penny-wise, it will not only overlook a great opportunity, but will cripple, if it does not destroy, the hope of a new empire upon our last frontier. The men who for 20 years have faced and grappled with the stern spirit of the North cannot bide much longer to await the nation's decision on this matter.

On the walls of a log cabin in Fairbanks there hangs a

moose hide upon which a local artist has sketched the graphic realism, a familiar scene—a prospector's cabin in a clearing of spruce and tamarack, snow-drifted about the sagging, deserted walls, no sign of friendly smoke from the fallen chimney. In the foreground a broken windlass dangles above a tumbled-in shaft; the wierd spirit dance of the Northern Lights flames in ghostly silhouette behind the spectral trees. A giant moose has returned to his one-time haunt and lifts his head proudly, sole lord once more of his old domain. The prospector-artist has named his picture, with a grim humor, "Reclamation."

We of the North must have help in this matter if we are to continue getting out our quota of the nation's gold supply. With our back against the Arctic Circle we are fighting to hold on. Would you have in your Alaska the "Reclamation" of that sardonic jest? Shall we leave this potential empire once more to the moose and the timber wolf, or shall we hold what we have now and go on to greater things?

MODERN INDUSTRY AND INDUSTRIAL PEACE

By **JAMES LORD**

President Mining Department, American Federation of Labor, Washington, D. C.

I regret more than I can say that circumstances have so shaped themselves that I must return to the East at once; but that is the situation, so I am dictating these notes, which will be along the lines on which I would have addressed you had it not been ordered otherwise.

I was hoping to take up with you personally some fundamental things in connection with modern industry and industrial peace with the same latitude and absence of restraint that you seem to show to all the speakers.

I have no illusions that these words will be able to change the mode of thought of all of you. I realize that strong men have strong convictions and strong differences. I also realize that in the struggle for success and supremacy in industry, often men's talents and ability are fully taxed in dealing with the material side of industry to the cost or exclusion of the human equation. This has been perfectly natural and a matter of course generally, but I think there is a distinct drift in the minds of many of the large employers in industry, especially the mining industry, to take a newer or a better slant over the field, and give more thought to the well-being and environment of the human element than heretofore.

I am inherently a miner. My people have for centuries, as far as I can learn, been miners. I have been in the mines since 1889. My father entered his first mine about 1850—at the age of six years. His father was a miner before him, and I find that both of my father's and mother's people, both men and women, worked in the mines in Britain, and that my relatives are scattered over the world wherever mining is carried on.

I think I can fairly claim to be a practical miner. As the saying is: "I went through the mill." I was taught by a man who only knew how to do one thing one way. Every line had to be kept, everything ship-shape, methods of timbering, blast-

ing, etc., never slipped over, and the working place kept in that condition it would be if it were the miner's own private property; which, indeed, is was so considered.

A miner of that training is a man who can do anything from the collar of the shaft to the working face, except the technical work, and, as far as he is individually concerned, can take care of his own back. So I, like many of you, learned my trade in rather a harsh school, but learned the lesson of thoroughness and efficiency.

The Miner is a Pioneer of Civilization

To the miner, as much as to any other man, our present status of civilization should bow its head. By the term miner I mean all who have played a useful part in winning the coal and metals from the earth for the further development and well-being of humanity. The prospector who has braved the dangers of the wild places has often had to furnish his own protection; the man who has taken the risk in extending the industry, often risking the labor and accumulation of a lifetime, and the actual miner, who, often without a rudimentary technical knowledge, relying often on his own common sense or traditional knowledge to cope with fire, weight and flood, has never seen the place or the mining environment that he feared to invade. To all these should civilization bow in reverence.

I have always been interested in doing what I could when opportunity presented itself to make a brighter and better environment for the subterranean toilers—to usher more sunlight and happiness into the lives of the men, women and children of the miners. I was brought up that way. I know the struggles of these people for a better life; their anxiety for better surroundings in toil and living. I joined the first miners' union I had the opportunity of doing. I realized early in the game that the individual, with the powerful interests he had to cope with, could do little or nothing, but that, united with his fellows, he could make a measure of orderly progress, or at least be in the position of preventing hostile interests from driving him backwards, which is not less important.

Organization seems to have always existed in some form among miners. Even in the terrible days of ancient Greece and Rome, with almost every avenue denied them, with death,

torture and crucifixion staring them in the face, the miners of Laurium and other fields were able at times to wring some concessions from their taskmasters.

The history of labor is the history of humanity. We can see in the early history of mining in Britain, when the Romans cast prisoners of war and entire communities into the mines, here and there a united attempt to get away from the degradation and cruelty, sometimes with a measure of success.

Early Labor Conditions

When legislation was enacted making free men of the miners of Britain, the most hardy among them began the battle for emancipation. When the bill was proposed in Parliament providing that the miners' children should be sent to school, we find one man in the Upper House savagely and bitterly fighting it, every inch of the road. This was Lord Londonderry. He was fighting for his own material interests. He raised, naturally enough from his viewpoint, the competitive question. He pointed out that the children were a necessity in the low seams of coal; that they could tram the little cars, and if this was denied, it would require untold expense to brush the roadways so that ponies could be used. But he went further than this: He raised the cry somewhat similar to the cry that was raised in some of our own States during the ante-bellum days: "An educated slave is a dangerous slave." He declared that if a few rays of enlightenment were allowed to permeate the minds of these boys and girls, they would never stand for the conditions that were visited on their fathers and mothers. He declared that if this legislation were to be adopted, many of the mine owners in the low seams would be competitively ruined and would have to go out of business. Of course, he was one of the most extensive mine owners in the North of England; he was speaking in the spirit of the times, and no doubt felt that he was making a logical, competitive argument for the industry. The same Londonderry family remained large mine operators in Britain and accustomed themselves to this radical departure in methods of mining.

Growth of Industry

The system of industry we are living under today is a growth. It is growing and extending all the time, and no man or set of men living can be held responsible. Changes are gradually brought about, and men on all sides of the situation live to revise their judgment at times, if they are intelligent. Hardships, mining disasters, bad ventilation, lack of adequate understanding and legislation naturally drive the workers together for their mutual self-protection and preservation. They know, by bitter experience, that in those communities where they have established the greatest amount of solidarity the best conditions of living and working obtain, the best laws are enacted, and the better enforcement of existing laws is prevalent. They know that no one can save them, but they must save themselves. They know that democracy cannot be handed down to them, but that democracy must be achieved. Therefore, they are banded together in trade and industrial unions in every progressive country in the world. They have made progress and they have made many mistakes. They have learned much by experience and by the mistakes they have made.

They alone may not be able to bring a full measure of stability and equity into the situation; therefore, the question of intelligent joint relations in industry arises. I have served the workers' movement in different capacities before I was honored by my present position, and have always been an ardent advocate and stickler for adequate joint relations and a strict observance of them.

I do not claim that we have reached that happy time when all friction has been eliminated and the lion and the lamb lie down together. I do not say that the interests of capital and labor are identical. I say that they have problems peculiar to the industry that no one on the outside can properly understand and appreciate, and the greatest good for all concerned and the public, whatever that is, is conserved by both sides of the mining industry composing their differences in joint conference, and reaching as complete an agreement regarding wages and working conditions as they can for a specified time, with machinery set up for the peaceful adjudication of any disputes that may arise, without stopping the industry.

In these joint negotiations neither side gets exactly what it wants; but if they are in earnest they will find a common ground where agreement can be reached on the general situation. I cannot claim that such agreements are perfect and are never violated, but that itself is a question of joint consideration.

Results of Mutual Conferences

A joint agreement is the property and concern of both parties to it, and the imperfections and shortcomings manifest themselves in the operation of the agreement, and are subject to amendment and change as time and experience warrant. When either side to an agreement violate it or decry it, it is proof at least that they admit failure as far as they are concerned. I believe there is enough intelligence and common sense in the mining industry to deal with that industry as it deserves, and know that the best interests of everybody are best conserved by so doing. Questions of competition, cost of production, freight rates, etc., are just as moot questions in these conferences as anything else, and where the facts are all brought out, it is hardly likely that any set of workers with full knowledge of what it means would legislate themselves out of an industry in a particular locality for the sake of something on paper.

Methods of pay, whether by the day or piece-work, the length of the work-day, the best methods of handling disputes, guarantees that the property should continue in operation pending the settlement of disputes, are all questions for consideration in the joint conference. Neither side can deal satisfactorily with these questions by itself. The workers' movement and the employers' movement constitute a joint organization, each with the same voting power. In these conferences the bars should be down and either side privileged to introduce any question or idea they desire. No matter can be adopted until it receives the unit vote of both sides, and any matter that does not receive such vote can be set aside or discarded for that contract period. In the operation of these joint agreements many things might occur that would prompt either side to offer changes or amendments to the next agreement that would be mutually beneficial to both sides. If competitive conditions warrant, an agreement might be

negotiated for an entire State, in other cases for a locality, where geologic and competitive conditions warrant. Those directly involved—the operators and the miners—will know best about this.

Confidence Replaces Former Suspicion

With these relations established, a greater confidence and a better feeling is established between the two parties where discord, suspicion and friction formerly existed. Better cooperation is assured and greater efficiency manifested all along the line. The workers feel that they are admitted, to some extent, to a voice in the councils of industry. The human equation has been recognized to the betterment and profit of all.

I have been instrumental and helpful in negotiating many agreements. I never yet saw one that gave either side just what it wanted. If you were to give me full authority to write a miners' agreement for the great copper industry, it would undoubtedly be a fine agreement for the miners and smeltermen, but it might be unsatisfactory and unworkable from an operator's viewpoint. But I never saw one of these agreements, negotiated in the open, without undue advantage on either side, but what was beneficial to the industry.

The only way our old antagonism will cease, the only way unreasonable men and fanatics will be permanently eliminated from the scene, is by equitable and candid joint relations. There are men on both sides of the proposition that the industry would be better without. There are employers who still stick to the idea that they have the immortal right to dictate terms absolutely, without considering the workers in the smallest degree; and there are those in the ranks of the workers whose purpose it is to stir up discord, hamper production, fan the flames of hatred and discontent, gather in a critical situation like vultures around a carcass, and when their mission has been accomplished and there is no more hell to raise, they fold their tents and steal away to other places, leaving their poor dupes to hold the sack while heralding the social revolution in other fields. Where no joint relation or understanding exists, there is always an open season for the rumbum revolutionist. These periodical tie-ups that lead nowhere, together with the cost of maintaining forces that pre-

vent intelligent organization, add to the cost of production, and might properly be figured as unpaid wages of the workers, as compared to a happier and more humane arrangement.

Many of you had an opportunity to see the working of joint relations in the metalliferous industry during the war. This industry is not adequately organized and, as a result, has more than its share of I. W. W. sentiment.

Work of the Department of Labor

In 1917 the President's Mediation Commission visited Arizona and other points in the West. Strikes were prevalent throughout the copper fields. A plan of settlement was worked out whereby the men returned to work, committees were elected at the various mines and smelters who would endeavor to adjust disputes with the management, and if unable to do so, such disputes were to be submitted to a representative of the Department of Labor. This was sort of a tri-party agreement, set up for the period of the war, to maintain industrial peace and a maximum production of copper for the war period. I was interested in the program. We determined that a program should be worked out that would safeguard the interests of the workers and prevent, in so far as it was humanly possible, any interruption in the production of copper. So in the poorly organized copper fields, with scanty restraint of the evil influences of I. W. W.-ism from the national labor movement in fields where this misguided philosophy was rampant, peace was established and uninterrupted production maintained. No basic industry gave a better account of itself during hostilities. I doubt if many of you realize the dangerous situation existing in that industry, whereby men, some undoubtedly actuated by sinister motives and serving questionable interests, were prepared to create havoc and chaos by the medium of wildcat strikes, shutting down of smelters and in jurisdictional disputes. Some were merely misguided, some were quite wrong. I personally gave my time and attention where it was needed, went directly up against some of these baneful influences and co-operated with the program in every way. We were all successful, and that industry went through from that time on without a cessation of work.

But here is another example: On the signing of the armis-

tice, so successfully did this program work that the producers had approximately 1,000,000,000 pounds of copper on their hands, and the Allies had a similar quantity of metal. A panicky situation was created, and I believe copper that was in transit for the Government was refused, and there was the threat or danger of the Government throwing its copper on the market for what it would bring. An unusual condition resulted therefrom. Prices dropped, which very naturally manifested itself in the earnings of the men. So we decided that here was another chance to recognize in the open the human equation. We invited the representatives of the workers and the producers in the copper States to attend a conference in the Department of Labor Building for a frank discussion. If some of you think it an easy matter to convince men that the better part of wisdom lay in accepting a reduction in wages of about a dollar a day in the face of an increasing cost of living, just try it some time. We gathered and went over every phase of the situation. There was naturally nothing but antagonism at first on one part of the conference, but a careful, dispassionate analysis of the stern facts eventually demonstrated to all the necessity of what was ultimately done, a unanimous agreement to accept the unavoidable reduction, and every endeavor was made on the part of the operators not to close down any of the plants, and where the production was reduced an equitable division of what work there was maintained. I would not have advocated or subscribed to this policy had I not been convinced that any other method would have been rank folly under the circumstances. It was agreed to unanimously, and each delegate pledged himself to advise its adoption on his return home.

Surely these two incidents carry a lesson worth knowing. In the event of closing down the industry by either side at that particular time, God knows what the results would have been. Here was a case where joint relations brought good into a mighty uncertain situation.

We sometimes draw the wrong conclusions. Some of us may be like the Cousin Jack who was shopping down in Sacramento. He had the hobby that a miner would not work properly except in a red flannel shirt. The saleslady was out of red flannel and was trying to convince him that the other colors of flannel were just as good, when he answered: "Look

here, lass, I like that red flannel; when he's cold and wet, he's always warm and comfortable."

The Human Equation in Industry

Germany had a wonderful organization. I wonder how many of us realize how near she came to taking the world. Where is the man who can explain how the forces of Imperial Germany were turned back at the battle of the Marne? As a matter of cold logic, they should have gone through to the Channel ports and bombarded the cliffs of Dover with their long-range artillery. If the Germans had been as intelligent as they are industrious, they would have taken the world. They builded and planned and schemed in a way that was marvelous. They thought to catch an unsuspecting world asleep. They sought to practice duplicity and dishonor on such a scale that the world could not realize or be sufficiently aroused till it was too late. Explanations could be made from the vantage point of the victor—that the end justified the means. They almost did catch the world asleep. They nearly went to Paris. But with all their diabolical scheming and organization, they were, after all, mere disciples of materialism. They do not, never have, nor ever will understand the great human equation. It was this human equation that saved the world from the domination of Germany.

I am by nature an optimist. There is nothing in this world to be afraid of. I have lived and traveled over this world under all kinds of conditions, adverse and otherwise. I would not exchange my experiences for anything in the world. And I know this world is growing better; that a better understanding between man and man is being brought about. I realize that as long as the desire for progress is prevalent in the mind and heart of man, the battle will be more or less to the strong. I have seen the boundless, undeveloped resources of this continent and Mexico. I have seen the great field for re-building and better planning in Europe. I believe that a better era is opening for all the children of men, and I feel that the future holds a greater measure of happiness for men, women and little children than it has known heretofore. I believe there is a growing sentiment among the pioneers and builders of industry that they are able to win fame and fortune without the exploitation of the toiling masses, and I

believe that the right ideas will prevail in the same proportion as men and women will stop and consider the other fellow's argument and status, and survey their affairs from the viewpoint of the common good and the advancement of the race.

We are all pretty much alike in our views and desires and aspirations. We want to live better lives; we want to create a better environment for our children that they may become better men and women. The luxury of today properly becomes the necessity of tomorrow. There is no way by which orderly progress and industrial peace may be maintained, in my opinion, other than the recognition of the human equation and equitable joint relations. By this procedure a greater measure of orderly progress can be guaranteed and the greatness of our beloved Republic safeguarded. And in addition to the security and happiness in industry, a field for joint mutual effort on the legislative field is opened that does not exist now, to the detriment of the mining industry as a whole.

A Desirable Condition

This address is incomplete, yet has taken up considerable of your valuable time. I appreciate fully the opportunity of expressing these few thoughts as they have occurred to me. I have no thought that you will unanimously agree with me in all that I have set before you, but if any word of mine should start any of you to ponder seriously over the economic situation, to really reason it out according to the rule that two and two make four, I feel that my visit to the Congress has not been in vain. Take some time from your busy lives to analyze the theory and practice of better understanding; try some phase of it out, if only in a local way; deal with the situation intelligently and in the open, and you will see that, with all sentiment aside, it is sound business policy.

Let us not live in the memories of the past, but rather let us face the terrific situation that exists in these critical hours throughout the world, with the conviction that there is enough intelligence and enough humanity in the mining industry to cope with all its problems, to establish a better understanding in this world, to the end that all men who do the useful work of our country by hand or brain may bask in the sunlight of economic liberty and peace.

WHY COLORADO MINING ENGINEERS ADOPTED THE OPEN-SHOP MOVEMENT

By CHARLES A. CHASE

Manager, Liberty Bell Mines, Telluride, Colorado.

A committee of the Colorado section, American Institute of Mining and Metallurgical Engineers, in May last proposed, and the section adopted, the following resolution:

"Freedom of thought and speech and of legal action and untrammelled contract are guaranteed by the Constitution of the United States; hence we assert these rights as inalienable to each and every citizen.

"We believe every citizen shall be free to exercise these rights, to the end that he or she may earn a living for self and dependents, regardless of political, religious or labor affiliations.

"Therefore, everyone must have the right to join a union or not, and the use of force, violence, blacklist, boycott and lockout as a means of influencing such individual action is to be condemned as vicious and against public welfare."

This resolution had no special reference to present conditions in Colorado, but rather echoed national conditions; in other words, it was our patriotic answer to a national roll-call. Civic and business organizations from coast to coast passed similar resolutions. At a time of scarcity of labor, quite unprecedented in the history of the country, and with labor making every effort to entrench the closed shop, these resolutions were a timely iteration and reiteration of a basic principle.

How the Resolution Was Received

The resolution is necessarily a challenge. Many, and among them organized labor in large part, look upon such expressions as a challenge to the unions to battle again over the old question of union recognition, but the real challenge to labor is admirably expressed by Sir Charles C. Allom, a Brit-

ish manufacturer, in a New York speech: "Labor should demand of its trades unions that they shall prove to the world that they have brains, and that labor's force is the force of intellect, and not of mere numbers. Labor, with its proved power to coerce industry, should now proceed to use its power in a civilized instead of an ignorant and uncivilized manner." I quote him, because he expressed the principal thought in my own argument—that intellect must govern industry.

The resolution is equally a challenge to owner and manager, which is of special interest to us, and I can give you no better statement of it as a challenge than to quote one of the principles (No. 6) enunciated by the National Chamber of Commerce:

"The wage of labor must come out of the product of industry, and must be earned and measured by its contribution thereto. In order that the worker, in his own and the general interest, may develop his full productive capacity, and may thereby earn at least a wage sufficient to sustain him upon a proper standard of living, it is the duty of management to co-operate with him to secure continuous employment suited to his abilities, to furnish incentive and opportunity for improvement, to provide proper safeguards for his health and safety, and to encourage him in all practicable and reasonable ways to increase the value of his productive effort."

Education of the Worker

A few sentences from the address of Mr. H. H. Knox as he retired from the presidency of the Mining and Metallurgical Society will illuminate the point. He makes clear the mental stagnation of the worker:

"* * * but what of the great inarticulate masses of workers who do not write technical papers nor read them? What profitable intercourse have they? It is no mere fancy to liken modern industrial wage-earners to the primitive races of antiquity or the backward peoples of the present.

"If, as I believe, the mental stagnation of the laboring classes is attributable to stagnant environment, then evolution can be promoted only through variation of the environment. * * * At all events, evolution will, if I may hazard a prediction, lie in such directions as will summon to action the latent mentality of the manual laborers and so blur the

sharpness of the line now separating the work of the hand from the work of the brain. Through such movements as these lies the promise of a new era, of which the coming can be hastened by the earnest application and friendly interest of every employer. The application of systems of similar aims to the peculiar conditions of mine and smelter is a task that will tax to the utmost the trained faculties and disciplined sympathies of the engineer, at the same time that it challenges his ambition by the breadth of the prospect opened out."

The quotation from the United States Chamber of Commerce represents some of the best thought of the country, and the phrases given were concurred in almost unanimously by the membership voting. In passing, I may call your attention to the excellent authority for the expression, which may be found in that part of the Bible that designated man as his brother's keeper. In the scheme of things, the more fortunate must assume some measure of responsibility for those less fortunate. By natural processes of selection, which govern in the main, the best intellects have come into the places of responsibility. We, who in part occupy those places, therefore, have the principal burden of thinking through. In my observation, an important mark of a great man is the ability and will to think clear through to right solution, based on fundamental principle.

However, we, as owners and managers, cannot say in so many words to labor that we have the best intellect, and, therefore, our word must govern, and hope to get away with it, but if we really have the best intellect and apply it, by that very fact we can gradually sell to labor (I adopt the salesman's expressive phrase) a scheme of industrial relations that will help. I do not say that it will be a prompt solution—the road is too long for that, but we can begin.

On the other hand, note Mr. Allom's injunction to labor to prove to the world that it has brains. A good industrial motto is: "Let the best brains make the plan."

Dull Mining and Freedom From Labor Troubles

Colorado's metal-mining industry has been too unhealthy in recent years to make a good prize in battle, and we have had peace, and the open shop in the main. Coal mining, on the

contrary, has been active. Wages have been governed by country-wide schedules, but as to other phases of industrial relations the industry presents remarkable contrasts between the closed shop, as applied by the United Mine Workers of America on the one extreme, and the Colorado industrial plan of employe representation of the Colorado Fuel & Iron Co. on the other extreme. The former calls for no comment. The Colorado industrial plan has been much described, but for those who are not familiar with it I may say that it provides equal employe and management representation in each of four divisions:

- 1—Co-operation and conciliation,
- 2—Safety,
- 3—Education and recreation, and
- 4—Sanitation, health and housing.

We hear much of special campaigns of Americanization, but this industrial plan must Americanize. It is courageous, sound and broad, providing representation in every important branch of civic activity. It meets fairly the issue of unionism. The miner may carry his union card and yet work under this plan. He may go to a closed-shop union mine if it offers more, and, plainly, if he goes in great numbers, he will deprive these mines and plants of necessary labor, but these mines have had at least their share of labor. The plan has now operated six years and is a success. In other words, able management is succeeding in selling to labor a plan based on better intelligence, courage and vision than any program that labor has offered in this field.

Results of Such Representation

I wish to offer a comment on one implication in the success of this plan of representation. We have heard of the democratization of industry, and yet at this time the best minds of the country believe our future safety politically lies in a swing back, away from our approach to the purely democratic and toward the representative form of Government. It is possible for the body politic to judge the fitness of a man as its representative, but unthinkable that it can pass wisely on the complexities of legislation. Therefore, instead of industry absorbing weakness from a wrong political system, indus-

try may well prove afresh the value of representative government. I have mentioned the Colorado industrial plan only. It is certainly the most important example of employe representation in Colorado. In general, it is like the plan for shop committees elsewhere, but stands out for the completeness of its written framework of principles, to which the men attach great and increasing importance. I acknowledge Mr. Welborn's courtesy in discussing the plan with me.

Having mentioned the Colorado plan as a local example of a plan fathered by owners and management, I may go afield so far as the clothing makers of the Amalgamated, where union, under able leadership, has sold to that industry a scheme for employe representation. This work is notable, because unionism accepted as a basic consideration *the welfare of the industry*. Unionism in this case guarantees production and assumes the burden of disciplining workers. The shop is nominally open, but, in fact, a trifling minority have kept out of the unions, but unionism seems to have justified its existence and its right to confidence by demonstrating that it has brains.

My theme has been the requirement that intelligence, God-given, shall be permitted to operate in industry as against the force of great wealth wrongly applied on the one side, or of great numbers wrongly led on the other. The principle cannot be over-emphasized, and it is by adherence to great principles that we progress.

I have not argued expressly against the closed shop as we know it today, because I believe it unnecessary. We are probably a unit in believing it unthinkable if the nation is to progress. The complaint that it is unfair to the non-union man is as nothing as compared with the fact that it represents a barrier to the free functioning of the best intelligence, whether of management or labor. That the country cannot afford.

LABOR CONDITIONS IN THE BISBEE DISTRICT

By ARTHUR NOTMAN

Superintendent Mine Department, Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Ariz.

In the following paper I will endeavor to give a brief outline of working conditions in the Bisbee district at the present time, with particular reference to the operations of the Phelps Dodge Corporation. Our good friends and neighbors, the Calumet & Arizona Mining Co. and the Shattuck-Arizona and Denn-Arizona companies, are, in general, working along parallel lines. The figures shown, however, apply solely to the Copper Queen Branch of the Phelps Dodge Corporation:

PERSONNEL.

	Number of men on payroll.	Citizens.	Married.	Single.
Underground, Oct. 1, 1920	1541	1163—75%	911—59%	632
Steam-shovel operations	1030	369—36%	424—41%	606
Mechanical department..	279	256—91%	155—56%	124
Total	2850	1788—62%	.....	.....
Mill construction.....	462	81—17%	199—43%	263

HOURS OF LABOR:

Underground:

Eight hours, collar to collar (one-half hour for lunch on company's time).

All other Departments:

Eight hours (one-half hour for lunch on employe's time).

WORKING DAYS PER WEEK:

Underground:

Six days per week (excepting necessary repairs).

Other Departments:

The same.

The work is carried on in two shifts of eight hours each, alternating from day to night every two weeks, excepting for a small number of jobs which require continuous operation.

WAGES:

Wages are on a sliding scale, based on the average selling price for copper as shown by the *Engineering and Mining Journal* quotations for the preceding month. The base was established at \$4 per day for miners on 15-cent copper, with an increment of alternately 10 and 15 cents for each increase of one cent per pound in the selling price. Owing to various adjustments made during the war period and since the armistice, the present wage is \$6.10 per day for miners. These changes were made at the request of the Government with a view to stabilizing labor conditions in the industry. Recognition of the increased cost of living played a part in these arbitrary adjustments that were made in the original scale and still do so. As a result, wages have been maintained at their present level in spite of the falling copper market.

The men are paid semi-monthly by checks on the local banks.

The rates paid other labor classifications bear a fixed relation to the miners' rate. At the present time the average rate paid all labor, exclusive of salaried employes, is about \$5.15 per day.

All rough labor on the surface, including steam-shovel operations and mill construction, is Mexican, to whom the lowest rate paid is \$3.25 per day.

BONUS WORK:

In addition to direct wages, from 25 to 30 per cent. of all employes participate in bonus earnings. Underground, all men engaged on development work are given an opportunity to earn individual production bonuses, based on past performance in the various sizes and designs of openings and class of ground. Responsibility for the classification of the ground and the setting of standards is assigned to the engineering department, and not the operating department. A small group of men cover this work for the whole mine. The object desired is to equalize opportunity and give a man the chance to earn the same bonus for the same intelligence and effort, regardless of the class of ground or kind of opening which he is driving, the boss or the general conditions surrounding that portion of the mine in which he is employed. The system adopted differs from many in general use in that the classification is made as

the heading is driven and the standards varied accordingly. They are not set in advance and maintained for a given period of time regardless of changing conditions. The standard is expressed as so many feet per man-shift, and any economy in labor is divided equally between the men and the company. For example: A man who doubles the standard of performance will earn as bonus one-half his daily wage and the company will secure this additional footage at one-half the average labor cost for similar work. The system is being extended to include stoping operations. It seems probable that eventually 75 per cent of the underground force can be employed on bonus work. The men engaged in the classification of ground and setting of standards are, in part, technically trained engineers, and, in part, skilled miners. Any dispute as to standards which cannot be adjusted between the individual and the head of the department can be referred to the superintendent of the mine department. If the individual is still dissatisfied, the matter, at his request, will be investigated by the Employees' Grievance Committee and presented, with their recommendations, to the manager for final decision.

All bonuses are paid on checks separate from the regular pay-checks.

In the steam-shovel operations conditions seem to call for a different scheme, and an over-all or gang bonus has been adopted. The standard is expressed as so many yards per man-shift for every man engaged below the rank of steam-shovel superintendent, and is based on past performance and general conditions. Any labor economy shown by the organization as a whole, due to better methods, better equipment, better co-operation or more earnest and intelligent effort, is shared equally between the men and the company. For example: If the yardage per man-shift shows a 10 per cent. increase over the standard set for the month, each employe will receive a bonus check for 5 per cent. of his earnings for that month, whether he has worked one shift or full time. Daily records are kept and curves plotted showing cumulatively the bonus earned to date based on car yardages. This yardage is subject to correction at the end of the month, and the bonus or economy dividend paid is based on the engineering department's monthly measurements of yardage moved from the various benches.

The advantage and disadvantages of the individual or gang bonus are fairly obvious, and I will not attempt to discuss them here. General conditions and personal preference will determine the choice. Neither will survive if not administered in a spirit of fair play, and must be protected from personal prejudice and partiality on both sides.

SAFETY DEPARTMENT:

The work of this department is conducted in a manner similar to that now familiar to all throughout the industry. Our particular practice has been adequately described in several papers presented by Mr. W. W. Gidley, safety inspector of the Copper Queen Branch, Phelps Dodge Corporation.

A system of bonuses for foremen, for accident prevention, has been of assistance in establishing a record of which we feel proud.

HOSPITAL DEPARTMENT:

An up-to-date hospital and dispensary are maintained by the company, manned by an adequate staff of surgeons, physicians and nurses, who care for injuries to and the sickness of employes and their families. For this service, men with dependents are charged \$2, and those without dependents \$1.25 per month. The deficits for the past four years which were met by the company were as follows:

Deficit 1916.....	\$13,165.21
Deficit 1917.....	18,886.61
Deficit 1918.....	22,810.56
Deficit 1919.....	29,569.82

In spite of increasing costs, the charges have not been increased. Copies of the rules and regulations covering this department are furnished the employe on entering the service.

EMPLOYEES' BENEFIT ASSOCIATION:

To provide for accident and health insurance not covered by the State Compensation Act, an Employees' Benefit Association, established in 1910, was reorganized in 1912, after the passage of this Act, and is maintained by joint contributions from the members and the company. The funds are guaranteed by the company and administered by a board of nine trustees; four of them are elected by the members and four appointed by the manager. The manager is chairman of the Board. Contribu-

tions from the membership are at the rate of 2 per cent. of the daily rate of wages, computed on an amount not to exceed \$150 per month. Benefits are calculated in a similar manner. The company's contribution is as follows: At the end of each year, if the average membership in the Benefit Association during that year has equaled 50 per cent. of the average total number of employes of the corporation's Copper Queen Branch, exclusive of Mexican employes, the corporation will contribute \$15,000 to the fund. The corporation agrees to advance funds temporarily when necessary for payments of benefits at due dates, to guarantee the safety of the fund and to pay semi-annual interest on the average balances at 4 per cent. A copy of the rules and regulations of the association is furnished each white employe on entering the service and his membership solicited. Membership is voluntary. Eighty-seven per cent of the white employes are now members.

PENSIONS:

The company has established a system of pensions for employes who have been in the service 15 years or longer. This system applies to all who, in the opinion of the company, have become physically disqualified for further service. The length of service is reckoned from the date of first employment. The amount of pension allowed is 2 per cent. of the average annual wages for the three years preceding the employe's retirement. The payments are made regularly in a manner similar to payments of salaries and wages. At the present time there are 74 on the pension roll.

HOUSING:

The company has long recognized the importance of housing its employes in a suitable manner. The Cochise Building & Loan Association has made a remarkable record in aiding the workingmen in the district to secure their own homes. In doing this they have been liberally assisted by the Phelps Dodge Corporation and the Calumet & Arizona Mining Co. In addition, the two companies named, at the suggestion of the late Dr. James Douglas, have financed an organization for the purpose of loaning funds for a period of 100 months to employes to erect their own homes of modern type; the money to be paid back with a low rate of interest.

LIBRARY AND READING-ROOMS:

A public library is maintained by the company exclusively. Eight thousand volumes are on file; also 24 daily papers and 60 magazines. It is well patronized and renders an excellent community service.

Y. M. C. A. AND Y. W. C. A.:

Substantial and well-equipped buildings have been furnished, rent free, to the Y. M. C. A. and Y. W. C. A. organizations for the conduct of their work. Liberal contributions are made to both organizations for current operating expenses.

EMPLOYMENT AND DISCHARGE:

All men seeking employment make application to the employment agent. After satisfactory personal interview and investigation, they are given a physical examination and may, at the same time, be examined for membership in the Employees' Benefit Association. Upon passing a satisfactory physical examination, they are assigned to some department and given a card stating when, where and to whom they are to report, together with general instruction in the rules and regulations of the company, and such advice as they may seem to require in regard to living conditions.

If, for any reason, a foreman finds an employe unsatisfactory, he is returned to the employment agent with a recommendation for discharge or transfer. At the same time, the foreman sends the agent a statement of the reasons for his action. The latter then exercises his own judgment in the matter of following the foreman's recommendation. The employe may appeal from such decision to the manager of the labor department, and from him to the employes' committee, who, after investigation, will report and make recommendation to the manager of the company. To summarize, the right of a foreman or boss to work only such men as are satisfactory to him remains unquestioned, but the right of summary dismissal from the service of the company has been centralized and the individual's interest protected.

LABOR DEPARTMENT:

The labor department is under the direction of a manager who is directly responsible to the manager of the company.

The functions of this department are to supervise the following activities:

1. Employment and discharge.
2. Safety department.
3. Hospital department.
4. Employes' Benefit Association.
5. Pensions.
6. Employes' representation.
7. Educational department.
8. All other functions generally classed as welfare work.

Naturally, close co-operation is maintained between the operating department and the labor department in all matters. All questions of labor policy are formulated by the manager of the company, with the advice and counsel of the assistant manager, the superintendent of the mine department and the manager of the labor department.

EMPLOYES' REPRESENTATION:

A number of years ago it was deemed advisable, inasmuch as the employes contributed to the support of the hospital department, that they should have a voice in its management. Consequently, they were invited to elect a committee whose duties should be to inspect the operation of the hospital department and make reports and recommendations to the manager. Early in 1917 the duties of this committee were enlarged to cover all questions of welfare and grievances. Early in the present year the size of the committee was increased to one representative for each 100 employes, elected by divisions. The name was also changed to "Employes' Conference Committee." At the same time the foremen and bosses were invited to elect a similar committee, known as the "Foremen and Bosses' Conference Committee." At the present time these committees are functioning, under the supervision of the manager of the labor department, in an advisory capacity to the manager of the company and his staff in all matters concerning the welfare and working conditions of employes.

These, in general, are the conditions under which men in the Bisbee district are working.

Perhaps, in our desire to protect the rights of the individual workman in industry, there may be a tendency to overlook the

importance of the foreman and shift boss. To do this in any organization is like attempting to construct an arch without a keystone. With this fundamental in mind, we organized our Foreman and Bosses' Conference Committee to ensure the proper presentation and consideration of their function in the smooth running of the organization as a whole.

To discuss intelligently the so-called "open-shop" policy, it is first necessary to define the term. We understand it to mean that no man shall be discriminated against for membership in or affiliation with any organization whose principles are not in conflict with the Constitution of the United States. As a result, many of our employes are and have been for years members of the various trade unions affiliated with the American Federation of Labor. Many others have never felt the necessity to associate themselves with the trades-union movement.

We acknowledge the value of trades-unionism; the soundness of many of its professed principles; the honesty and sincerity of many of its leaders; and its necessity where other and perhaps better means of securing to our citizens the American right of equal opportunity to all are not available. We also recognize that men have the sole right, individually and collectively, to determine when and by what means they shall seek to protect themselves in this right, provided they are within the law. When, through the action of unscrupulous leaders, the unions seek to deprive their fellow-citizens of that right, they weaken their own cause.

Trades-Unionism Not a Requisite to Industrial Peace

We do not believe that trades-unionism as now conducted is a *sine qua non* to industrial understanding and orderly progress. The history of the trades-union movement in the metal-mining industry in the West shows only too plainly the ease with which it can be betrayed into the hands of the enemies of our country through the insidious process of boring from within by the advocates of the destruction of existing institutions.

It is the policy of wisdom, therefore, for us to seek a mutual understanding with our own employes, in whom we have confidence, and whose confidence in us we must foster. Our faith in American institutions demands this of us. In the light of present conditions, adoption of the *laissez faire* attitude

towards this matter, and a stand-pat resistance to departure from accustomed methods cannot fail to alienate our employes, and will subject the industry as a whole to the uncertainties and failures of divided counsel.

The right to determine when and how the scope of operations shall be changed is a function of management and cannot be questioned by the employes. The conditions under which human labor shall be employed is a matter of mutual agreement between the managers of industry and those who may seek employment from them.

Perhaps the most serious problem facing the individual in industry is that of uncertainty of employment. The larger the organization the more readily can the uncertainty be minimized and the individual protected from personal prejudice and partiality. However, conditions occasionally arise beyond human control, which involve the discharge of large numbers of men. It is the duty of the industry to see that under such conditions the change is made with the minimum of injustice and hardship. We, in the copper industry, were faced with such a condition early in 1919. Realizing the importance to the individual of his means of livelihood, we, in the Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Arizona, determined to adopt the procedure followed by the Government under the selective service regulations, and drafted the men for lay-off with the assistance of their own elected representatives, having due regard to dependency and length of service with the company. We have but just now faced a similar condition, which involved a 50 per cent. reduction of our steam-shovel operations. The matter was handled in the same manner by the Employes' Conference Committee. In both cases the men have expressed their belief that this vital matter was taken care of in an eminently fair and just manner.

There can be no doubt of the response which the American people will make to fair and square dealing between employers and employes.

WHAT 1920 DEVELOPED IN THE ANTHRACITE INDUSTRY

By EDWARD W. PARKER

Director, Anthracite Bureau of Information, Philadelphia, Pa.

For a little over seventeen years, or since October 1902, when the anthracite mine workers terminated their great strike of that year and returned to their working places in accordance with their agreement with President Roosevelt, and the appointment by him of the Anthracite Coal Strike Commission, industrial peace has prevailed in the anthracite region. As a result, the miners and the communities have prospered to an extent probably not equalled, certainly not excelled, in any industrial locality in the United States, if indeed in the world. It is too much to hope and expect that there should not be some local disaffections, and these there of course have been, but they were sporadic and not contagious nor epidemic, and have been settled through the agency established by the Strike Commission, namely, the Anthracite Board of Conciliation, which, as you probably know, consists of six members—three from the operators and three from the miners. The more recent Anthracite Commission (of which I shall speak more in detail later) says in its majority report that the creation of the Board of Conciliation “is, perhaps, the most valuable and most abiding work of that Commission.”

Work of the Anthracite Board

The Anthracite Board of Conciliation has not only maintained peace in the anthracite region by the amicable adjustment of such grievances as have come before it (and these have numbered some 800 during its 17½ years of existence), but since 1912 its members have constituted three-fourths of the committee that has negotiated the wage agreements, of which there have been no less than nine, including the one of September 3, 1920, since the Anthracite Coal Strike Commission made its report to President Roosevelt in March, 1903. It is true that when the latest agreement terminated, on March 31, 1920, the negotiations for the construction of a new agreement signally failed, and this failure is responsible for whatever of

an unfortunate character the year 1920 developed in the anthracite industry.

The failure to negotiate a new agreement, which resulted eventually in the appointment by the President of a commission to settle the matters in dispute, was due primarily to the interjection into the controversy of a new element known as the "consulting economist," impersonated by one W. Jett Lauck; and, secondarily, to the demand of the miners for a "closed shop" in the anthracite region. As the latter can be disposed of more briefly than the former, it will be given first consideration.

Demand No. 5 of the 15 demands originally presented by the miners for the consideration of the negotiating committee was:

"We demand a closed-shop contract, which means full recognition of the United Mine Workers of America as a party to the agreement."

Closed-Shop Demand a Stumbling-Block

It proved to be the principal stumbling block in the deliberations of the Committee. The two sides were, except for this, not far apart when, after nearly two months of negotiation in New York, and a final disagreement, with a resulting suspension of work imminent, the Committee accepted the invitation of the Secretary of Labor to come to Washington. There, nearly a month of time was taken up in conferences with the Secretary, who, with extraordinary patience and diplomacy, endeavored to effect a settlement. After numerous separate and joint conferences with the two sides of the Committee, the Secretary submitted a tentative plan of an agreement, most of which was in a spirit of compromise accepted by the representatives of the operators. The representatives of the miners, however, unwisely advised, had somewhat amended their original demands, and had presented to the Secretary what they designated as an "ultimatum," included in which was a demand that Article IX of the Anthracite Coal Strike Commission award should be eliminated. This particular article, next to the one providing for the creation of the Board of Conciliation, is probably the strongest pronouncement of that Commission. It says:

"IX. The Commission adjudges and awards: That no person shall be refused employment, or in any way discriminated against on account of membership or non-membership in any labor organization; and that there shall be no discrimination against, or interference with, any employe who is not a member of any labor organization by members of such organization."

Anthracite Commission Favors Open-Shop

That Commission then spoke unequivocally for the open shop. In giving utterance thereto it did not fail to state its reasons in language no less forcible, and I may be pardoned if I here quote a portion of that language:

"The right to remain at work where others have ceased to work, or to engage anew in work which others have abandoned, is part of the personal liberty of a citizen that can never be surrendered, and every infringement thereof merits and should receive the stern denouncement of the law. All government implies restraint, and it is not less, but more, necessary in self-governed communities than in others to compel restraint of the passions of men which make for disorder and lawlessness. Our language is the language of a free people, and fails to furnish any form of speech by which the right of a citizen to work when he pleases, for whom he pleases, and on what terms he pleases, can be successfully denied. The common sense of our people, as well as the common law, forbids this right should be assailed with impunity. It is vain to say that the man who remains at work while others cease to work, or takes the place of one who has abandoned his work, helps to defeat the aspirations of men who seek to obtain better recompense for their labor, and better conditions of life. Approval of the object of a strike, or persuasion that its purpose is high and noble, cannot sanction an attempt to destroy the right of others to a different opinion in this respect, or to interfere with their conduct in choosing to work upon what terms and at what time, and for whom it may please them so to do.

"The right thus to work cannot be made to depend upon the approval or disapproval of the personal character and conduct of those who claim to exercise this right. If this were otherwise, then those who remain at work might, if they were in the majority, have both the right and power to prevent others, who choose to cease to work, from so doing.

"This all seems too plain for argument. Common sense and common law alike denounce the conduct of those who

interfere with this fundamental right of the citizen. The assertion of the right seems trite and commonplace, but that land is blessed where the maxims of liberty are commonplaces."

But to return to the Secretary: So far as the matter of wages was concerned the operators had agreed to practically all of the compromise suggestions the Secretary had made, but positively declined to agree to any change of principle enunciated by the Anthracite Coal Strike Commission, and the Secretary had finally to notify the President that he had gone the limit his conscience would permit. The miners, in convention at Wilkes-Barre, repudiated the Secretary's suggestions and requested the appointment of a Commission, as the President had announced he would do if the controversy were not settled otherwise. That Commission has also spoken for the open shop. It ordered, to be sure, that an agreement based upon its findings should be made with the United Mine Workers of America, but it added that, "this official recognition of the United Mine Workers of America for the purpose of adjusting differences and strengthening collective bargaining does not carry with it the theory or the fact of the "closed shop," or the "check off." And it strengthened the award of the Anthracite Coal Strike Commission by providing the machinery through which the non-union man should be protected in his rights of having his grievances presented before the Board of Conciliation, for it provided further, "that it does not in any degree interfere with or annul the provisions of the award of 1902 in which the rights and privileges of non-union men were stated and protected; and provided, further, that in cases where non-union employes have grievances, or where, for any reason, the grievance committee or mine committee fails to give such grievance consideration satisfactory to the employe, his right to appeal from the decision of the foreman or grievance committee and to the Board of Conciliation shall be inviolate."

This endorsement of the principle of the open shop is one of the things that 1920 developed in the anthracite industry.

Doubtful Value of a Consulting Economist

And now to go back a little and consider the primary cause of the failure to reach an agreement by the wage committee—

the consulting economist. First, at the meetings in New York, and later in the hearings before the President's Commission, the miners' case was presented in the shape of elaborately prepared statistical exhibits in which the increased cost of living as compared with increased earnings, the theory of "the living wage," the budget plan of determining wage scales, the occupational hazards of anthracite mining, etc., were set forth in extraordinary detail and manifold combinations. The miners had engaged a consulting economist, W. Jett Lauck, aforesaid, for whose services the treasury of their organization was mulcted, according to a statement in *Coal Age*, to the extent of approximately \$40,000. Lauck, it seems, had burst from obscurity into a certain degree of prominence by having himself appointed as secretary of the War Labor Board, from which he graduated into his present line of activity. And he has been decidedly active. He has organized a highly efficient publicity department which secures for him a large amount of free advertising in the daily papers, and he is a liberal contributor to the magazines and the publications of economic societies. He poses as the advocate of labor, and has figured in a number of labor controversies, notably among recent ones the street railway strike in Boston, before the Railroad Labor Board in Chicago, and in the hearings before the two coal commissions.

Mine Workers Wrongly Informed

Whatever may have been his success in the other controversies, his efforts on behalf of the anthracite mine workers were less than useless. It was developed at the hearings before the Commission, indeed by Lauck's own confession, that the exhibits he presented were neither statistically nor mathematically correct—in fact, every statement was discredited, and the money spent upon the preparation of all this "testimony" and the services of the consulting economist before the Commission was little more than money thrown away. Undoubtedly the representatives of the miners were deceived by the plausibly concocted exhibits. They were deluded into the belief that they were entitled to more concessions than the operators felt were justified, and into the hope that by refusing the offers made by the operators and the compromises suggested by the Secretary of Labor, they would obtain further

such as replacement, without expense to the miner, of tools lost through no fault of his own, and were granted without much demur. Others were of local importance only, and provision was made for their adjudication through the Board of Conciliation. What happened to the demand for the closed shop has already been noted. The only other two of major importance were the ones for increased wages and the 8-hour day.

Interpretation of Demand

It developed at the hearings before the Commission that the demand for an increase to correspond to the increases granted the bituminous mine workers by the Presidential Coal Commission was susceptible of several interpretations, the rate of increase being stated to mean anywhere from 27 to 31 per cent., with a \$6 minimum for common labor, both with and without existing differentials, and that the different conditions prevailing in the anthracite and bituminous fields were played one against the other to secure advantages in the matter of wages. For instance, in the hearings before the Bituminous Coal Commission, particular stress was laid upon the larger *earnings* of the anthracite mine workers, because notwithstanding the higher *unit rates* in the bituminous fields, the miners could not earn wages on account of the fewer number of days they were able to secure employment. This condition was strongly brought out in the minority report of John P. White, former president of the miners' union, and it was largely because of these conditions that the increase in *rates* to the bituminous workers was given. It was clearly shown by the operators that the anthracite mine workers were then earning more wages than were the bituminous workers after the advances granted by the President's Commission had gone into effect. In presenting their case before the Anthracite Coal Commission, the exhibits prepared by the consulting economist made comparison with the *rates* in the bituminous fields, the earnings being either ignored or stated in the form of estimates which so grossly misrepresented the facts that there was little doubt of premeditated and determined intent to deceive the Commission.

It is not my desire or intention to charge the representatives of the miners on the negotiations committee with being

party to this attempt at deception. They were, as I have already stated, themselves deceived by speciously manipulated statistics into the belief that the anthracite mine workers were not as well paid as their bituminous brothers, though had they taken cognizance of the prosperous condition of the anthracite region as compared with those in the bituminous fields, they might have thought differently.

Award Similar to Compromise Suggestion

The award of the Commission on the wage demand was in close agreement to the compromise suggestion of the Secretary of Labor, with, however, a special consideration to the lower-paid class of labor, which was given a minimum of \$4.20 per day, or per shift, as against a minimum rate of \$4 suggested by the Secretary. In their original offer of an advance of 60 per cent. to the contract miner over the 1916 base rate, and of 15 per cent. to the day men over the then going rates, the operators felt that they had, in justice to the public, which must in all such cases pay the bill, gone as far as they could.

The Secretary of Labor, in a letter to the President, outlining the situation after his attempt at mediation had failed, stated that the basis of compromise he had proposed was as far as he could go and justify his position.

The consulting economist evidently had fore-knowledge of the Commission's conclusions (by which is meant, of course, the majority report), for hardly had the report with the President's acceptance of it been released at the White House before a mimeographed discussion of it by W. Jett Lauck was in the hands of the newspaper representatives in Washington and in the mails. In this review, the consulting economist informed the public that the increase in wages granted was not sufficient to warrant any advance in the price of coal. He ignored the fact that the Federal Trade Commission had shown that the labor cost of producing anthracite was \$3.41 a ton, and that if this were applied only on the domestic sizes the labor cost was \$4.89 a ton. It is estimated that with the larger advance to the low-paid labor the total added labor cost by the Commission's award is 18 per cent., or about 88 cents a ton on the prepared or domestic sizes. The Trade Commission's report showed that the average margin on fresh-mined coal was 36 cents a ton, equal to about 4½ per cent. on the capital invested,

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namely, \$7.50 to \$8 per ton of output.² And this did not represent profit, for out of it had to be paid Federal taxes, sales expenses and interest on borrowed capital, and from it reserves for non-insurable risks had to be set up.

Evidently Mr. Lauck is of the opinion that the anthracite operators should do business at a loss from 60 to 75 cents a ton for the pleasure of supplying him with his winter's supply of fuel.

Review of the Consulting Economist's Work

It may not be that the "vacation" strike of the anthracite mine workers following the President's acceptance of the majority report was actually instigated by the consulting economist, but he was at least cognizant of the plans of those who fomented and directed it; for in the same statement he announced that "as a result of this award there probably will be trouble in the anthracite field," though he attempted to escape any responsibility for such an eventuality by saying that the weather forecaster who predicted rain did not produce the rain. Not content with mulcting the miners' treasury to the extent of \$40,000, he was, in the light of succeeding events, apparently responsible, if only in part, for the sacrifice of several million dollars in wages, a goodly part of the back pay accumulated since April 1, and for the non-production of some 2,000,000 tons of badly needed coal.

The demand for an 8-hour day, with punitive overtime, was denied by the Commission. It was shown that if the breakers were to operate on an 8-hour basis, it was necessary for some men to put in regularly from 9 to 10 hours, and, conversely, if all employes were limited to 8 hours, the breaker time would be shortened and production reduced accordingly.

Miners Abide By Agreement

It is gratifying to be able to state that the anthracite mine workers faithfully carried out their agreement to remain at work during the six months that the negotiations were passing through their several phases, although, as stated above, dissatisfaction with the terms of the Commission's award was

²Anthracite Mining Costs, by R. V. Norris, Engineers' Committee, U. S. Fuel Administration. Transactions A. I. M. & M. E. New York meeting, February, 1919.

manifested by authorized strikes, under the guise of "vacations," which seriously affected production, particularly in the Schuylkill and Lehigh regions, during the month of September, and resulted in a substantial decrease in tonnage. Unfortunately, this was not the only factor that acted against increased production of anthracite during the present year. Several untoward incidents occurred, among which may be mentioned (1) the outlaw switchmen's strike in the spring and early summer, which interfered with car supply and the movement of customary tonnage at that season to the head of the Lakes; (2) embargoes by the New England railroads, particularly the New York, New Haven & Hartford, that limited all-rail distribution into that territory during a goodly portion of the summer; (3) strikes of towboat men in New York harbor, which lasted over two months and reduced the water movement to ports on Long Island Sound; (4) a strike of about two months' duration by about 10,000 employes of the Pennsylvania Coal Co., and (5) an appreciable shortage of productive labor (miners and miners' laborers) throughout the entire region. As a result of these combined circumstances, the shipments for the first six months of the present coal year show a total of 44,325,000 tons, as compared with 35,099,432 tons last year. This does not tell the whole story, however, for the production this year, on account of the increased demand for anthracite, made more insistent by the shortage in bituminous coal, includes a considerably larger proportion of washery coal; how much it is not possible to say at the present time, probably as much as 2,000,000 tons.

Resume of the Anthracite Industry in 1920

What 1920, therefore, may be said to have developed in the anthracite industry may be summarized as follows:

1. In wage controversies, satisfactory conclusions may best be arrived at through direct negotiations between the parties at interest as determined the agreements in the anthracite industry from 1902 to the present year, without the interference of consulting economists or other outside influences.
2. Co-operation of railroad and other transportation agencies is necessary to ensure the orderly distribution of the product.

3. The production of anthracite, under most favorable conditions, is not more than sufficient to meet the domestic fuel requirements of the territory it serves. Consequently, steady employment is offered to its employes, and any interruptions to continuous operation will result in possible inconvenience to the public, or the substitution of other fuels if they are available.

4. The policy of the open shop is a safeguard to the individual freedom of the American workman.

SURVEY OF CONDITIONS OF OPERATORS AND PRO- DUCTION IN SO-CALLED OPEN-SHOP DISTRICTS OF WEST VIRGINIA

By GEORGE WOLFE

Secretary of The Winding Gulf Operators' Association, Beckley, W. Va.

The president of our Association, Mr. E. E. White, was the one who was called upon to come here and talk to you on the labor conditions and matters in general, as we see it, in the non-union districts in our State, and I am very sorry indeed that matters were in such shape that Mr. White could not come.

I want to say at the start that I have been connected with the mining industry in our State for the past 25 years, and I am today looking after and managing six different coal properties, besides attending to the secretarial duties of our Association. I have grown up in the smokeless fields of West Virginia, and have seen the time when the union in our State held but little sway, and I have noted from year to year the gradual growth of the United Mine Workers and the hold that it has taken upon the industry. I think I have made a thorough analysis of the situation and have gained a pretty fair knowledge of the reasons why one non-union district after another has fallen under the power of these people. I think it would only be fair, in going over this subject, to discuss these reasons and draw conclusions as to the whys and wherefores, and to show you gentlemen why we people operating in the so-called open shops, or non-union fields of our State, are able to do so; why we ourselves are able to operate our property better, and why the men themselves who work in the mines are the beneficiaries and enjoy greater freedom and higher earning capacity in the open shop or non-union districts than their brethren in the highly organized sections of our State.

Managing Both Union and Open-Shop Mines

Let me also say that I am today in charge of properties which are union, which operate with the closed shop and

check-off, and am also in charge of properties which are entirely free of any alliances with the United Mine Workers. I came into the Winding Gulf section some seven years ago, and at that time we were partly under the sway of the union, having some locals and a working agreement with our men which bore the unofficial signatures of certain members of the union. I have seen all of this pass away, serving as one of the executive committee of our Association, and finally becoming the managing director of that committee, and I presume from the success which was accomplished by our shaking off entirely the shackles of the union hold is why I am in the position today that I hold with our people, and living up at Beckley, so to speak, sitting on the lid.

Agitators Constitute 15 Per Cent. of Labor

I have always thought that the first fundamental principle that one must embody in his system before he can hope to carry on this non-union or open-shop idea successfully is to first have faith in yourself, and believe absolutely that it can be done. The next principle to become thoroughly embodied in your framework is that 85 per cent. of your labor are honest people, who look to you as a leader, and who have faith in your integrity. The other 15 per cent. of your labor are the restless tormentors who neither want to do well themselves nor let others do anything. It is this noisy minority in the business that often overshadows and brings the management to a state of mind where he believes that the union is going to take possession and that he might as well come to terms and make a contract with them. The operators themselves are largely to blame for not being able to operate districts more largely on the open-shop principle. If our people would stand together as a unit and select a small working committee to handle these questions, and absolutely abide by the decisions of this committee, I think many times you would more successfully combat with the demands made upon you by the 15 per cent. of your men whom I have termed the "noisy minority." We see operators pulling this way and operators pulling that way, and they seem to lack the idea of standing together, one for all and all for one. I have seen districts in our State turned over to the powers of the union because of financial difficulties. Properties with large bonded indebtedness, and controlled by

the bankers in distant cities, are sometimes compelled to make terms, rather than shut down the mines, and continue at work. These conditions in some fields cannot be overlooked, and for this reason alone the union has been able to gain the upper hand.

Smokeless Coal

In the southwestern part of our State we have a limited acreage with a tonnage of what is called smokeless coal. This ranks as the highest steaming coal in America, and I might say is equalled by none in the world. For a number of years the operators in these smokeless fields have lived on their properties and have been more or less closely allied with their men, and this has been one of the underlying reasons why the United Mine Workers of America has not been able to gain very much of a foothold. Several years ago a large interest in Pennsylvania secured holdings in what is called the New River District of this smokeless coal field, and for reasons best known to themselves they effected a trade with the United Mine Workers, which threw about this New River District the shackles of the union, and these people today are operating under a contract embodying the closed shop and the check-off. But not all. There was one man in this New River District who refused to sign the contract and said to himself: "I will operate open shop and will not have any check-off." He called his men together and said: "We will work Americans, Gentiles and Jews, union or non-union people, so long as you are good Americans and observe the laws of our country; but I will have no contract with the United Mine Workers of America. I will not operate with a closed shop, and I will not collect any check-off dues. These houses are here, and you boys can go ahead and live in them, seeking work elsewhere if my ideas are not satisfactory to you." For 60 days no work was done on this property, and the management made absolutely no attempt to do any work. Gradually it dawned upon the men that the owner meant what he said. They called meetings together among themselves, and voted and had many stormy sessions. However, the majority prevailed. The men accepted the situation and went back to work. There has never been a shot fired on the property, and outside of night watchmen, put on to protect the tipples and storehouses, no

force of any kind has been used, and today in the New River District, Mr. William McKell is running his mines absolutely on this basis and mining a large tonnage of coal. He is entirely surrounded by the union mines, and his own people see to it that agitators do not come in the camps and that they are not molested. His people have gradually come to believe that the check-off and closed shop is a bad condition, and that they themselves are better off on the open-shop plan than their neighboring brethren are who work with the closed shop. Not long ago Governor Cox of Ohio spoke at a small town close to Mr. McKell's works, and some of the people went to hear him talk. Mr. McKell happened to ask some of his people on their return what they thought of the Governor's talk. Their reply was that "he was just like them other agitators that hang around Beckley and Mount Hope." I might say that the Governor, in his talk to the people, did not give the coal operator a good word; and it is quite evident from the reply made to Mr. McKell that his employes did not relish this line of thought. I have dwelt on this particular incident so, if possible, to drive home the fact that if you yourselves make up your mind you are right, and that you can run your property on an open-shop basis, and notwithstanding the fact that you are completely surrounded by the United Mine Workers, that it can be accomplished.

The Winding Gulf District

Taking up the Winding Gulf District, of which Association I am secretary, we believe that we have one of the best associations in the United States, and that our men are one of the most contented set of employes, and that they themselves are well satisfied with the conditions which surround them. You must understand, gentlemen, that the Winding Gulf District borders on the New River District, and side by side we are operating today. The outposts of our district interlock and join with the outposts of the New River District, and in many instances, within a stone's throw I might say, on one side of the railroad is a highly organized union mine, and on the other side absolutely non-union. I know that one of our largest mines (a shaft mine, if you please) owned by Mr. E. E. White, our president, is within a short distance of a shaft mine controlled by the Guggenheims of New York, which

is highly organized. Mr. White's mine is absolutely non-union, and his men today would risk no interference by the union in the management of his property. We stand in the Winding Gulf District in the first line of trenches, and have stood in that position for the past five years, protecting any further encroachment into the so-called Pocahontas coal fields of our State. I believe that our employes stand a hundred per cent. behind us, and are thoroughly contented with the policy pursued by our operators. We have laid down certain principles of procedure. The first is that we deal directly with our employes as individuals. It makes no difference how small the matter, it is adjusted satisfactorily to both sides. We make a strong drive for better living conditions; we are constantly improving the miners' homes; amusement halls, recreation-rooms and children's playgrounds are constantly being added, and we have supplemented the educational features by adding to the months of school laid down by the county authorities, and also increasing the payment to the teachers out of our own pockets, thereby creating a better working force for our children. Our churches and religious endeavors are not neglected by any means, and one of the greatest features that we have in the summer time is to gather our people together in picnics—these being in charge of the church folks—and our constant aim is to drill into our people a better feeling of good-fellowship and a general community of interest in these matters. Publicity is not overlooked, and we are constantly trying to lead the minds of our employes in a broader and better direction, and give to them a fair statement of both sides of these questions. We have found that our efforts have been successful, and by a gradual system of elimination the United Mine Workers has dropped out of our field. We are strong for good roads, voting for all bond issues, and are endeavoring to open up the byways and highways so that our people can have better communication. Many of our employes own their own automobiles and take advantage of all the good roads, and it is quite evident that the outdoor recreation secured along this line is of the most beneficial character.

The writer well remembers last year, when the general strike all over the United States was called, that many folks said to us that we would find that our district would not stand up, and that the union would prevail. It is well to remember the 15 per cent. minority in all of these matters, and we were not asleep. At 7 o'clock in the morning of November 1, 1919, there was unloaded in the city of Beckley, which is on the dividing line between the union and the non-union districts, some 750 boys from the American Expeditionary Force.

Result of Firmness

These soldiers had been moved in quietly during the night, and when they marched up the streets of Beckley and went into camp there was more or less surprise. I want to say that within three hours after these boys had gone into camp, every miner working inside of the mines that day in the Winding Gulf District knew that these soldiers had come, and had arrived to protect those who wished to work. If any of our men had any idea of joining the general strike movement that idea vanished, and from that day on the tonnage in the Winding Gulf District increased by leaps and bounds, and the day the strike was officially called off we were loading a tonnage that we have never been able to load since. Of course, we had a supply of cars every day, and our men seemed to take an interest in the fact that it was their duty to produce coal and keep the general public in our country from freezing. This we might call the acid test to which the Winding Gulf field was subjected, and we came out absolutely with flying colors. This field stood as a protecting line to the Pocahontas fields on the Norfolk & Western and to the Guyan Valley fields on the Chesapeake & Ohio, and from these fields, gentlemen, there was produced the bulk of the tonnage which saved the situation, saved your property and saved the people of the United States from a fate which we would hardly like to dwell upon. We have our troubles, and today there is just being concluded on the Norfolk & Western a desperate fight which the United Mine Workers of America has waged for the past six months.

The Union Tries Other Fields

Passing over our district as not being possible, the union went into Mingo county in the spring of this year, and has

tried by every means possible to unionize that section of the country. The situation got so bad that martial law was finally declared, and the soldiers have been on the job for the past 60 days. Notwithstanding the combined efforts of the union in this non-union district of Mingo county, it has been unsuccessful. They did succeed in curtailing the tonnage to about 40 per cent. for 30 days, but this is as far as they were able to go, and today the conditions in that field are rapidly returning to normal, and I do not hesitate to say that before the year is out the union will have withdrawn its assault on the Mingo county coal fields, and that the operators will have won their fight, and the principles of the open shop and non-union field will be continued. At which point the union will next drive we do not know, but we people feel in the smokeless fields, which are operating non-union, which take in Winding Gulf, Pocahontas and Tug River, the high volatile fields of Logan county, on the Chesapeake & Ohio, and the high volatile fields in Wayne and Mingo counties, on the Norfolk & Western, that the United Mine Workers of America cannot gain a foothold.

From personal experience I find in the union districts of our State that the miner earns less money; that his living conditions are not as good; that he is constantly called upon to contribute in the way of check-off; that his individual liberty is curtailed; that the ablest man is bound to do only the amount of work that the poorest man does; that the limited production per man is curtailed down to the point of the weakest member; that the personality of the management is lost, as dealing with the men, and that their affairs are handled through a mine committee, the men become mere units, and a feeling of distrust exists between the management of the coal operating company and the employes who work within the mines. On the contrary, in the open shop and non-union districts we find the men today earning more money; their tonnage yield per man is greater; their individual liberty is as it should be; they can go and come as they please; if they are not satisfied with the management they can, if not able to work out their troubles, move on to another place; that if a man is willing and able his tonnage is not curtailed, and he can load as much coal and work as hard as he pleases; that

his wages are as satisfactory and his income better. I find that the good men, men who want to get on in the world, leave the union fields of West Virginia and come into the non-union fields to work. I had seven men one day leave a mine in the New River District under my charge, and go over into the Winding Gulf District, simply because they resented the fact that they had to pay \$2.50 every two weeks to the check-off fund, and that their turn of cars was limited to what the mine committee said they should have. The result of all this is that in the union fields of our State the sorry, disturbing element is at work. In the non-union fields we have the best men. Is there any reason why we people who are operating non-union and open shop should wish to change over and go into the fold of the union? Our employes think as we do, and I believe that as long as we continue the policy that we have successfully carried on in the past that the United Mine Workers of America will not have very much chance to gain a foothold in our midst.

Now, gentlemen, in closing, West Virginia is a long way from Colorado, and I have thoroughly enjoyed my trip out here, and highly appreciate the honor of coming before you in this brief way and trying to bring home to you the outline of the conditions of the operators in the open-shop districts of our State. I do not know whether I have been successful or not in getting home to you the fixed idea that I have always had in connection with handling this labor problem, but, as I stated in starting out, you first want to get yourself right, get your own mind in the proper state, before you attempt to take hold of a proposition of this character, and line up your own employes. If you yourself get in the proper frame of mind, I can see no reason why you cannot successfully, in any mining district in our country, eliminate the evils of the closed shop and check-off, which is thoroughly un-American, and operate your territory on an open-shop basis.

THE APPLICATION OF INDUSTRIAL MEDICINE AND HEALTH CONSERVATION IN THE DEVELOPMENT OF MINE LABOR EFFICIENCY

By ARTHUR L. MURRAY

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The efficiency and stability of labor employed in mining has been the subject of much criticism since the close of the war. This lack of stability and apparent inefficiency is not peculiar to mine employes, but has been general to all classes of labor. The unusual physical strain and nervous tension, which every person associated with industry labored under through the speeding up of production during the late war, is now having its natural reaction. This reaction is expressed by a spirit of restlessness and a tendency toward irresponsibility.

Necessity of Counteracting Restlessness

Employers of mine labor who desire a permanent and efficient working force will do well to take cognizance of these conditions and lend their every effort to bring influences to bear to counteract this restlessness and failure to take employment seriously. Stability and efficiency in labor do not grow naturally as weeds do; they are created and stimulated, and employers to be rewarded with such virtues in their employes must be willing to put forth conscientious endeavor to develop and encourage them.

In the field of industrial medicine and health conservation lie some of the potent means of stabilizing labor and building up efficiency.

Selection of Mining Camp-Sites.

Industrial medicine and health conservation have an effective and constructive adaptation to every stage and every branch of mining operations. At the very outset in the selection and planning of camp sites, the sanitary engineering phase of industrial medicine is most helpful in determining adequate

and potent water supplies, proper methods of drainage, including sewage disposal, suitable housing conditions as regards light, ventilation and overcrowding, and sanitary disposal of refuse and wastes.

In the past too little regard has been paid to this phase of industrial medicine as applied to mining. Many camps today are horrible examples of improper planning and failure to anticipate the sanitary needs of communities before they developed. The mining industry, through unwholesome and insanitary living conditions, has committed many lives of employes to an early death from preventable diseases. Miners are not created as such in a day or a week. They become proficient in their vocation only through adaptability, proper training and experience. Every such death, especially of a man experienced in mining, is a loss to the industry and detracts its part from normal production.

Selection and Placement of Man-Power

The human machine in industry, particularly in the mining industry, where a considerable part of the work depends upon manual labor, is one of the most important factors to successful operation. Human machines or man-power should be accredited the same consideration as inanimate machines or horse-power.

Men should be selected for mine work with two main considerations in view: physical ability and adaptability, and like machines should be placed at work for which they are known to be mechanically and temperamentally fit.

Every man before being employed by a mining company should be given a physical examination. Such an examination will furnish an index by which men may be placed in positions where they can do the work they are physically capable of doing. The employer and employe are thereby mutually protected. Men with physical defects that are not debilitating, if placed at work which exerts a strain on the parts affected, may become temporarily or permanently debilitated. The employer in many instances has to pay compensation which would have been avoided had these men been placed at work not conducive to aggravating the original defects.

The records kept of pre-employment physical examinations by firms employing large numbers of men show a very low

rejection rate. Quite frequently the physical defects found upon examination are subject to easy correction. The friendly advice given by the examining physicians, if taken advantage of, leads to the restoration of normal physical condition through simple treatment or minor operations. The reports from one large corporation employing thousands of men show that on original examination 7 per cent. of those applying for work were found physically unfit, but by simple operations or other corrective measures three out of every four of those rejected on original examination were sufficiently restored to normal to warrant their employment; thus the total net rejections amounted to less than 2 per cent. of all those applying for work.

Recently the writer of this paper had occasion to study the physical examinations of metal-mine hoisting engine-men applying for certificates in the State of Utah. Among the 81 applicants the examinations showed 20 cases with defective vision, 3 cases with hernia, 4 cases with minor deformities of the limbs and 2 cases with constitutional diseases. Two only of these applicants were rejected, the other cases through simple treatment or properly fitted glasses or trusses were physically reclaimed so as to follow their calling safely.

Men Should Fit Their Work

Many men are wrongly placed at work for which they are not fitted through previous training or employment. By carefully carding at the time of physical examination the lines of work with which a man is familiar and has had experience, a permanent record of the working force is always at hand. The original placing of men employed can be governed by their past experience as shown by their card records. Also, if at any time men are required for a special line of work, the card records may afford an opportunity to locate the men needed among the mine force.

So far as possible men should be selected for their stability. Frequent labor turn-over is costly in many ways. The cost of breaking new men in, the disrupting of mine crews, the increased office work of opening and closing accounts, to say nothing of the effect on morale, can be measured in dollars and cents.

The average cost of breaking in a new worker and making

him an efficient, integral part of the operating force of an industry has been estimated to be \$53.92 for employing, surveying, directing and training.

Tendency of Miners to Drift

In mining, to a greater extent than in any other industry, men tend to drift from one camp to another. This tendency seems to have become much more marked during the past few years. All things being equal, a married man is more likely to become permanent and to be a greater asset to a mining camp than a single man. As a rule, a miner with a family takes his employment more seriously than a single man, has at heart the welfare of the camp, and usually will direct his influence to develop the moral tone of the community. Many mining companies failing to realize this fact have discouraged rather than encouraged a stable working force by neglecting to provide living conditions which appeal to the family man.

Living Conditions

As a man lives so is he liable to work. The living conditions at any mine largely determine the type of labor that seeks employment and remains at that mine. A camp where housing conditions are poor, where sanitary conditions are below standard, where the general morale has been permitted to become lax, does not attract the best element. Men who are willing to put up with such conditions are usually of the "floater" type, shiftless, lacking in responsibility and easily influenced to find fault. At such camps agitators find fertile soil for creating dissatisfaction.

The conservation of health and the prevention of illness is one of the biggest problems faced by industry. The energy a man may expend depends directly upon his physical condition, which, in turn, depends upon the way and conditions under which he lives.

Housing conditions for workers, to promote their best efforts and production, should be as wholesome as they can be made. There should be no overcrowding. Living-rooms should be light, well ventilated and provided with adequate heating facilities. Houses for married workers should be attractive and of a type to encourage homemaking and the development of self-esteem.

Boarding-houses should be kept clean, and caretakers should be held to strict account for their care and cleanliness. Rigid supervision of the dining-rooms and kitchens of boarding-houses should be maintained. Food is one of the most important means of spreading disease, and lack of care in its preparation and serving may cause serious outbreaks of illness, which lead to a decided curtailment of production.

The food supplied at a mining camp should be good, plain and wholesome. It should be stored and handled in an absolutely cleanly manner.

Every mining camp should be provided with an adequate supply of pure water and every precaution should be taken to safeguard its purity.

Wherever possible a mining camp should have a sewerage system with an effluent that permits of no nuisance. If such a system is not practical, usually a sewage-disposal system with septic tank or tanks can be installed. The general drainage should be such as to prevent the accumulation of stagnant water in or about the camp. Refuse of all kinds should be collected at regular intervals and burned. Refuse heaps are incubators for germs of disease and their distributors, filth and disease-carrying flies. Piles of cans and filth dotted over its confines detract from the appearance of a mining camp. Such conditions not only reflect upon the inhabitants of the camp, but also upon the management of the mine.

Proper supervision of the sanitary conditions of a mining camp is no small problem, but the benefit is shared by every member of the community. Every mining community should have a printed sanitary code covering the usual classes of nuisances and provisions for their abatement. An experienced sanitary supervisor should be placed in charge of the enforcement of these regulations and held to strict accountability for the general sanitary condition of the camp.

Working Conditions

The surroundings under which a man is forced to work re-act on his mental attitude and his labor output in proportion to whether they are healthful or harmful, safe or unsafe.

Safety, sanitation, ventilation and lighting underground should receive proper attention. By careful study of working conditions and the correction of causes leading to accidents

and illness much needless time loss may be eliminated. Safety devices and properly directed safety supervision more than pay their cost in decreased loss of labor through lessened accidents and saving in compensation.

The number of fatal accidents in the mines of the United States have averaged during the past four years more than 3000 per year. The loss of so large a number of men—many of them experienced miners—must be no small factor in reducing labor efficiency and increasing cost of production through compensation settlements. Added to this are the non-fatal accidents causing time loss varying from one day to total disability and their compensation costs. The metal mines alone have averaged for the past four years more than 45,000 non-fatal accidents per year.

On large operations a safety engineer is as much a necessity as a mining engineer.

Men at work breathe more air than otherwise, and the wholesomeness of the air they breathe largely determines the amount of labor they can perform. Therefore, both as regards health and labor economy, proper ventilation of working places benefits not only the employes, but also the employer.

Drinking fountains and sanitary latrines underground are recognized necessities of large mining operations and add much to the comfort and health of the men. The general care of underground workings in respect to keeping them clean and free from debris has a marked effect on the men. The sight of debris in passageways, drifts and tunnels encourages shiftlessness and carelessness.

Well-constructed change-houses where miners can bathe and change from their soiled and sweaty mine clothing to dry, clean clothes before going home promotes both health and self-respect.

Above ground the general sanitary conditions about the mine should be good, the same as in the camp. Debris should not be permitted to accumulate in and about the mine entrance or about the buildings. Drainage should be such that water will not collect and stagnate. Adequate toilet facilities should be provided.

Efficiency is applied intelligence. As men become more enlightened their desire for better and more wholesome work-

ing conditions is a natural result. Hence, employers who desire intelligent and efficient men must make their working conditions as safe and wholesome as possible.

The interest of employes in their work and their employing company should be stimulated and kept aroused at all times. Committees on safety and committees on employes' welfare, selected from among the workers, to meet and discuss problems affecting conditions in and about the mine and camp with company officials, can be made the means of effecting a common viewpoint on matters of interest to all concerned. The company should open-mindedly be willing to consider all matters affecting the well-being of its laboring force, and use all reasonable means of promoting and enhancing such conditions. Mutual regard for the welfare of the employes and the economic limitations of the employer, and the ability to equalize both factors is one of the greatest assets to be desired in mine superintendents.

Medical Care, Supervision and Instruction

The man who is best able to serve industry is the one who is most physically fit. It is the purpose of industrial medicine to keep the working forces of industry as near physical par as possible.

Industrial medicine operates through three distinct but closely allied channels: preventive measures, corrective measures and curative measures. The first two are better known under the name of industrial hygiene.

Preventive Measures

The careful supervision of the sanitary condition of mining camps and the safeguarding of the conditions under which employes live promotes the general health of the community.

The proper control of contagious diseases by quarantine and placarding reduces the number of cases arising from such causes.

Medical welfare work, especially popular instruction in personal and public hygiene can be made the means of preventing much sickness, with its resulting suffering and time loss. The average loss of time due to illness among the workers of the United States is nine days per year, or 900 days per

100 employes (about 2½ years). The greater part of this illness is due to preventable causes.

Some of the agencies for conducting medical welfare work in mining communities are as follows:

Visiting nurses are a great aid in caring for the sick and at the same time giving instructions in home sanitation, proper methods of nursing, prevention of the spread of communicable diseases and personal hygiene.

Short, interesting talks on health subjects given at regular intervals, illustrated when possible by lantern slides, motion pictures or charts are of much benefit.

Classes among the women and older children of the camp for instruction in first aid and home nursing of the sick can be made both instructive and interesting.

The schools should provide a course in personal and public hygiene. Oftentimes through interest stimulated in children at school the adults at home are reached.

Clean-up campaigns and anti-fly campaigns are useful in promoting health education and a spirit of civic betterment.

Health circulars and folders often serve a useful purpose, and if the community supports a publication a department devoted to the health of the worker can be established.

Corrective Measures

All working conditions should be carefully and constantly studied from a standpoint of hygiene. Processes or conditions that in any manner operate to incapacitate workers, should be remedied so as to eliminate such dangers or reduce them to a minimum.

Regular medical examination of each employe is a great aid in keeping them physically fit and aids materially in checking on working conditions which by their nature tend to cause incapacity and time loss.

Many conditions in mining which lead to disabilities, both temporary and permanent, are insidious in their causation, and seldom receive the attention they merit until irreparable damage has been done. Among the diseases so caused are: Miners' nystagmus (eye trouble), miners' phthisis (lung trouble), and lead poisoning.

Curative Measures

The medical and surgical care for workers should be as good as can be provided. The time loss from disabling sickness and injury can be materially lessened by prompt and efficient medical attention. Slight ailments or injuries if promptly attended to may be corrected with little or no loss of time, but if neglected they may become serious, and their correction or cure entail a long period of absence from work. Men below par physically cannot be expected to measure up to par in effort.

Where practical a hospital, fully equipped, should be maintained at the mine. If no hospital is provided there should be an emergency room where patients can be given emergency surgical care and made as comfortable as possible until they can with safety be removed to a hospital.

Community Influences

The social and moral tone of a mining community is the sum total of the social status and moral consciousness of its inhabitants. They are elevated or lowered in direct proportion to the predominating type of the population. Lack of regard for community influences has been costly to many employers.

Approximately one-third of a man's time is employed at his labor. Another third is usually given over to sleep. The remaining third a man seeks diversion through recreation. This spare time through environment may be influenced for good or for evil. Every mining camp, if it desires to progress, must recognize that wholesome and health-building facilities for recreation are a necessity.

A few of the community influences which operate as an asset are given below:

Good schools, which provide for the growing generation an opportunity for education.

A community-house, accessible at all times for community social gatherings, is a decided advantage. A community social and recreational program promotes well-being and provides clean, wholesome amusement for all the population.

A community-housing proposition which makes possible the building of homes is a most valuable means of developing

a conscientious laboring force who, through property ownership, have a greater interest in the permanency and the civic and moral welfare of the camp.

Community gardens offer a means of healthful exercise in the open air and aid in reducing the cost of living.

A co-operative store which is really co-operative in function is a great help in making a camp prosperous and its inhabitants contented. Such a store, where the profits are shared by all who patronize it in proportion to the total of their purchases, goes a long way toward reducing living costs.

Summary

Mining, to take the place it deserves along with other branches of industry, will be compelled to keep step with the progress of the times and give careful study and due consideration to the development of its labor efficiency.

Industrial medicine and health conservation can be of material aid in building up and maintaining an efficient working force.

Pre-employment medical examination affords an opportunity for selecting a working force physically and constitutionally fit for the strenuous manual labor required in mining.

Well-planned camps having proper sanitary supervision safeguard the health of the workers and eliminate much needless time loss from sickness. Attractive camps with good housing facilities tend not only to hold the labor already living there, but they attract the better class of labor from camps less wholesome. The class of labor drawn to a mining camp, whether thrifty, industrious and stable or shiftless, inefficient and unstable, is largely influenced by the nature of the camp.

Careful study of working conditions so as to safeguard them against accident and health hazards reduces lay-offs from such causes and frequently leads to improvements in the working environment, which markedly increases labor efficiency.

The type of medical service provided in a camp has a direct bearing on the amount of time loss due to accidents and illness. Prompt and efficient medical care usually reduces the period of disability in cases of injury and sickness, effecting a saving in time loss to the company and wage loss to the

worker. The medical service of a camp should be so organized that its efforts in the maintenance of health will be along preventive lines, as well as curative.

The wholesome or unwholesome influences of a mining camp bear a decided relation to production. Efficiency and disorder are never associated. Conditions that stimulate efficiency and industry are the same as those that make a community wholesome and a desirable place in which to live and rear a family.

As an incentive to thrift, industry, and efficiency, every company should recognize that its working force is entitled to good living conditions, an adequate water supply, sewers, light, medical care, community welfare endeavor, and facilities for healthful and wholesome recreation as a part of the cost of production.

A POWDERLESS MECHANICAL PROCESS FOR MINING COAL

By D. VANCE SICKMAN, B. S. E. E., Denver, Colorado.

The coal industry today is confronted with a greater combination of difficulties, and a situation more critical as effecting its future welfare, than ever before in its history. We are undoubtedly on the threshold of an era of great industrial development, and to make this possible we must have a constant, adequate and ever-increasing supply of coal. Are the present difficulties going to be set aside—the great basic problems now confronting the industry solved—so that the production of coal in the near future will meet this new demand?

Troubles of the Coal Industry

The coal industry has bound up in it all the combined difficulties, annoyances and jeopardy of every other business or industry. In addition, it is so hazardous, in respect to life, property and capital that our Government spends more time, effort and money in protecting and safeguarding it than all other industries combined. The coal operator, in addition to combating the combined difficulties inherent in all other industries, has to comply with numerous State and Federal laws, rules and regulations, enacted and promulgated to protect life and property. Practically every one of these laws, rules and regulations, although in their general application necessary and for the public welfare, they nevertheless are an annoyance and result in burdening the coal operator with additional costs, regulations and restrictions from which the ordinary industry or business is relieved. Also the coal industry suffers from a more pernicious, ignorant and unjust public criticism and antagonism than does any other industry. The politician who wishes to attract notice has but to shout from the house-tops, "Down with the Coal Trust!" and he instantly springs into public favor. This very spirit of public condemnation of our most important industry may result in new State and Federal laws being enacted in the near future, which will further jeopardize the welfare of the industry. Beset on every side with handicaps, burdens, legal restrictions and

difficulties of every conceivable nature, such as no other industry has had to endure and withstand, these very forces that now seem about to crush it may be the cause of binding the discordant factions together, and this unity of purpose and effort result in stabilizing the industry, insuring it against future, pernicious, legal restrictions and the harmful condemnation of an uninformed and misinformed public.

It takes more brains, more nerve, initiative and executive ability to operate a coal mine successfully than any other business. An explosion, a serious accident, a mine fire, an error in engineering judgment, a labor strike, a shortage of cars, an unfavorable market, or even a mild winter, may convert a paying mine into a financial burden, or in an instant destroy entirely the result of years of investment and development.

The greatest difficulty in the coal industry is, however, not external, but internal. It has, in general, become stagnant within itself. It needs rejuvenation—a new life, new efficiency. It must throw off its old bonds, its restrictions, its old subjections to the "human element" and adopt a new, more modern and more efficient method of extraction and operation.

Machinery and American Progress

America's great industrial development is primarily due to the use of mechanical appliances. In this we excel the world. And, further, in the introduction of mechanical appliances, we have but followed one of the great generative and creative instincts of man. When God created the world and turned it over to man, He also gave him "dominion over the fish of the sea, and over the fowls of the air, and over all the earth," and this includes all the forces of nature. In exercising our dominion over these forces we have invented and perfected our marvelous mechanical devices. This instinct is today so fully developed that we have evolved what may be briefly termed the "psychology of the machine." The perfecting of the automobile and the aeroplane, and their effect on the human instincts, illustrates, perhaps, more forcibly than any other modern mechanical achievement, the application of this "psychology of the machine" to industrial development. When a man buys an automobile, the first few months are devoted to mastering control of its forces, but the moment he has mas-

tered those forces and has confidence in his ability to control them his natural instinct is to drive those forces to their utmost limit. He is but following his God-given instincts, and the result is that we have the speed demon of the automobile and the dare-devil of the air. And right here is where a second phenomenon occurs, and it is due to this one thing, perhaps, more than to any other that America dominates the industrial world. It is the fact that the moment the operator learns to manipulate, control and direct the forces of the machine, he subconsciously becomes dominated by those forces.

The machine, for the moment at least, becomes master of the man!

Machinery and Operatives

Observe any highly developed, labor-saving machine in the hands of a skillful operator, and as long as the machine does not require any undue amount of physical effort in its manipulation, you will observe that the operator will drive it to its work to the limit of its capacity, that he is captivated by the forces he controls, and that he becomes temporarily and unconsciously the employe of the machine. He is no longer the servant to the machine. He is the director and dictator—the employe of the forces controlled.

Due to the development of these instincts for several generations by the universal use of mechanical appliances in our American industries, we have reached the stage where labor-saving appliances and machines are now demanded by the American workman. He no longer opposes their introduction—he demands it as his right. He demands appliances and equipment, which he merely puts in motion, controlling the forces of nature, and refuses to use his own physical effort as a substitute for the machine as he has in the past.

Machinery and Efficiency

There is also a third consideration in the “psychology of the machine,” and that is the increase in general efficiency resulting from the installation of labor-saving devices. The miner, using the pick and shovel, of which he is the servant, may shirk his work and refuse or neglect to do more than he feels he ought to do, but under the impulse resulting from the

introduction of the machine, he is unconsciously stimulated in his efforts. The machine itself decides the speed at which the work shall be done, and the laborer who follows after or who directs its operation has no desire to see it lag. The machine sets the pace—labor co-ordinates and co-operates with it. The mechanical efficiency of the machine breeds a like efficiency in the man. The skilled and efficient workman will seek employment in the highly developed, mechanically operated mine, and will shun the mine that neglects to provide efficient appliances.

In attempting to apply these same general principles to the present methods of extraction in the coal mine, the efficiency engineer is immediately confronted with insurmountable difficulties. This is due to the fact that present methods of mining are not a complete mechanical process, and the frailties of the "human element" are injected into such a large number of the operations that the advantages incident to the use of such mechanical appliances as are now employed are, in a large measure, neutralized.

The great panacea for the coal industry is to perform every operation in the entire process of extraction by purely mechanical means. Ever since coal has been mined this has been the dream of every coal operator, every engineer and every miner.

The most important operation in mining coal—in fact, the actual mining function itself—is now done by an agency over which the efficiency engineer not only has no control, but use of such agency interferes with and practically prevents any advantages due to the use of mechanical appliances being attained.

This disturbing and efficiency destroying element is powder.

The Effect of Powder on Coal Mining

Abolish the use of powder, perform all the operations in the process of extraction by purely mechanical means, and the coal mine becomes subject to the same general laws and principals that have made our great factories such models of efficiency. Every operation in the entire process of extraction becomes entirely under the control, direction and supervision of the efficiency engineer, and the production of coal is placed on a par with the efficiency of the factory. All the

disturbing factors due to the "human element" are set aside and coal is produced by a routine of mechanical operations that ensure constant and uniform results. All the uncertainties, the jeopardy and hazard to capital and property, the toll of death and accidents, are forever eliminated.

All the restrictions and regulations imposed by existing and all future laws are entirely set aside. The coal industry is at once and forever freed from its bonds and its greatest burdens.

The process of extraction in the coal mine of the future will consist of three mechanical operations: First, the use of undercutting machines; second, the use of mechanical appliances for breaking the coal down after it has been undercut; and, third, loading it into the pit cars by efficient, mechanical, labor-saving loading machines. The use of the pick and the shovel will become a "lost art."

All the elements of a purely mechanical process of extraction are now in general use, except the breaking down appliances. In performing this function we have not made a single advance in a hundred years of coal mining. We still use powder.

Mining Coal Without Powder

After more than 14 years of experimenting, developing and perfecting, the mechanical appliances for breaking the coal down after it has been undercut are now ready to take their place in this ideal process of extraction, making the dream of a century a reality, in that coal can now be mined practically and commercially without the use of powder.

It is not my purpose to describe fully the details of mechanical construction, the operating characteristics, or the method of application of these breaking-down appliances. Nor is it possible to discuss fully the economical and operating advantages that result, or the relative costs of using a mechanical process of extraction, as compared with the use of powder. These are big subjects in themselves, and as they all have been so fully discussed and illustrated in published articles, pamphlets, etc., they are, no doubt, more or less familiar, at least, to the operators and engineers of this territory.

Briefly stated, however, the principle employed is a duplication of that found in nature in every coal mine, in that the

coal is broken down by developing and applying what may be termed an "artificial squeeze." We have all witnessed the effect of roof pressure on a "pillar" or an old "stump" and observed that the application of the enormous pressure of the slowly closing-in roof has completely broken and shattered the mass of coal along its natural "cleavages" or "slips." This same effect is obtained in the application of the breaking-down appliances, with the added advantages that the coal is first undercut and the forces applied in a more scientific and practical manner to produce certain definite results.

Preparation for Breaking Down Coal

The coal is first prepared for breaking down by cutting rectangular slots into the body of coal, one slot near each "rib" and one in the center of the "room." These slots are cut as near the "roof" as possible and parallel with the roof. Those on the "rib" are cut parallel with the "rib" wall and as close up in the corner as possible. Where the coal is reasonably well stratified, that is, having the usual cleavage planes and "slips," the center slot is not necessary, as the coal will break down from "rib" to "rib" without using the center slot. The slotting machine used for cutting these slots is self-contained and self-propelled. It consists of a traveling bed-plate of the "caterpillar" or "chain-track" type, which can be driven from place to place in the mine just as tractors are driven on the farm. It can also be run on the rails when desired. The slots are cut by a cutter bar of standard design, mounted on this traveling bed-plate, and arranged so that it can be easily raised or lowered, adjusted in position for cutting the slots and then locked in position.

The cutter bar is simply inserted and withdrawn, cutting the slot in less than three minutes after the machine is locked in position. The slots are cut to a depth, approximately, the same as the depth of the undercut. The standard width, or "kerf," is $4\frac{3}{4}$ inches and the length of the slot is varied to fit condition, simply by changing the width of the cutter bar. On the standard slotting machine cutter bars 18, 24 or 32 inches wide can be used. This slotting machine is simply the combination of two old and very highly developed machines, the "chain-track" type tractor, converted into a traveling bed-plate, making the machine self-contained and

self-propelled, and the old-style under-cutting machine, simplified and modified for cutting a slot near the roof instead of underneath the coal. It, therefore, embodies no new or untried mechanical ideas or construction. Both of these old elements have, however, a great many new and special operating characteristics, all of which have been carefully worked out, ensuring great rapidity and ease in operation and manipulation.

Description of New Coal-Mining Machine

Into these rectangular slots, using one slot at a time, is inserted a rectangular, hydraulic expanding bar made in two sections, each section containing pistons which are expanded by water pressure. The bar is rectangular in cross-section, being $4\frac{1}{2}$ inches in depth by $5\frac{1}{2}$ inches wide, the length of each section depending on the number of pistons used. The shorter section bar, containing from three to six pistons, depending on the size used, is inserted into the slot first. The slot is cut of proper length, 18 to 32 inches, permitting this section to be shoved to the back of the slot and placed parallel to the back wall of support immediately above the termination of the undercut. The longer section of the bar, containing from five to eight pistons, is then inserted into the slot and placed at right angles to the first section and parallel to the rib wall, directly above the termination of the undercut, at the "rib." The water for ejecting the pistons is conveyed from a high-pressure hydraulic pump to the bar through folding steel tubing, each section of the tubing being 22 inches long and joined together by means of a specially designed, flexible, universal joint. This tubing is folded up like a clothes rack. Connection from the high-pressure pump to the bar can be made any distance, from a few inches up to 24 feet. This folding steel tubing is practically indestructible, and solves one of the big problems in this process of mining, as it permits of water being conveyed at very high pressure from the pump to the bar. The pump is of standard design, suitable for delivering a constant volume of water to bars of proper size for developing the necessary expanding forces. A 24-foot length of this folding tubing weighs approximately 42 pounds, and will withstand 30,000 pounds per square inch water pressure. The normal water pressure used is 10,000 pounds per

square inch. The entire equipment, however, is designed for using water at 15,000 pounds per square inch if this pressure should ever be required. All parts have a factor of safety of two to one. The expanding bars are furnished in four sizes. The smallest size develops a total expanding force of 1,000,000 pounds and the largest size 2,500,000 pounds. The pistons have large, flat bearing surfaces to prevent indentation. The thickness of vein, character of coal and other local conditions determine the size of bar used. Under normal conditions the bar, developing 1,500,000 pounds of expanding force, will break down coal nine to ten feet in thickness with uniform results. The ejection of each piston, or sets of pistons, in the two sections of the bar is controlled by means of external valves, so that the ejection of certain pistons, or sets of pistons, can be retarded relative to the others or ejected progressively, thus producing a combination of fracturing forces at will to meet local conditions and in breaking and shattering the mass of coal to the extent desired. The expanding bars are comparatively light in weight, the longest section of the smallest bar weighing only 145 pounds, while the longest section of the 2,500,000-pound bar weighs but 192 pounds. As each section is placed in the slot separately, these weights are easily handled.

To develop such enormous expanding forces in bars of these light weights necessitates special construction of the pistons and piston chambers. With the ordinary type of piston and piston chamber, subjected to 10,000 pounds per square inch water pressure, there are developed such enormous internal stresses, reactions and bending moments that the bar is distorted to such an extent as to become entirely inoperative. To overcome this each piston chamber contains in reality two pistons, one telescoping within the other, but traveling in opposite directions, one piston being ejected upward against the "roof" rock and the other downward against the coal to be broken down. The effect of this construction is to neutralize all the internal reactions which tend to distort the bar; in fact, the bar itself is subjected to a maximum internal reaction equal to but 18 per cent. of the total expanding force exerted. The bar, all parts of which are made of chrome-vanadium steel, has sufficient rigidity to withstand this reaction without distortion. Engineers who have examined this type of tele-

scoping piston pronounce it a most ingenious design, yet it is simple in construction and extremely powerful. It represents the final step in the solution of the problem of mining coal by mechanical means. It is the result of years of experimenting and designing. It permits of the use of expanding bars of small size and sufficiently light in weight to be practical, and also of the use of water pressures that develop forces hitherto undreamed of in any former appliance used for this purpose.

Effect of the New Machine

As the enormous forces exerted are slowly applied, those exerted by the short section of the bar, which lies parallel to the back wall of support, shear off the body of coal squarely at the termination of the undercut, while those exerted by the long section of the bar shear off the body of coal squarely at the rib wall. At the same time these forces follow the general law of forces applied to a non-homogeneous mass, as they are shunted off along the paths of least resistance throughout the mass and along the natural cleavage planes and "slips," dissipating themselves throughout the entire body of coal, so that when it finally falls it is broken into large lumps, readily handled and loaded out. By manipulation of the external valves, controlling the ejection of the pistons, the operator can produce definite shearing stresses along and parallel to the walls of support, and also cause the body of coal to be broken up and shattered to almost any degree desired. The effect and the result is analogous to that of the "roof squeeze," with the advantages of being scientifically applied and within the control of the operator.

The crucial requirement of a successful mechanical appliance for breaking down coal is to shear off the coal squarely at the termination of the undercut and also along the "ribs," maintaining uniform width of "rooms" and "entries." The failure of all previous attempts to solve this problem has been due to the fact that heretofore no form or type of mechanical appliance has ever developed adequate forces to perform this function. The type of expanding bars used in this process of mining will develop not less than two times the required forces necessary to shear coal off squarely in veins at least 10 feet in thickness at their point of application and at the termination of the underminings.

The breaking-down equipment, consisting of the high-pressure hydraulic pump, the folding steel tubing and the hydraulic bar, are also mounted on a traveling bed-plate of the "caterpillar" type and rapidly conveyed about the mine, thus permitting the breaking-down process to follow up and co-ordinate with the slotting machine.

Advantages of Elimination of Powder

The economical and operating advantages resulting from the elimination of the use of explosives in coal mining is a subject on which volumes could be written. It effects economies in production and operation that are simply astounding. The possibility of its ever being accomplished has, in the past, been so remote that few engineers have ever seriously considered the great economical revolution and evolution it would effect in the coal industry. The saving in life and property, the preventing of accidents in general, and other humane and altruistic features are apparent. The roof fall is the greatest death-dealing and accident-producing element in coal mining. Its toll is greater than that of all others combined. Eliminate the shattering effect of powder explosions to the roof strata and you have made the mine as safe as the factory. Also, remove the health and efficiency destroying powder smoke and fumes, and the sanitary and working conditions become so pleasant and healthful as those of any other industry.

The economic and operating advantages affect every item of production cost, resulting in a saving of timbering; the preventing of timbering being blown out and the subsequent loss in output and cost of cleaning up the roof fall; the saving in costs by the elimination of the "shot-firers" and other highly paid labor; the saving in installing and maintaining "shot" firing" apparatus and equipment; the saving in timbering costs due to the "roof" strata not being disturbed or shattered, and many other similar cost reducing and operating advantages.

Great as these savings are, however, the one great operating advantage that overtops any and all other considerations, and which effects such an increase in efficiency in every operation, severs the bonds and sets aside the handicaps inherent in present methods, is that resulting from continuous, uninterrupted extraction. It requires a very careful study and

analysis of underground operations to grasp even partly what this really means in effecting economies in the whole art of coal mining.

Effect on the Industry

A very brief resume of what it does in the coal industry is as follows:

(1) The output is constant and uniform for every hour the mine is operated, resulting in at least 25 per cent. to 30 per cent. increase in tonnage over present methods, with no increase in overhead or burden costs.

(2) Coal can be continuously produced 24 hours per day if desired, instead of only 8 hours as under present methods. The operator can take care of "peak demand" by simply running the mine 16 hours or 24 hours per day instead of having to develop and maintain territory from which coal is extracted but a few months each year. This saves an immense investment in development, interest and maintenance charges. Conceive the great advantages that would have resulted had this been possible during our recent war, or, even now, in meeting our present demands. Increase the present daily tonnage 25 per cent. as a result of constant, uniform output per hour, and then operate 16 hours per day for such period of the year as necessary to take care of an unusual or "peak demand," and it would be unnecessary to open up a single new mine for at least a quarter century. We have enough mines opened up, and in them sufficient tonnage developed and ready for extraction, which, if properly mined, would produce in excess of a billion tons annually for many years to come.

(3) A 50 per cent. increase in the amount of coal extracted from a given developed territory. Rooms can be driven up in less than half the time now required, and the coal extracted twice as rapidly. The concentration of operations into a comparatively small area for a given output will prevent the development of "squeezes" on both room and chain pillars. Our present percentage of extraction is approximately 66 per cent. We are now producing 650,000,000 tons of bituminous coal annually. We develop in our mines, ready for extraction, not less than 970,000,000 tons in order to produce 650,000,000 tons. One-half as much as we produce, or 320,-

000,000 tons, is forever and irrecoverably lost by reason of the inefficiency of our present methods of mining. A concentrated, continuous process of extraction will save more than one-half of this enormous loss, equal to more than the entire output of our greatest coal-producing State—Pennsylvania. How much is the saving of 160,000,000 tons every year worth to the coal operators of this country? And further, what is it worth to future generations?

(4) The concentration of operations also permits of better supervision, prevents accidents, results in greater output per dollar invested, and other savings due to increased efficiency, all of which result in material reductions in production costs.

(5) New territory can be developed with great rapidity. If the new development work is fairly well concentrated and three eight-hour shifts employed, entries and narrow places can be driven four times as fast as under present methods. A great many coal companies would be in existence today and paying dividends had this been possible in the past.

Slack Coal May be Reduced by Fifty Per Cent.

(6) A reduction of at least 50 per cent. in the amount of slack coal produced. In the West and Middle West slack coal is more or less a "by-product," often sold for much less than the cost of production, and at certain seasons of the year "dumped." As the average per cent. of slack coal, using powder, is 40 per cent. of the total output, the lump, nut and other prepared sizes must carry the burden of costs and pay profits, if any. A reduction in the amount of slack coal produced, therefore, very materially increases the "mine run" value. This mechanical process of extraction will reduce the amount of slack to less than 20 per cent. of the output, effecting an increase in the mine-run value, at present prices, of not less than an average of \$1 per ton in all the mines of the West producing coal primarily for domestic use.

There are at least six other important advantages. The above, however, are sufficient to indicate the possible scope of the system.

How much are all these advantages worth in dollars and cents to the coal operator?

A number of the best engineers in the West have tried to figure this out. When you get into the problem, however, you find that there are so many local conditions, so many unknown and inestimable factors, that it is impossible to arrive at even a reasonable estimate. The figures pyramid into an amount that seems unbelievable to anyone who has not analyzed them. It can, however, truly be said that the perfecting of the appliances used in this process of mining, making it now possible to mine coal by a purely mechanical means, effects a saving in production costs and an increase in operating efficiency to a greater extent than has ever occurred in any other American industry.

The basic principles necessary to a practical, commercial and efficient, powderless, mechanical process of extraction have been solved. The mechanical principles involved are as old as civilization.

The appliances used are simply modifications of those in use for the past quarter century, developed and modified to meet conditions found in the coal mine, and given operating characteristics that fit in with modern standard practice, completing the present mechanical operations without retarding, interrupting or interfering with any other operation or with transportation.

In this connection it may be well to recall the statement made only a few years ago by our own great scientist and mathematician, Dr. Simon Newcomb, for many years professor of mathematics in the United States Naval Academy. In commenting on the possibilities of developing the flying machine, Dr. Newcomb said: "We must admit that if any hope for the flying machine can be entertained it must be based on the discovery of some way of reversing the laws of gravitation, so that matter will be repelled instead of attracted; then we may have a flying machine."

A few years after this scientific opinion was expressed the flying machine was perfected. No new mechanical or scientific principle was discovered or used. Orville Wright simply developed and applied known forces and agencies in a proper and scientific manner. So in this new, modern and more scientific process of mining coal old principles, old ideas, old appliances and old forces are employed, but developed and applied in a proper and scientific manner to meet the require-

ments. Like the flying machine, its solution is the result of years of study and analysis of what was required, and then the employment of known forces and mechanical principles in appliances developed and perfected to perform the necessary functions and to meet these requirements, co-operating, co-ordinating and completing the mechanical operations already performed by existing machines.

Today we must recognize that philosophy which is the foundation of all modern creative effort, namely, that there are few border-line limits to science and invention, and practically no finality to sanely directed human effort. This is the philosophy that has solved the flying machine and which in the future will take powder out of the mine and make its toll of human suffering, jeopardy and hazard a thing of the past.

STATE TAXATION OF METAL MINES

By JAMES G. FITCH, Socorro, New Mexico

The essential differences between the utilization of mineral and of other classes of lands logically require different methods of determining the valuation upon which taxation is based. The use and occupation of other classes of lands do not involve any destruction or depletion of their values where the principles of conservation are observed. The value of such lands can be determined with almost scientific accuracy by applying the doctrine of economic rent. The value of such lands increases with the growth and development of the community usually termed "unearned increment." The anticipation of this unearned increment leads to speculative prices in all growing communities, but they are usually too fluctuating and uncertain to form a proper basis for taxation, and, as a matter of fact, are rarely taxed. It would seem that it is only when this unearned increment has actually accrued that it becomes properly subject to taxation.

Depletion of Mineral Lands

Mineral lands, however, apart from their surface value, present none of these characteristics. From the very nature of the case their use involves the destruction of their mineral values. These values can be taken but once, and when taken, are gone forever, so far as the land is concerned. Every pound of mineral extracted diminishes the value and brings nearer the day when the last pound that can be profitably extracted has been taken and the land ceases to have any value as mineral land. With quantity production, such as is demanded by our modern methods, the coming of this day is hastened. It is true that in most metalliferous mines the arrival of this cannot be foretold long in advance, owing to the impossibility of ascertaining the amount or value of the mineral content, and of foreseeing the future rate of production, which is necessarily dependent upon the state of the market and of other contingencies. It is, nevertheless, certain and inevitable.

Unlike other classes of lands, whose values of soil or loca-

tion are inherent in the properties themselves, and can only be used and enjoyed while they remain in the land, mineral values cannot be utilized as long as they remain in and form a part of the land. It is only by severing them from the land that they can be made to serve human needs or desire. In an economic sense, these mineral values are as truly products of the land as are the products of the farm and of the range. But while the latter, in the form of food and clothing, soon reach the ultimate consumer and cease to have any taxable value, the former—at least the metallic products—in large part enter into the construction of buildings and other structures, machinery and equipment of various kinds, all of which are of a more or less permanent character, and thus become subject to taxation for considerable periods of time. The doctrine of economic rent, as applied to other classes of land, cannot be made applicable to mineral values; and the doctrine of the unearned increment appears to be applicable only partly, since the growth and development of the community seems to affect these values only in so far as it may afford better or cheaper means of transportation. The speculative prices at which mining property, especially if undeveloped, is usually held are not due to attempt to anticipate the unearned increment, but to the uncertain and unascertained values. Such speculative prices are based upon hope and expectation, not upon demonstrated facts.

No mining man can afford to ignore these underlying but all-important facts. And it would seem that the State, in prescribing a just and adequate system of taxation for mineral lands, should take into consideration these essential differences.

Estimation of Mineral Values

There is another difference of great practical importance, due to the fact that the mineral values, of metalliferous mines at least, throughout our region are, for the most part, unascertained and practically unascertainable at the time when any particular tax is imposed. In the case of prospects, and nearly all unproductive mines, this unascertainability is well-nigh absolute: In the case of productive mines it is only partly so, due to the fact that the value of the product for the year or other period for which the tax is imposed can be accurately ascertained. And this difference between productive and non-

productive mines is directly, or impliedly, recognized either by statute or by administrative regulations in all the States of our region.

Idaho, Montana, Utah and Wyoming assess unproductive as well as productive patented claims at the Government price of \$5 per acre; Nevada, at \$500 per claim, in the absence of \$100 annual expenditure; while Colorado, Arizona and New Mexico attempt to assess unproductive claims like other property; that is, upon their supposed mineral values. In the last-named State the assessed valuation was originally about the Government price of the land; but it has been increased, and now varies in different counties and in different years, according to the needs for revenue or the whims of county officials, from \$15 to \$50 per acre or more.

Patented Locations and Productive Mines in New Mexico

In this State, out of more than 40,000 recorded locations, less than 5 per cent. have been patented, and only one-quarter of 1 per cent. are productive mines today, or have produced commercially in the past five years. I do not know how far these percentages hold good in the other States, but they illustrate conditions with which we are all familiar. It matters not whether the value of these claims remains undetermined, because they were not sufficiently promising to interest the capital necessary for their adequate exploration and development; or whether the necessary capital has been forthcoming and their worthlessness has been demonstrated; or whether a rich and productive mine has been developed, but in which production has ceased owing to the exhaustion of the ore bodies, or to one of those many casualties, below or above ground, to which the mining industry is subject. In all these cases they have never realized the hopes and expectation of their owners, or they have ceased to realize them. They are today, from an economic or practical business viewpoint, failures. The Supreme Court of the State of Washington has said:

“Mining properties, as such, have no market value. The value lies not in a certainty of a return of a fair interest or income, but in dreams and hopes. They are merely tables upon which cards are turned, and courts are not disposed to hold that a prospect which was the subject-matter of a contract was a borrowing asset.”

But neither do dreams and hopes or a gambler's chance constitute much of an asset for taxation. The dreams and hopes of the owners of unproductive mining property are usually very persistent, but unless realized they fade sooner or later, and the property is sold for taxes. In some instances I have known the fortunate purchaser to acquire a valid title to a patented claim for less than 50 cents per acre, but whether he ever realized upon his investment is another story.

On the whole it is quite evident that the States have been realizing by taxation about all that they could reasonably expect to realize upon this class of property, and that the amount has been comparatively insignificant. The possible injustice to the owners owing to over-valuation is of no economic importance, for the taxes have been small and have not contributed to the failure.

Productive Mines the Fairest to Tax

We are obliged to turn to productive mines as the only ones from which the State can derive any considerable revenue, and the taxation of which is of any real importance to the mining industry. The number of these, as we have seen, is quite small. It is evident that the assessment at a uniform valuation per acre, even at the highest valuation that has been attempted, is absurdly inadequate where the value of the minerals underlying even a small fraction of an acre is being demonstrated yearly by actual production running into the thousands of dollars. Assessment on an acreage basis is indeed absurd, for the adjoining acres are usually entirely barren, the orebodies commonly underlying only a very small portion of the surface of the claim.

But the difficulty of determining the value or extent of the ore in the mine still remains. Even a true fissure vein, about which the old-timers talked so much, had an inconvenient way of petering out. Now, in many of the large producers, the ore bodies are not situated in any vein or lode, but are irregularly distributed throughout certain strata. The only method of adequate exploration is by the slow and expensive one of underground working. This, even for an approximate determination of the entire mineral value, is very expensive and is the work of years. The opinion of experts is of assistance in suggesting where and how this work should be undertaken,

but is not a substitute for it. Nor are borings of much assistance, except in the rather unusual cases of large surface deposits or of comparatively continuous blanket veins.

Exploration and Production

Theoretically, it would seem possible to complete the work of exploration before incurring the large expense incident to quantity production. But from a business viewpoint this, in most cases, is not possible. Capital, in any considerable amount, cannot be tied up for many years without the possibility of dividends. The tendency is quite the other way. Inexperienced concerns, with a view to early dividends, often incur the large expense necessary for commercial production before sufficient ore has been developed or the proper method of treating it has been ascertained. The result is quite uniformly disastrous. Companies with the requisite experience and capital rarely make such a mistake; but, even with them, as soon as the existence of sufficient ore to warrant the expense and the method of treating it has been ascertained, production must be undertaken. And during the period of production, in a great majority of cases, exploration and development is seldom more than a year or two ahead of extraction. Beyond this, the extent, value, or even the existence of the ore bodies, is largely problematical.

Coal veins present a somewhat different aspect. Given an undisturbed strata of considerable extent, it is possible, by a study of geological conditions and by borings, to determine with approximate accuracy the continuity, thickness and quality of the vein. But such ideal conditions are rarely found in our region. The coal strata are more or less irregular, distorted and intercepted by dikes and faults, and occasionally the coal is burned out. Under such conditions, the designation of any area by the Geological Survey as coal land only means that coal may be reasonably looked for there; not that it actually exists in commercially workable quantity or condition. And the work of exploration is rendered more costly, and at the same time less effective.

It seems, therefore, that mineral values, whether contained in ore or coal, can be ascertained with the requisite degree of certainty only when and as they are produced, and that is the proper time to tax them.

Tax Systems in Western States

Idaho, Montana, Nevada, Utah and Wyoming pursue this method by a straight tax on the net value of the product at the same rate as on other properties; to this they add the Government or other price of the land as fixed by statute. In Idaho this is termed a tax on net profits, but a reading of the deductions allowed shows that it is essentially a tax on the net product.

New Mexico arrives at the same result with more elaborate statutory provisions, dividing all mining property into two classes productive and non-productive, and in the case of productive mines adding the surface value of the land. It is provided also that the tax upon the net value of output each year is "in lieu of the assessable value of the mineral" in the mine, and the taxes are made a lien upon the mineral land, just as taxes assessed upon all other real property. But it is wholly immaterial whether the tax is viewed as merely a tax upon the product or a tax upon mineral values in the mine, measured and determined each year by the value of the products during that year.

The method followed in these six States is the one I am contending for. If my premises are correct, and the mineral cannot be utilized as long as it remains in and forms part of the land, but only by severing it from the land, it constitutes at best potential, not actual wealth. Until it becomes the subject of human use and enjoyment it does not, in the economic sense, constitute wealth at all. It is not perceived why it should be taxed any more than the future increases of the herds of the stockmen; of the two, the future increase can probably be counted on and estimated with the greater degree of certainty. Then there is the practical difficulty, or rather, in most cases, the impossibility of assessing mineral values with even approximate certainty while they remain part of the land. The method I am advocating does away with this uncertainty, and at least provides a way by which the value can be ascertained with almost absolute accuracy—something which can scarcely be said of the assessment of other kinds of property under present methods. It requires the mining industry to bear its fair proportion of the burden of taxation as compared with other industries, while at the same time

it is not unduly burdensome to the miner, as it requires him to pay each year a tax proportionate to his prosperity and to the actual wealth produced.

Results in New Mexico

Five years' experience under our New Mexico Statute, in spite of some minor defects in the law and in some details of administration, confirms, I believe, the conclusion at which I have arrived. Certainly it has yielded a revenue from productive mines many times greater than was ever obtained under our old, absurd method of attempting to tax them upon an acreage basis.

The law has, nevertheless, been the subject of much controversy and criticism, and was one of the local issues in the late political campaign, the main objection urged being that although these mineral values remain in the mine year after year until the mineral is extracted, they are taxed but once; that they should be taxed every year like all other real property. We have considered the reasons for taxing them but once. This objection has been strenuously urged against our larger coal companies which own many thousands of acres of coal, or supposedly coal lands, lying contiguous to but outside of the areas workable through their present openings. It is contended that these contiguous, but at present non-workable coal lands, should be classified and taxed as non-productive mineral lands. From an economic standpoint this contention is invalid. Suppose all the coal underlying a considerable district could, by some miracle, be brought to the surface and placed on cars in a single year; what would be the value of the immense surplus left after supplying the maximum market demand, bearing in mind that in our Western country markets are quite strictly limited by the cost of transportation? It could not be given away, as no one would be willing to incur the expense of hauling it off. It would be as worthless as the dirt alongside of the track. How then can it have any present value if it be left in the ground? Surely the cost and risk of mining does not give it any value. Estimates as to the time for the consumption of all known workable coal in the United States vary considerably, but the shortest, I believe, is something like 400 years. At present the entire world is crying for coal; but we cannot see far into the future. Those who

ought to know tell us that within the next few decades white coal, wherever it can be made available, will take the place of the black diamond variety throughout the United States and throughout the world. And scientists are now grouping (not altogether blindly it seems to me) for methods to harness the sun's rays and the ocean's tides, and to tap the heat stored in the earth, all for a like purpose. Who can say that unmined coal will have any value 50 or 100 years hence? If, then, it has no present value, and there is no certainty that it ever will have any value, how can it be just or economically wise to attempt to tax it?

Gross Value Urged as Basis for Taxation

It is also urged that the gross rather than the net value of the product should be taken as the basis of taxation. But the value of the ore or coal in the mine is their market-value less the cost of producing, preparing and placing it upon the market. This is the rule that has always been applied by the courts in determining the value of a crop or other product. A tax upon the gross value would operate very unequally, since the ratio of the cost of production to gross value varies greatly in different mines, especially metalliferous mines, and even with the different classes of ore in the same mine. A mine, for instance, in which the necessary costs of production are 90 per cent. of the gross value, leaving net value of 10 per cent., would be taxed nine times as heavily as another mine where conditions were reversed and cost of production was 10 per cent., leaving net value of 90 per cent. A tax based on gross values would in many cases operate oppressively, and in some instances, disastrously. It would certainly tend to prevent further production of the lowest grades of ore that are now being produced.

State Participation in Mineral Values Urged

Again it is urged that since mine operators are depleting the natural resources of the State—doing, indeed, what necessarily must be done to render mineral values available at all, and convert them into actual wealth—such values should be taxed at a much higher rate than other property; in effect, that the State, under the guise of taxation, should appropriate a considerable share of these mineral values. Such a course

would be both unwise and unjust. Capital cannot be induced to engage in any hazardous business, such as mining undoubtedly is, unless there is a possibility, at least, of large returns. Were it once known that, if the venture proved successful, the State would step in and appropriate a considerable portion of these returns, the mining industry would begin to languish and would tend ultimately to disappear, and the State would cease to derive any appreciable revenue from it. Unless and until, therefore, the State is itself prepared to engage in the mining business, it would seem that it must be content to take only such proportion of these values as it takes from other property. In other words, it must observe the rule of equality and uniformity in taxation prescribed by its Constitution. It must be borne in mind, also, that the States never owned these mineral values. They were the property of the Federal Government and were granted upon conditions prescribed by acts of Congress, designed to promote the mining industry in the Western States and Territories. By compliance with these conditions they have become the property of the present owners. The State has never had any proprietary interest in them. Its interest in and control over them is that of a sovereign only. It has neither the moral nor the legal right to confiscate these values under the guise of taxation.

Tax Assessments in Colorado

In Colorado, producing mines of coal, iron, asphaltum and quarries are attempted to be assessed in the same manner as other property. Presumably this is because their mineral values are more nearly susceptible of ascertainment than those of gold, silver and other valuable metals or minerals. The latter are valued for taxation at one-fourth of their gross production, unless their net output exceeds one-fourth, in which case the net is taken. This provision seems to be based upon the proposition that the cost of production ought never to exceed three-fourths of the gross. There would seem to be no warrant for indulging in any such assumption.

In Arizona, the State Tax Commission, under the broad but somewhat vague powers vested in it by the Constitution or statute, has undertaken to divide producing mines into no less than eight classes and two sub-divisions; and it then capitalizes the net earnings of each class upon a percentage basis ranging

from 20 to $33\frac{1}{3}$ per cent. for the purpose of determining mineral values. This method seems to be not only cumbersome, but arbitrary and unjust. It certainly taxes the mineral values remaining in the mine, upon the assumption that such values in each class and sub-division bear a fixed proportion to the net production. Such an assumption cannot be true in the case of many mines of any class and is probably true of none.

It would seem that Colorado and Arizona, while they have adopted partly, at least, the method of determining mineral values from production for the purpose of taxation, have not done so as fully and as logically as have their sister States.

THE ADMINISTRATION OF LAW AFFECTING THE MINING INDUSTRY

By EDWARD C. FINNEY, Board of Appeals, Department of the Interior, Washington, D. C.

The existing mining laws of the United States as applicable to mineral deposits in the public lands and reservations may be divided into two classes:

Existing Mining Laws

1. The general mining law, so called, which has been in force for more than 40 years, and under which the prospector or discoverer of mineral deposits, by making location, performance of a specified amount of development work, and payment of a nominal price per acre for the land containing the deposits, receives a patent in fee simple from the United States for the lands or deposits. These laws still govern the acquisition of public lands containing mineral deposits ranging from gold to building stone, and are administered by the Department of the Interior through the General Land Office and 94 local land offices scattered throughout the public-land area.

2. The so-called leasing laws, applicable to various deposits in the public lands and reservations, and covering deposits of oil, gas, coal, phosphate, sodium and potash.

There is also a leasing law governing the development of metalliferous minerals in Indian reservations in certain Western States. The leasing laws generally provide for the issuance of a lease or leases to citizens of the United States, associations of such citizens, or to corporations organized under the laws of the United States or one of the States, of known or proved lands or deposits; and are designed to encourage the search for deposits not known to exist through prospecting by granting prospecting permits, giving to the permittee the exclusive right of possession for a limited period of areas within which he desires to explore for minerals, his reward for discovery being a lease for all or part of the lands or deposits.

With the exception of the metalliferous mining leases authorized in Indian reservations, the line of demarcation between the laws which permit of the acquisition of fee-simple title and those which extend a leasehold only may be stated as follows: Mineral deposits producing fuels and fertilizers are now disposed of under a leasing system. Other minerals are disposed of under the old mining laws, or the fee-simple title system.

Time will not permit of an extended statement of the reasons, but in passing it may be said that the old laws were not adapted either to protect the prospector during exploration or to secure the best development of the fuels and fertilizer minerals. On the other hand, up to the present time it has been the general view that the search for and development of the precious metals and of the minerals other than those covered by the leasing law would be best secured under the old form of location and patent.

Departmental Organizations

The Department of the Interior touches and deals with the mining industry primarily through three of its Bureaus: the Geological Survey, the General Land Office, and the Bureau of Mines. The Geological Survey deals with topographical and geological surveys of the country, with the classification of lands, the collection of mineral statistics, and its records and reports are constantly consulted by those engaged in exploration for and development of our minerals. The General Land Office, under the Secretary of the Interior, deals with the disposition of the public lands and resources through patent or lease, investigates the various claims presented, passes upon controversies arising between claimants, and collects the purchase moneys or royalties derived from the lands sold or leased. The function of the Bureau of Mines is largely to deal with the mine; that is, to study and suggest mining methods; to prevent waste, to look out for the safety and welfare of mines and miners, and to, in every way possible, foster, encourage and advance the mining industry.

In the execution of the general mining or patent laws, the Geological Survey aids by classification and expert advice, but the principal work of disposition is through the General Land Office. Applications for patent are filed in the local land office

of the district where the lands or deposits are located, and after notice and other required preliminary proceedings are transmitted to the General Land Office for examination and disposition. If found regular and free from contest, patent issues to the applicant, and the function of the Interior Department ceases, except as it may, through the Bureau of Mines, aid the mine operator in his work.

The leasing laws being of comparatively recent date, the practice is perhaps not so well defined or known; but the Department will deal with permits and leases to a greater or less extent through all three of the Bureaus named. Applications for prospecting permits and leases, like applications for patent, are filed in the local land office of the district, thence forwarded to the Commissioner of the General Land Office. If in proper shape and free from conflict, a recommendation is made to the Secretary of the Interior for the issuance of the permit or lease. If conflicts or controversies arise, decision is rendered by the Commissioner, from which an appeal may be taken by the aggrieved party to the Secretary of the Interior.

The Department has a keen appreciation of the importance of prompt action in these matters, particularly in dealing with such substances as oil, gas, and coal, and has endeavored, so far as its limited force would permit, to expedite action thereon in every way. It realizes that the operator who is seeking to develop our mineral resources looks upon *time* with an opposite view from that of the hog in Secretary Payne's story. A Yankee was traveling through North Carolina and observed a lank razorback near a mountaineer's cabin. How old is that hog, he asked the native? Two years old. My friend, do you know that if you had a Poland China or Berkshire hog he would have been twice the size of that razorback in two years? The native replied, "Well, that may be, stranger, but what's *time* to a hog?"

Owing to the wide demand for oil, gas, and coal prospecting permits, and to the fact that relief leases under the oil and gas act had to be filed before August 25, 1920, the Department is now struggling with 7500 applications for permits, and a large number of applications for leases, but every effort is being made to expedite action and to put the applicants in a position where they may begin prospecting or production.

The Geological Survey has, in this connection, the duty of advising as to the character of lands sought, so far as disclosed by geologic conditions and developments, and as under the oil and gas leasing law the geologic structure of producing oil or gas fields is required to be defined, is charged with the duty, subject to the approval of the Secretary, of designating such areas throughout the public-land States. When permits or leases have been issued and exploratory or development work begun, the operations are supervised and the lessees advised and helped by the field and office force of the Bureau of Mines, a bureau particularly fitted to be of service to the operators and to the public in this field. Supervisors and deputy supervisors are appointed to act for the Secretary of the Interior in the field and are required to visit, inspect, and supervise operations with a view to preventing waste and to aid, if possible, in the economic development of the deposits. It is confidently expected that the work will be carried on with the hearty co-operation of the operators and of the State mining bureaus. In fact, much assistance has already been had from those sources, and such co-operation cannot fail to be of mutual benefit.

Laws Designed to Prevent Holding Lands and Deposits Idle

The general mining laws required work to be done upon each location annually and authorized re-location by others as a penalty for the failure to perform such work. The leasing laws continue this policy and extend it. They require a specific amount of work to be done each year until discovery, authorize the Secretary to insert conditions in leases issued after discovery to insure the reasonably continuous extraction of the minerals; also to distribute opportunity as far as possible and prevent monopoly. The leasing laws contain restrictions upon the areas that may be held by a single individual or corporation. In the case of oil or gas, but one lease may be held within the geologic structure of the same producing field, and not more than three leases at any one time in the same State. Not more than one coal, phosphate or sodium lease may be held in the same State. But one potash lease may be had in any area 50 miles square. In the case of coal, provision is made for acquiring additional coal areas as the coal deposits in the leasehold are worked out.

The prospecting features of the leasing act as to oil and gas give the prospector an exclusive right in the United States to prospect for two years upon the land covered by his permit, but require that he shall begin drilling operations within six months and do a specified amount of drilling annually. In the case of coal prospecting, permits will be issued for such undeveloped lands as require prospecting or exploratory work to determine the existence or workability of the deposits. These permits also run for two years. Permittees are, by the regulations, required to begin work within 90 days from issuance of the permit, and to continue such work with diligence.

Changes in the Mining Laws

The general mining laws as applied to the substances not covered by the leasing act have worked very well. Their provisions are so well known to the prospector, and so many of the doubtful legal points have been settled by decisions of the courts and of the Department, that it is my opinion that no radical changes in those laws should be made. Improvements and modifications could, however, be profitably made. Those laws require the actual discovery of mineral as a pre-requisite to valid location. In case of deep-seated deposits covered by non-mineral material this is practically impossible, and a law which would give the prospector the exclusive right to a limited area for a reasonable period of prospecting, with the right to a patent after discovery, would encourage the search for and development of this class of mineral deposits. I believe it would be a good thing for the prospector as well as for the Government if the law could be changed to require the recording of location notices in the district local land offices, possibly with the additional requirement that application for patent should be made within five or seven years. At present these notices are recorded in the county records, and the land officials and those who consult the land-office records with a view to entering lands have no notice thereof. It sometimes results in the patenting, under other laws, of lands which include valid mining locations.

Policy Should Be to Encourage Mining

The mining law of 1872 was entitled, "An Act to promote the development of the mining resources of the United States."

The general Leasing Act of February 25, 1920, bears a like title. The provisions of the various laws show that Congress intended that this important industry should receive encouragement. In my opinion, the administration of all of these laws should be both reasonable and liberal. Any doubt should be resolved in favor of the miner. Requirements made upon him in connection with the acquisition of a patent or lease, or in connection with the operation of the mine, should be reasonable, and no unnecessary or hampering restrictions placed upon his royalties under the leasing act should be fair and moderate. The exaction of unreasonable royalties would defeat the very purpose of the statute by discouraging exploration and production. The risks and uncertainties connected with prospecting and mining are so great that those who are successful in discovering mineral should not be denied their reward. The uninformed, hearing of the occasional great fortunes that have been made in mining, are apt to be like the Irishman who landed in New York, and on his way up the street from the pier found a \$20 gold piece. As soon as he could get pen, ink and paper he wrote to his relatives in Ireland to come to America, because it was a place where you did not have to work for money, but could pick it up off the street.

Moreover, unnecessary burdens placed upon the producer are quite likely to be passed on to the consumer in the form of higher prices for the product of the mines. Shortage of fuels and other needed minerals can best be averted and the supply for the public at reasonable prices secured by stimulating production, and that can and should be brought about by a liberal administration of the law and fair treatment of the mining operators.

Prevention of Waste—Important Methods of Mining and Reduction

It is sensible and right that none of our resources shall be wasted, and this is particularly true of limited and exhaustible minerals, such as oil, gas and coal, and to this end it is the duty of the Department to prevent waste and to encourage better methods of mining, handling and reduction. His interest will ordinarily prompt the producer to take care of his mineral product, but experience has shown that ignorance of methods, lack of facilities or a desire to take the cream and leave the milk has, in many cases, resulted in a waste of

material that should have been saved and utilized. In this work of discovering and putting into effect improved methods, the American Mining Congress and the operators can perform a valuable service in aiding the Department, with resultant benefit to themselves as well as the nation.

Constructive Suggestions Welcome

Captious criticism and petty fault-finding are of no benefit to the Department, the public or the operators. Constructive suggestions or criticisms cannot fail to be of advantage to all concerned, and will greatly aid the Department in its administration of the mining laws.

American Mining Congress Service to Mining

The American Mining Congress occupies a peculiarly favorable position to be of service both to the Government and the mine operators. Its organization permits it to gather information promptly from the entire mining area, to use that information for the general good, to thresh out and harmonize differences of opinion, and to render a real and lasting service to the people.

On the occasion of its twenty-third annual convention it merits and receives our esteem and congratulations.

THE BUREAU OF MINES AND THE INDUSTRY

By F. G. COTTRELL

Director (until end of 1920). U. S. Bureau of Mines, Washington.

The Bureau of Mines has now been in existence for ten years. This seems an opportune time and place to take account of stock; to look over the ground already covered, and to note the direction in which we are headed. It is right, also, to give to the mining and to the general public an accounting for the moneys spent, and to gain from them ideas and suggestions as to how, within our funds and organic powers, present and probable future needs can best be met.

Briefly, the Bureau receives from Congress for the present fiscal year a total of \$1,302,000. Of this, \$77,000, or approximately 6 per cent., is spent for general operating charges including the salaries and expenses of the administrative officials, clerks, accountants and other necessary overhead expenses. This compares favorably with the percentage for overhead found in commercial corporations.

Mine-Rescue Cars and Stations

One of the oldest and perhaps the best-known division of the Bureau's work is that of the Mine-Rescue Cars and Stations. Briefly, the Bureau operates and maintains ten mine-rescue railroad cars, which, with personnel, travel from mine to mine in the different mining districts, giving training in first-aid and mine-rescue work, and assisting in times of mine disasters and fires. In addition, there are eight fixed mine-rescue stations, seven of which are equipped with motor mine-rescue trucks available as in the case of the cars. This service to the mines and miners has been a real and a paying one, counted only in the number of lives and in the value of property saved. Its by-products have been an awakened sense of responsibility of miners and operators alike, resulting in a decided decrease in the number of non-fatal as well as fatal accidents.

The allotment for this mine car and station work is about \$240,000 per year, or 18 per cent. of our funds. This sum is

arrived at by taking \$126,000 of the Congressional appropriation of \$155,000 for operating mine-rescue cars and combining with this \$112,000 from the mine accident appropriation.

Mine Accidents Investigations

The largest single allotment of the Bureau is for the so-called Mine Accidents Investigations, amounting to \$409,065, or about 31 per cent. of the total. As noted above, \$112,000 of this is used through mine rescue cars and stations, leaving \$297,065, or 23 per cent., of our yearly moneys for other provisions of the appropriation. It has been inferred by some that the Bureau expends this much money for the purpose of simply gathering facts and statistics on accidents as they occur in the industry. As a matter of fact, the term mine accidents is an abbreviated title for an appropriation that is used, not only to collect mine-accident statistics and investigate mine accidents, but "for investigations as to the cause of mine explosions, methods of mining, especially in relation to the safety of miners; the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the use of explosives and electricity, the prevention of accidents, and other inquiries and technologic investigations pertinent to the mining industry"; and this covers, as does the Rescue Car and Station appropriation, both the coal and metal mining industries. Thus, out of this fund come the expenses for testing and research studies of explosives; the use of electricity and mechanical appliances underground; ventilation; coal and metal mine dusts and their relation to the health and safety of the miners; the operation and maintenance of the 15 Bureau schedules of approval for explosives and safe equipment underground, and the extensive field and experimental mine investigations relating to the prevention of explosions from coal dust and gas. In short, this appropriation supports the basic investigations which bear not only on the fundamental problems pertaining to the improvement of health and safety conditions in the whole mineral industry, but have also the widest economic significance.

Safety First and its Economic Aspect

Thus, although the appropriation for Mine-Rescue Cars and Stations, and for Mine Accidents, together totalling about 43 per cent. of our appropriations, had "Safety First" as their original inception, in reality they cover a wide range of economic interest as well.

The records show that in the beginning the American Mining Congress was vitally interested in, and, as an organization, helped very prominently in the creation of the Bureau. From its continued co-operation, I am led to believe the results have been reasonably successful and at least encouraging.

The movement for safety in the mines is rapidly outgrowing its original position as something quite apart from operating management, and, in fact, often in conflict with it, to be used only when sentiment dictated; rather, it is proving itself closely interwoven in the economic structure of mining, a part of every drift, every machine, and every man's work, and, best of all, it is furnishing a common meeting ground and common direction of humanitarian effort for the miner, the operator, the Government and the public.

The mine-rescue and first-aid training work will be continued with the principle in mind that the Bureau organization acts as a teacher and standardizer, not to take the place of self-preparedness and self-help on the part of the individual mine in time of disaster or fire, but rather to help organize, encourage and train local men and companies to help themselves. However, that part of our safety work which deals with investigations of safe and dangerous practices, development, use and approval of underground explosives, ventilation methods, mechanical and electrical appliances, and health and working conditions of the miner must grow in proportion to the growth of the industry and the use of more complicated machinery and appliances.

Technologic Investigations

The Bureau received last year \$125,000, or 10 per cent. of its appropriation, for "inquiries and scientific and technologic investigations concerning the mining, preparation, treatment and utilization of ores and other mineral substances, with a view to improving health conditions and increasing safety,

efficiency, economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical and other industries." This is a field so broad that it recognizes the need for economic work in the whole of mineral mining — metallic and non-metallic — ore-dressing, metallurgical, and inorganic chemical and alloy fields. In commercial work this field today employs many thousands of mining engineers, metallurgists and chemists. Its locale is nation-wide, its field is the whole of industry, and in its intensive development we see as a parallel the basis which made modern industrial Germany possible. A considerable number of the larger metallurgical and chemical companies in the United States each spend yearly for research on their own particular problems considerably larger sums than the yearly appropriation of the Bureau for corresponding work which is expected to reach and benefit the whole industry.

It is evident that with its present resources the Bureau will be doing well if it can influence and benefit even a smaller number of the many problems whose solution would build up the industry. Frankly, the Bureau takes this attitude: Work likely soon to be successfully undertaken by private laboratories is left untouched unless there is some special reason why work by the Bureau itself would be of probable general benefit to the whole industry. On the other hand, there is a great deal of fundamental research that can most properly and efficiently be undertaken, either by the Bureau itself or through co-operation between it and the industrial concerns, either individually, or, best of all, in groups or associations. Any industry advances in direct proportion as the amount and quality of the new fundamental information is put at the disposal of the whole industry. Excessively secretive industries do not develop to their full possibilities. Considerable good is coming and will continue to come from the Bureau as a non-partisan body, putting at the disposal of the industry facts and data discovered or compiled under its direction.

Moreover, there is a growing recognition of the number of research problems, the solution of which would benefit the whole industry to a marked degree, yet the value of which, to an individual concern, is not great enough to justify commercially the expense involved. This is a vast and proper field in which the Bureau may grow. Familiar examples are the

Bureau's work in radium and the rare metals on the one hand, and with the household and small plant fuel on the other.

Patents

We hear much today about the economic aspects of mining, of the business problems of mining, treating and selling minerals as apart from the problems of pure technology. During the war the Bureau instituted a service that frequently placed before the Government, the producers, the consumers, and the interested public, reports and information as to a particular metal; the developments in mines and mining districts producing it; and as to supplies available, conditions of markets and conditions from a world-wide point of view of its political and commercial control. That this work rendered service is attested by the attention it received. However, it was necessary to discontinue this at the close of the war. I hope that before long the Bureau can again undertake at least certain features of this work, combining these necessary engineering and business factors from a non-partisan viewpoint. This is one of the possible fields for the Bureau's activity which borders most closely upon that of other bureaus in the Government service, and where cordial co-operation and intelligent and friendly delimitation of functions to the end of maximum public service and minimum of unnecessary duplication must be most earnestly striven for.

Non-Metallics and Chemistry

We have also to consider the research in and aid to the non-metallic and chemical industry's field. The public generally does not recognize that the stupendous and nation-wide programs of building and highway construction rest on an adequate production of building stone, road materials and, in general, vast quantities of non-metallic minerals and mineral products. It is estimated that the non-metallic mineral requirements for 1920 for construction alone will exceed \$400,000,000. To obtain a greater variety of products and better grades of materials by more economical methods than are now in use, the Bureau has planned a program which includes the following specific problems:

1. Dissemination of information as to the most efficient

methods and equipment in the *sand, gravel and crushed stone industries*.

2. Aid the *talc and soapstone industries* in improving present practice and finding use and markets for the off-color and impure talc now wasted in this country, but utilized abroad.

3. In the *slate industry*, encouraging the manufacture of a greater variety of products at the individual plant, and better utilization of the waste. Important branches of the slate industry have requested the Bureau to assist in these problems.

And again, problems similar to these exist in the glass sand industries, and in the limestone, mineral pigment, gypsum, and in the granite industries.

The phenomenal growth and importance of the *chemical industries*, involving the use of coal and mineral products, has been generally recognized and commented on. When the war shut off the chemical and chemical manufacturers' imports, the chemists of this country came forward and within a few years were able to establish chemical industries of a magnitude not incomparable with those which it had taken Germany many years to build up. Many of these industries, especially the smaller ones, will not be able to compete under peace-time conditions without some form of assistance. It should not be forgotten that most of the chemical industries depend for existence on the marketing of their by-products. In the study of this problem, and in encouraging and developing, especially in the smaller units, lies a very worth-while field of service for the Bureau. It should be the policy of the Government to aid these industries by fundamental research, as this is a service that would be not only of direct aid toward solving specific problems, but would incidentally furnish a broad general training to the personnel who gradually sift out into the industry, and in the dissemination of information would repay tenfold the money invested.

Alloys

Again, the possibilities of help in the alloys field are almost without limit. Metallurgists even claim that industrially we are just now entering into the age of alloys. At any rate, the technology of this field is developing at an astonishing rate, and the results of our previous small expenditures along this

line lead to the belief that a program of research by the Bureau would extend the field, lead to discovery and application of new alloys, and make for more efficient use and cheaper cost.

The work carried out by the Bureau for the Army and Navy in the production of *helium* points the way to astonishing possibilities in the production of *pure gases generally on a cheap commercial scale*; as for example, the concentration of *oxygen* from air at a cost which would allow it to be used in gas producers, metallurgical furnaces and other industrial equipment in place of air, as at present used, and thereby effect some remarkable economies.

The possibilities in the whole field of gases are great, but the reorganization of present methods so fundamental, and the immediate returns so uncertain, that private capital naturally hesitates to take the initiative. What better illustration can there be of the need of the Government taking the lead and fostering investigations which mean the supremacy of American industry?

The Experiment Stations

Besides the mineral mining appropriation just referred to, the Bureau received \$200,000, or 15 per cent. of its total appropriation, for the maintenance of eight field mining experiment stations, the object of which is to help the industry by the solution of technologic problems of mining and treatment of ores and mineral products. The policy has been adopted of placing these stations in the important producing regions and, if possible, to co-operate with the local industries and mining colleges already existing there, in order to avoid duplication of effort and reduce overhead expenses. Thus, our Ceramics Station is at Columbus, Ohio, in co-operation with the Ohio State University; the Southwestern Station at Tucson, Arizona, in co-operation with the University and State Bureau of Mines of Arizona, and is conducting investigations in copper leaching methods. On the other hand, our Petroleum Experiment Station is at Bartlesville, Okla., without direct college affiliation, but in quarters made possible by the support and gift of the Bartlesville Chamber of Commerce.

The scattered stations gain much by thus being in direct contact with local industry and local conditions, and are able to keep the central office at Washington closely informed as to

conditions and needs of the industry. On the other hand, this policy lacks the unity that would come should the stations be centralized, and requires close supervision in order to avoid duplication of effort. The Foster Bill, under which these stations were established, called for ten individual stations, eight of which have already been established, and the appropriations for the remaining two are included in the estimates now going to Congress.

As to future growth, the question naturally arises as to whether one or two large experiment stations located at a central point, such as the Bureau maintains at Pittsburgh, and where a wide range of technical equipment and talent are immediately available on a problem, are to be preferred to smaller and more scattered stations as just described. The situation is complicated by the fact that a local industry almost invariably desires, and with some justification, to have its problems investigated locally, even though work that is applicable to the local problem might be carried on at some other place.

The probable solution is the maintenance of a limited number of more or less temporary or movable field stations, but to supplement their work with several large central stations, each specializing on some one major line, such as our present Pittsburgh Station, which has specialized on coal and its myriad problems.

Testing Fuels

One of the primary functions of the Bureau was the testing of fuels—work that had been started by the technologic branch of the Geological Survey and transferred to the Bureau on its formation. For carrying on this work the Bureau received last year \$142,510, or 11 per cent. of its appropriation. Out of this a large service laboratory is maintained which analyzes all Government coal purchases and, in addition, thousands of samples each year which are collected by Bureau field engineers. Thus, gradually, there is being accumulated exact information as to the nature and character of every kind of coal from every district in the country. In the actual testing work special attention has been given to the economic combustion of coal by the small user, represented mainly by the small hand-fired boiler plant, and by the domestic consumer.

It has been easier and cheaper, also, to study the small furnace, and much fundamental data has been obtained and disseminated as to what actually takes place in the furnace during combustion of the fuel. Utilization of lower grade and cheaper fuels as substitutes for more costly fuels has been demonstrated and put into effect in many lines. Startling wastes of energy in the ordinary plants have been proved and brought to the attention of the public. Today the situation is more alive and more worthy of attention than ever before. In pre-war days, with coal in many regions available at about a dollar a ton, care, refinements and possible saving of energy were often a matter of technical interest only, where today, with coal at several times the above price, even small percentage savings of fuel are a dividend-paying necessity.

To the fuel engineer, the possibilities for the future are almost without limit. To the man who doubts the wisdom of research with public money, here is a field where the initial expenses of establishing and conducting real research are too great to justify private individuals or corporations to undertake from the standpoint of money returns to themselves alone; yet because the results of the research affect thousands of furnaces, each in a small way, the aggregate nation-wide benefit is immeasurably more than the initial expenditure. The successful researches of the Bureau of Mines, with natural gas heating and cooking appliances, are a case in view.

Smoke in Cities

For the future the public must realize that the *serious city smoke troubles* are remedial nuisances, dependent for remedy equally on the public, the fuel engineer, the consumer of coal and the fireman. Either the fireman and the man for whom he works must be taught to burn the coal without smoke, or else artificially prepared fuels from which the smoke forming tars and volatiles have been taken must be used. In both lines the interest of the Bureau is paramount. The program should be: First—Investigating, teaching and educating the great fuel-burning public to the money and health value of the right fuel, and the right furnace in the right place, fired in the right way. Second—Aiding in the development of preparing new fuels, especially from waste and low-grade fuels, such as lignites. If we add to these problems the host of fuel

problems that are acute in the petroleum product using or internal-combustion field, and the necessity for getting more energy from the national and rapidly wasting asset, petroleum, we must see that the right use of fuel has become a national concern.

The final main division of the Bureau's work is petroleum and natural gas, for which \$135,000, or approximately 11 per cent of our money, is expended.

Value of Trained Petroleum Engineers

A few years ago a trained petroleum engineer would have been a curiosity. The so-called oil man attended to the location and drilling of the wells, and usually had charge as well of the marketing of the product. It was considered essentially a game for the practical man who usually had spent a lifetime in the work in the older Eastern fields. Today we find the developed industry separating into a number of distinct fields, in each of which years of effort are required to become efficient, and which are requiring increasingly specialized technical experts. The astonishing increase in the number of producing districts and companies, the short life of properties and waste of product, the tremendously increased demand for the products of petroleum, and the universal dependence on petroleum products for power and lubrication of the automobile has made the question a national one. In addition, the Inter-State relations in the production, distribution and utilization of natural gas, and the immediate necessity for conservation measures, bring the whole petroleum industry before the public eye as possibly our most active and interesting national resource question. How has this national Bureau helped the industry? Most of all, by very definite practical field work. The efforts, it is true, have been conducted with a small staff and the work spread over a large territory. Operating, however, with a staff of engineers who have had a wide field experience and free from any local prejudices, better drilling practice has been fostered; for example, the conservation of oil and gas by the use of mud-laden fluids and other methods has been widely demonstrated, and wells considered ready for abandonment have been brought into production again by the operators. The Bureau is not necessarily the discoverer or first user of the many methods and processes it advocates; it

oftentimes is rather the agency for quickly disseminating valuable information to the field where the most good will result.

In the Bureau's petroleum laboratory, success has been attained in developing improved methods for analyzing oil and its products, and in standardizing and reducing to exact specifications the needs of the producer and consumer. Progress has been made in the working out of processes designed to recover greater percentages of gasoline and the other light fractions from the crude petroleum.

The future of the whole work is bright. The need of a national program which will bring the oil-shale resources of the West through the trying experimental and semi-commercial stages to the point where operating companies can be reasonably sure of success is a necessity. The advance work should be done now, so that in a few years, when the failing supplies of petroleum begins to be felt, the oil-shale industry can fill the gap without interruption in the nation's business. No other proposed substitute for petroleum has the possibilities for quantity and cheap production as the oil-shales.

There are still great possibilities in our older and supposedly exhausted oil fields through experimentation and applied engineering. Probably not more than 10 to 20 per cent. of the actual petroleum in the ground is recovered on the average from a well by the ordinary methods of pumping. Processes based on introducing water and compressed air into the ground give enough promise when properly conducted, so that an extensive campaign of experimentation and education should be started.

Natural gas, in the past so cheap and so common over large areas in this country, is above all the ideal fuel for the city domestic uses. When a recent French official mission visited Pittsburgh and saw the wonderful steel mills, coal mines and other activities, the point that interested them most was a pipe coming out of the ground producing gas that burned; a common thing to us was to them a wonderful natural resource without parallel in their previous experience. So accustomed have many large cities become to this fuel that its actual early forthcoming exhaustion is not vividly appreciated. The inconvenience and great cost of replacing this fuel with a more costly and inefficient artificial gas should be delayed as long

as possible. The Inter-State relations of supply and consumption are intricate, and an independent outside agency as the Bureau of Mines, through ascertaining facts and promoting efficient use, can assist in prolonging the supply.

Losses in Oil Operations

Of late we have realized the enormous losses by evaporation in petroleum and petroleum products between the well and the refinery. The annual loss, which may be measured by the individual producer as a few barrels or a few thousand barrels per year, becomes millions of barrels per year for the country as a whole, and in the face of our declining supply demands a vigorous campaign in order to lessen it.

The 4 per cent. of the Bureau's money not accounted for in these remarks is used for routine expenditure, as rents and improvements of grounds, etc.

I cannot close this discussion of the policies of the Bureau without bringing to the attention of the mining public a novel, and so far successful, phase of our work whereby we have endeavored to make one dollar of our appropriation do the work of two. It is by means of co-operative agreements with outside agencies for the conducting of investigative work. Thus, during the present year the Bureau has in force over 40 such agreements, and is spending about \$500,000 of outside money in the work.

Briefly, another governmental agency, or a State agency, or a private agency, has a problem in mining or metallurgy to solve. The Bureau of Mines has the organization and equipment best fitted to do the work. The facts to be obtained are fundamental and widespread in application, and probably will benefit the whole industry. The Bureau will have the rights of publication of any or all phases of the work. The outside agency furnishes part or all of the money for the work which is conducted under the direction of the Bureau.

The apparent success and increasing call on the Bureau for co-operative work of this character leads me to the belief that its expansion will go far to answer the question so frequently asked, "What is the Government going to do to foster research?" May not the answer be, "As much as the industries themselves have enough demand for and confidence in to share part of the burden of the work."

THE MINERAL LEASING ACTBy **CLAY TALLMAN**

Commissioner of the General Land Office, Washington, D. C.

A New Policy

The mineral leasing act of February 25, 1920, may be regarded as epochal in the history of our public land legislation, for with this act we have an entirely new governmental policy introduced into our public land system. This act marks as wide a departure in the administration of the Government's mineral lands as did the homestead law of 1862 with respect to the Government's agricultural lands. This is all in harmony with the changing public sentiment characteristic of a progressive people. You will recall that from the beginning of Government under the Constitution the general public land policy up to the time of the homestead law of 1862 was to consider the public domain primarily as a source of revenue to meet the national obligations. During that period our mineral resources were of comparatively slight importance, but during that period there developed a conviction in the minds of thinking men that it was a mistake to regard the land and natural resources merely as a source of revenue without consideration of the questions of the development and use of such resources. The results of the old policy had not been satisfactory. It required many years for the country to learn that development, use, home building and equitable distribution were far more to be desired than immediate returns in cash, and that the increased values resulting from a wide distribution of the land resources among all the people furnished far greater sources of revenue with which to run the Government.

Homestead and Mining Laws Followed Same Principle

The same underlying principle was followed in the mining laws of 1866 and 1872, and the coal-land law of 1873. The first of these were merely confirmatory of the customs of miners that had developed by force of circumstances on the public domain in California and Nevada. Technically, all mining on the

public domain prior to 1866 was a trespass. The mining laws were extreme in their liberality; the prospector who found mineral drove in his stake, and the mine and all the proceeds thereof were his. That policy led to intensive exploration and development. The homestead law of 1862 and the mining acts of 1866 and 1872 are generally looked upon as among the greatest contributory factors to the unprecedented development of the land and mineral resources of the West and Middle West during the past half century.

Reluctance to Change

I mention these facts merely to explain the reluctance on the part of the public and Congress to break away, even to a limited extent, from a policy which, notwithstanding many apparent abuses and defects, on the whole had been productive of such tremendous results. It required 10 years or more of constant agitation in and out of Congress to inaugurate the homestead law; it took about the same length of time to get through this leasing act. Though it seems strange to us now, the homestead policy was seriously attacked on constitutional grounds; some were disposed to view this leasing act as unconstitutional, or at least not in harmony with the theory of the Constitution to admit new States on a parity with those already in the Union; but the absolute power of Congress over the public lands had been so completely settled by decisions of the Supreme Court that the main consideration in the passing of the leasing bill was that of governmental policy.

Change of Conditions Requires Change of Laws

But as time went on radical changes took place; the time came when the land and mineral resources were no longer unlimited as compared with the country's necessities for the use and products of such resources. The great virgin forests, regarded in the early days as an obstacle to development, became largely destroyed or consumed; no longer was there available a quarter section of fertile land which the settler could have for the taking; the reclamation of arid lands at heavy expense became a necessity; an ample supply of certain mineral resources became vital in the world competition for national supremacy; the control of certain natural re-

sources by particular groups became incompatible with the public interest generally; the time arrived when further development and additional production must come from a better use and conservation of the resources already discovered or partly developed, rather than by merely expanding over virgin territory. In a word, changing conditions rendered some of our laws and policies impractical and unadapted to the necessities of the present. The American people are forward looking; they are not prone to worship idols or dream of the past in dealing with problems of the present; they are disposed to test out the efficacy of any measure on the basis of the cold facts rather than to be controlled by a policy simply because it is what we have always done. This mental attitude explains the enactment of the mineral leasing law.

Defects in Coal Laws.

The mineral leasing act provides a new method for the disposition of coal, oil, oil-shale, phosphates and sodium deposits. The forerunner of this act was a coal-leasing act for Alaska and a potash-leasing act. First, let us consider for a moment the reasons for a new plan for the disposition of these minerals. The coal land law was passed in 1873, and subsequently incorporated into Secs. 2347 to 2352, inclusive, of the Revised Statutes. Briefly, it provided that any citizen of the United States could acquire one quarter section of coal land at a minimum price of \$10 or \$20 per acre, depending on the distance from railroad; an association of persons could take not exceeding 320 acres, and an association of not less than four, who had expended not less than \$5000 in working and improving the mines sought to be purchased, could get 640 acres—that was the limit. The theory seemed to be that a quarter section, or at the most a section, was sufficient for a mine, and that individuals or groups of individuals in the areas where coal existed would be able to supply their own necessities and that of the country by making possible a large number of little mines. But the coal-mining business is not handled in that way. The nation's needs for coal many years ago became so great that coal mining had to be conducted on a large scale with large equipment and ample transportation facilities, all necessitating heavy investment, otherwise the coal could not be economically taken out and

marketed; the little operator could not compete with the big operator; it was hardly practical even for a farmer to operate his own coal mine on the back lot; he could buy his coal from the big producer cheaper than he could mine it himself, particularly if he had to mine at any depth. This led to the coal land frauds with which the Land Office records have been replete for the last 25 years. The primary cause of these frauds was the desire to get enough coal land to justify the development of a real mine that could produce coal in competition with the general market and with other mines on private lands. The coal land frauds resulted not so much from an unwillingness to pay a fair price for the land or fair royalty for the right to mine as from the absolute inability otherwise to get together enough coal land to make a mine. It is unnecessary for me to comment on the importance of making that supply available at a fair price. The concentration of the coal supply and the control thereof by private interests constitutes one of our principal economic and industrial questions of the day. There is still an enormous amount of coal on the public domain. The old law was inadequate, either from the standpoint of practical operation or public control; hence coal was a fit subject for the new legislation.

The Placer Law

But with the placer law applied to oil, we had a worse misfit than in the case of the coal laws. The first placer law was passed in 1870, and now appears as Secs. 2339 and 2330 R. S. It provided that

“Claims usually called ‘placers,’ including all forms of deposit, excepting veins of quartz, or other rock in place, shall be subject to entry and patent, under like circumstances and conditions, and upon similar proceedings, as are provided for vein or lode claims.”

Everybody knows that “claims usually called placers” was understood by the public and Congress at the time this act was passed to refer to the loose gold deposits found in the gravel beds of certain rivers in California. Congress had already provided for lode locations on a different theory; that is to say, the location was of the lode or vein in place; some other law was necessary to cover mineral deposits not in place, hence, originally, the principal distinction between lode

and placer claims was whether or not the mineral was found in rock in place. But Congress and the Department have long disregarded this distinction; by legislation or departmental construction, the application of the placer law has been extended to a variety of deposits, both as to composition and occurrence. If the Department refused to extend it, Congress would extend it. The placer law was made applicable to petroleum deposits by the Act of February 11, 1897, because the Department had refused to patent an oil claim under the placer law. A closely related question was whether oil is a mineral within the meaning of that term as used in the mining law, and this was not finally settled until a decision in the United States Supreme Court in the Burke case in 1914 (234 U. S., 669, 691).

Why Unadapted to Oil

The impracticability of trying to apply the placer law to oil has been amply demonstrated. It is fundamental that discovery of mineral within the area of the location is the origin and basis of all rights under the mining law. The prospector cannot discover oil with his pick and shovel; it requires extensive equipment, large expense and time, hence the oil prospector found himself in a precarious situation while he was prosecuting his work of exploration. At the most, he could legally hold only the claim on which he was drilling if he kept at it diligently; if he struck oil, others would have an equal chance at adjoining lands. To set up a separate rig on each of a number of claims in an unproved field and began drilling on all of them when one well would prove the structure was, of course, out of the question. He, therefore, had no assurance whatever of acquiring title to a sufficient area of public land to justify the expense of testing an unproved field. These conditions led to the practice of making so-called "paper" locations, that is, stakes and notices without discovery. As a matter of law such "claims" were not claims at all, and were respected just enough to lay the foundation for much litigation. Strong-arm methods and subterfuge were frequently resorted to so as to hold the land pending discovery. Yet titles of this character were made the basis of enormous investments. To have a great industry dealing in a public necessity like the oil business has come

to be in such a chaotic, haphazard and uncertain condition was certainly not in harmony with the genius of the American people.

Changes in the Oil Industry

In the meantime there was a tremendous increase in the use of petroleum and its products, which led to great activity in the attempt to secure claims on the public domain and to drill for and produce oil. The desire to acquire territory led to the use of dummy locators, a species of fraud at once difficult to prevent and difficult for the good-faith purchaser to guard against. Operations were not conducted with the care or good judgment or subject to the regulations under which the business is now conducted. In many instances operations were so conducted as to cause great damage to the oil deposits. It was evident that the supply of oil in the ground was limited. Though fortunes were being made out of oil production, the Government was selling the land for \$2.50 an acre. Everything pointed to the necessity of a more practical law, closer supervision and conservation of the oil deposits. It was for the purpose of holding the public oil lands in *status quo* pending such legislation that the withdrawals were made.

The Withdrawals

The withdrawals precipitated the oil-land controversy which has continued in the courts, the Land Department, Congress and the press for the last 10 years. Millions of dollars' worth of property were involved. The large and widely distributed use of petroleum products interested the whole public, and the problem was aggravated by the vital need of such products during the war. So much misinformation and misunderstanding as to the real facts in this controversy and the real issues to be determined seemed to prevail, that, in one of my annual reports, I endeavored to summarize in a simple and comprehensive way the main points in the public oil land situation as then presented, as follows:

The Oil Land Controversy

As to the matter of proceedings now pending, there are in the main three general classes: (1) Land Office hearings on Government contests against applications for patents; (2) what are commonly known as the with-

drawal suits in the courts to quiet title in the Government to unpatented lands, for an accounting and damages, with ancillary receiverships, and (3) what are commonly known as the Southern Pacific suits, which are to cancel patents for alleged frauds committed in the acquirement of title.

*It should be noted at the outset that the Southern Pacific suits (the third class) have no connection whatever with the withdrawal suits, the facts, principles and issues all being entirely different. The fraud alleged in the Southern Pacific suits is that the lands were all of known mineral character, and so known to the Southern Pacific officers and agents at the time the company filed and received approval and patent of its selection list. In all of these Southern Pacific suits, except one, an important question of law is involved, in that the fraud was not discovered or suits filed for more than six years after the issuance of patent. One suit, commonly known as the Elk Hills case, involving 6,109.17 acres, was commenced before the statute had run. This case was won by the Government in the trial court, and is now pending on appeal. The evidence in the other Southern Pacific cases, eight in number, and embracing 163,654.09 acres, has practically all been taken. Some of the lands involved in the Southern Pacific suits are among the most valuable oil lands in California, and the suits involve many millions of dollars.

Coming to the so-called withdrawal cases, classes 1 and 2, it is first to be noted that some years ago practically all the known public oil lands were withdrawn from entry and selection "in aid of proposed legislation affecting the use and disposition of the petroleum deposits on the public domain." The two principal withdrawal orders around which the present controversy hangs were made on September 27, 1909, and July 2, 1910, both covering substantially the same lands. The effect of the first withdrawal order was to cut off everything but valid, perfected, legal claims. At this time there was great activity in certain sections in the location, development and exploitation of new fields. Manifestly this order caught the claimants in every conceivable stage of development, from those who had only "paper location" to those who had drilled nearly to oil. In this connection there was not a little argument and difference of opinion as to the validity of this withdrawal order of September 27, 1909, and some of the lower courts held that the order was

*But cases subsequently disposed of the Elk Hills in favor of the Government and the other in favor of the claimant

without authority of law and void, but the Supreme Court of the United States in February, 1915, settled the question in what was known as the Midwest case, holding that the order was lawful, valid and effective.

In the meantime, however, Congress took a hand in the matter, and on June 25, 1910, the so-called Pickett Act was approved. The principal purpose of this act was to remove any doubt as to the authority of the President to make withdrawals by expressly giving him that authority. At the instance of the oil men, who complained that they had been treated unfairly, in that they had been taken unawares after the expenditures of large sums on the basis of the ten existing laws and conditions, a proviso was inserted to the effect that "a bona fide occupant or claimant" who at the date of any withdrawal order "heretofore or hereafter made" was in diligent prosecution of work leading to discovery, and continued same with diligence, would not be affected by the withdrawal; but Congress expressly disclaimed any intention of validating or invalidating the withdrawal therefore made, i. e., that of September 27, 1909.

So the whole question, so far as the effect of the withdrawals is concerned, is: Was the claim perfected by the discovery of oil before the withdrawal; and if not, was the claimant in diligent prosecution of work leading to discovery on that date, which diligence was continued to discovery, and, incidentally, of course, what constitutes diligence under all the varied and complicated facts and circumstances of the many cases that have arisen, for it now appears probable that hundreds of thousands of dollars have been expended in the development of immensely valuable properties not covered or saved by the proviso to the Pickett Act.

Another feature of the withdrawal matter is that of the naval petroleum reserves. By order of September 2, 1912, the President created naval petroleum reserve No. 1, commonly known as the Elk Hills, consisting of a gross area of a little over 38,000 acres; by order of December 11, 1912, the President created naval reserve No. 2, sometimes referred to as the Buena Vista Hills, and covering a little over 29,500 acres; by order of April 30, 1915, naval reserve No. 3, the Teapot Dome, in Wyoming, was created, embracing 9481 acres. Large portions of naval reserves No. 1 and 2, in California, are private patented lands; naval reserve No. 2 contains some of the most valuable producing oil lands in California. The so-called Elk Hills suit against the Southern Pacific Company includes a considerable area in the Elk Hills naval reserve. It should be understood that all the

lands included in these naval reserves was also included in the orders of withdrawal of September 27, 1909, and July 2, 1910. The creation of the naval reserves only operates to set aside these areas for the exclusive use of the navy. While the principles of law and the right to a patent on claims situated in the naval reserves are essentially the same as those situated in withdrawn areas outside of the naval reserves, due to the fact that the navy has been desirous of immediately clearing the naval reserves of all doubtful claims, a somewhat different policy has been followed in the naval reserves from that outside. There are no patented lands in naval reserve No. 3, in Wyoming, though there is a small area of school sections.

Injected into this oil-land situation in many cases is the issue of fraud, resulting from so-called dummy locators. This issue, of course, has no connection with the withdrawal policy and would have existed in any case regardless of the withdrawals. The placer-mining law provides that a person may locate a claim of 20 acres, and that an association of persons up to eight may locate a claim equal to 20 acres for each locator; hence the great majority of the locations consist of 160-acre claims located by associations of eight persons. The courts and the Department during recent years have repeatedly held that each locator in an association claim must have an actual bona fide interest in the claim located, and that he cannot simply lend his name as a locator for the use and benefit of somebody else. A corporation may locate any number of claims of 20 acres each, but a group of association locators cannot locate a claim for the use and benefit of a corporation or individual. The advantage of the association location is that only one discovery and the same amount of expenditure for patent is required on each claim, whether it be a 20-acre claim or a 160-acre claim. A corporation whose title is now bad because, based on a location made by dummies might have acquired a perfectly legal title to the land in question by locating it in 20-acre claims by making a discovery on each. It is possible that in the absence of the intervening withdrawals those defective locations might be abandoned and proper locations made. The fraud in the use of dummies consists in one individual or corporation by this device seeking to acquire a larger area of public lands with a certain amount of expenditure and development than the law allows. Unfortunately, the use of dummy locators appears to have been quite generally resorted to, and dummy locations are void, at least as to all those connected with or benefiting by the fraud.

Another class of cases consists of those where the charge is non-discovery by reason of the fact that the alleged discovery on which the location is predicated consists of gypsum or fuller's earth. This difficulty would also have existed just the same regardless of the withdrawals, except that in the absence of the withdrawal a proper and legal discovery of oil might later be made.

The proceedings directed in all the Land Office hearings against the applications for patent in the oil-land cases consist, therefore, of three general classes: (1) Diligence of the claimant as against the withdrawal; (2) fictitious locators, and (3) alleged subterfuge discovery.

In cases in the naval reserves and some outside, suits have been started to quiet title in the Government or for an accounting and damages notwithstanding applications for patent are pending, also some other suits have been brought against claimants who have never made any application for patent. These are the suits that are commonly known as the withdrawal suits as distinguished from the Southern Pacific suits.

As soon as the Government began actively to press these cases, operators who are producing oil from the lands found it difficult to sell same because the purchasing concerns refused to incur any liability for damage which might result from having purchased oil taken in trespass. Consequently Congress, by the Act of August 25, 1914, authorized the Secretary of the Interior to enter into agreements whereby the production could go on pending the determination of the right to title. Under this act security is given, or a certain portion of the proceeds of the oil is impounded, to satisfy any claims of the Government.

Two Propositions Involved in Leasing Act

It was apparent to most everybody that a means should be found for settling and compromising this litigation, expensive alike to the Government and the operators and subversive of a normal program of development. Therefore, in the enactment of this legislation Congress had to do, not only with the laying out of a future leasing program, but the adjustment of pending claims, and the latter was by far the more difficult matter to handle. Had the former been the only question, the leasing law would have been passed five or six years before it was. The difficulty of working out a basis on which to settle the existing claims was the principal cause of delay in the enactment of the leasing law.

General Character of Act

Like many other laws passed under the circumstances above indicated, this act is really a series of compromises. Eventually sentiment in Congress became crystallized in favor of a leasing law, and the tendency was to give and take until an act was agreed upon. Several different bills passed one House or the other in prior Congresses. The bill that was finally passed, first passed the Senate and House as entirely separate and different bills under the same number and title in order to throw the whole matter into conference where the differences could be adjusted; after so much difference of opinion the House adopted the conference report by a vote of 287 to 13, and the Senate adopted it unanimously. It really got to the point where if one member of the conference committee insisted that something be put in, it went in; if another insisted on something coming out, it went out, and not infrequently this was done without anybody taking the trouble to ascertain how the operation left the general structure of the bill. The law is inconsistent with itself in numerous respects; many provisions are not clear or not in harmony with other provisions; still other provisions either are meaningless or mean so much as to be clearly beyond the intention of Congress. As a rule, little attention was paid to harmonizing this act with the general body of the public land laws, as the result of which grave questions have arisen as to the effect of this act on other public land laws. You will find in the act illustrations of both the radical and the conservative tendencies of the times. But on the whole, we have a workable foundation laid for the inauguration of a leasing system. The inconsistencies will be construed, parts that are obscure will be clarified, some changes will doubtless be made by Congress and many changes will occur in the regulations as time and experience develop the necessity for them. The general principles of the act are deemed to be sound, and, with the use of reasonable judgment and good sense in its administration, I feel that it will serve to place the mining and marketing of the minerals to which it applies on a sound business basis, beneficial alike to the operator, the States, the United States Reclamation Service and the public generally.

A striking feature of the act, and, in my judgment, a good one, is that much is left to regulation. This tends to elasticity and gives the executive departments leeway in which to exercise administrative discretion on situations as they may arise.

Regulations

The act is in a sense paternal in character; that is to say, there is not so much in it of *legal rights*, as ordinarily understood, as of privileges granted pursuant to the judgment of the administrative authority. To a large extent the act is inoperative in the absence of regulations. For instance, one of the few illustrations of a self-operative provision of the act is where in Section 13 it is provided that one may procure a preference right to a prospecting permit by posting a notice on the land, which preference must be exercised by the filing of an application within 30 days. But the act provides no place, manner or form in which to file the application; that is left entirely to regulation, and, in fact, the granting of a permit at all is discretionary with the Land Department. Realizing the absolute necessity of detailed regulations, as the bill took definite and final form, we in the Department made diligent effort for several weeks preceding the approval of the act to whip into shape a set of regulations; this required many conferences of many hours. None of us realized the number nor the magnitude of the questions involved in the act until we started in to make concrete provision for its administration. Fortunately, the conference committee held the bill for some weeks; a few more days elapsed before the conference report was adopted by both houses, and the President held the bill the full 10 days before he signed it, during which last period, of course, we knew exactly what the law would be. Under these circumstances I had the satisfaction of submitting to the Secretary of the Interior on the same afternoon that the President signed the bill, a complete set of regulations for the administration of the oil and gas provisions of the act, which had theretofore been reviewed and criticised by the legal force of the Department. But as luck would have it, just at this time we had a change of secretaries, which delayed the approval of the oil and gas regulations until the 11th of March.

General Scope of the Act—Beneficiaries

Now let us consider for a moment the general scope of the act. As I have before stated, it applies to coal, oil, oil-shale, phosphates and sodium. A leasing act for potash deposits, along the same general lines as the Act of February 25, 1920, became a law on October 2, 1917, and a coal leasing act for Alaska was passed in 1914. First, it should be noted that those who may exercise the privileges granted by the act are citizens of the United States, associations of such citizens or domestic corporations, and, in case of coal, oil, oil-shale or gas, municipalities. Note the recognition of corporations as a necessary instrumentality for the conduct of modern business. While corporations can acquire rights under the mining laws of the United States, this has not been the general rule under other public land laws. The only privilege afforded an alien under the act is to become a stockholder in an American corporation operating under the act, and then only in case his country grants the same or similar privileges to American citizens. Though several cases are before the Department, it has not yet been finally determined that any particular foreign country is a reciprocating nation within the meaning of this provision of the act.

Lands and Deposits to Which Applicable

Another significant feature is that the classes of deposits to which the act is applicable are all such deposits and lands containing same which are "owned by the United States," except in the Appalachian forests, national parks and military and naval reservations. The view has been expressed that the Department might under this provision lease the Capitol Plaza for oil development if it saw fit. This feature is important, in that ordinarily the public land laws are applicable only to the unwithdrawn and unreserved public lands, while this act has been construed by the Department to be applicable to withdrawn lands, whether national forests, specifically provided for, or any other withdrawals, subject to the condition, however, that the use of withdrawn lands for development and production of mineral under this act shall not be permitted to destroy the use or purpose for which the withdrawal was made. We are, therefore, granting prospecting permits

in national forests and on lands withdrawn for power purposes, areas withdrawn under the reclamation act and various other withdrawals, but all in accordance with stipulations protective of the uses and purposes for which the reservation was created.

This is a practical solution of the matter which permits the land to be devoted to the most useful purpose, or several useful purposes, of which it is susceptible. In this connection, also, the act applies to reserved deposits where the Government has already disposed of the surface with a reservation of the mineral. Conversely, the act authorizes the reservation from a mineral lease of the right to dispose of the surface. All this is a wide departure from the old practice, for prior to the so-called "surface acts" now in full operation, public land had to be disposed of by a hard and fast rule either as mineral land or non-mineral land. Now we dispose of the surface to the farmer and of the mineral to the miner, or different minerals even to different miners; we may reserve land for various reclamation or power uses and yet, under this act, we are not compelled to tie up withdrawn lands from mineral development and production, though it may be many years before the lands will actually be devoted to the purposes for which withdrawn.

Ample Unit of Operation—Limitations

Another feature of the act is a sensible recognition of the amount or area of land necessary for a practical unit of operation. I called attention at the beginning to the defect of the coal laws and the placer laws in this respect. Under this act one may procure a lease to as much as four sections of coal land or may procure the exclusive privilege for two years to prospect the same area of oil land, and may procure a lease on 5000 acres of oil-shale; he is not restricted to individual development; he may associate others with him, either as an association or corporation, so as to facilitate the financing of his venture. On the other hand, there are many limitations in the act and some severe penalties designed to prevent monopoly, and to procure an equitable distribution of its benefits among more people, yet giving each person or group a sufficient area of land to conduct a good business-like opera-

tion on a scale commensurate with like operations on private lands.

Co-operative Use of Lands

Another important feature is the reservation by the Government of the right to permit the use of any lands leased for rights-of-way for pipe-lines, roads or other equipment of other operators. There will be no opportunity to secure control of a strategic location so as to keep others out. To the same end it is provided that pipe-lines controlled by lessees or occupying public lands shall be common carriers.

Royalty Oil

A provision that will be of great importance as time goes on is that with respect to the disposition of royalty oil. As we all know, the supply and price of oil has always been very largely controlled by the owners of the pipe-lines and refineries, supplemented by long-time contracts covering the production of different producers. Under this act, the Secretary may offer the royalty oil at public auction, thus encouraging independent or competing refineries; or he may sell the royalty oil at the market price to other departments of the Government, thereby enabling the Government to use its portion of the production to meet its needs. We are all familiar with the heavy demand that exists at present for fuel oil. The United States Shipping Board has experienced the greatest difficulty in procuring a sufficient supply to meet the requirements of its fleets. Acting under this provision of the act, the Secretary of the Interior has already entered into a year's contract to sell all the royalty oil coming to the Government, in both Wyoming and California, except that from naval reserves, to the Shipping Board. This, in turn, made possible the practical handling of the royalties arising from the inland fields. The Shipping Board has already entered into contracts whereby the Wyoming Refineries take the Shipping Board's royalty oil at the well, in consideration for which the refineries deliver agreed quantities of fuel oil at coast points where the Shipping Board needs it.

Division of Proceeds

One of the problems presented by the act, over which there was much discussion and difference of opinion in Congress, was the division of the proceeds arising from its operation. This problem was intimately related with the contention of the States that any leasing system which contemplated the indefinite retention in the Government of the title to public lands must of necessity deprive the States of the opportunity to tax such lands for the support of State institutions. It was at once apparent that if the leasing policy was to be inaugurated, the States in which the lands were situated must have some portion of the proceeds arising from operations under such leases in lieu of the taxes it might otherwise levy. But the United States Reclamation Service since 1902 has received the entire net proceeds arising from the disposition of public lands. Practically all the public lands that would come under the leasing act were situated in the arid States. The representatives of the Reclamation Service pointed to the tremendous benefits resulting from the great projects that had been built, resulting in heavy increase in the taxable property of the arid States; they pointed to the further fact that the Western States and civic organizations were clamoring for Federal aid for more reclamation projects, despite the enormous drain on the Federal Treasury resulting from the war; they argued that the indirect benefits to the Western States by using the proceeds for reclamation purposes would exceed the benefits to the States from the direct use of such funds. Then, too, it appeared that the Federal Government would be put to considerable expense in the administration of the act. All of these considerations led to the compromise which we now find in Section 35, to the effect that 10 per cent. of all royalties go to the Government; that 70 per cent. of past production and 52½ per cent. of future production is appropriated for use under the Reclamation Act, and 20 per cent. of past production and 37½ per cent. of future production shall be paid over directly to the States "for the construction and maintenance of public roads or for the support of public schools or other public educational institutions." In addition to this, there is reserved to the States "the right to levy and collect taxes upon improvements, output of mines, or other

rights, property, or assets of any lessee of the United States." Thus we see that this act is really a revolving development and improvement proposition as well as a so-called conservative measure, and that, except for the 10 per cent., the Western States in which the lands are situated will receive, directly or indirectly, all the proceeds arising from operations thereunder.

Detailed Discussion Impracticable

Coming now to the specific provisions as to permits and leases and the restrictions and limitations thereof, I am a little at a loss to know how extensively I should go into it, for, to cover the subject with any degree of thoroughness would take the rest of the time of all the sessions of this meeting of the Mining Congress. Moreover, many of these details would be of little interest to a general audience. I understand that some sectional conferences will be held where these features may be taken up and questions asked if desired. I shall be glad to contribute anything I can in that way that will be at all helpful, for I am well aware of the many difficulties that operators have experienced in their endeavor to construe and comply with the act and the regulations thereunder, and the great task we have had in the Department in construing and applying it. I will, therefore, sketch very briefly the specific provisions with respect to the minerals which may be leased.

Coal

As to coal, the act provides: First, for leases for not exceeding 2560 acres for an indeterminate period, to be granted by competitive bidding or by such other method as may by general regulations be provided; second, for a prospecting permit, good for two years, for prospecting areas where the existence or workable coal has not already been demonstrated, the prospector, on development of workable coal within the period of his permit, having a preference right to a lease; and, third, the act provides for a limited revocable license to mine coal, without the payment of rent or royalty to supply domestic needs and not for sale.

Oil and Gas Permits

The oil and gas provisions of the act contemplate two distinct classes of land which, for want of better terms, we will refer to as "proven structures" and "wild-cat lands." Proven structures, for the purposes of the act, are those producing structures, the boundaries of which have been arbitrarily and specifically designated by the Government; wild-cat lands are all lands outside such proven structures. This line of distinction runs all through the oil and gas provisions. Primarily, the act provides for oil and gas permits on wild-cat lands, oil and gas lease on proven lands, and for so-called relief permits and leases to which I will refer later. Prospecting permits on wild-cat lands are granted for not exceeding 2560 acres for the period of two years. The permittee must commence operations within six months, must sink a hole 500 feet during the first year, and to a depth of 2000 feet or to oil during the life of the permit or any extension thereof. If the permittee strikes oil within the life of the permit he is then entitled to a lease of a flat 5 per cent. for one-fourth of the area of the permit and for not less than 160 acres, unless the entire area of the permit shall be less than 160 acres. As to that portion of the permit area not included in the 5 per cent. lease, the permittee is given a competitive preference right at a royalty of not less than 12½ per cent., "the royalty to be determined by competitive bidding or fixed by such other method as the Secretary may by regulations prescribe." The first regulations stated this provision substantially in the language of the statute. It has been the subject of much consideration and criticism. The point is made that royalty bidding is always an unsatisfactory method of awarding a lease, for it is easy for one to make bids of what he is willing to pay out of future production. Again, it was urged that for a prospector to go into a wild-cat field at large expense, taking all the hazard of a total loss, and then, if he finds oil, be compelled to bid against others, who may thus take advantage of his discovery, on a royalty basis, is unfair to the prospector and not conducive to his taking the chance and going into the new field. Consequently, in the new regulations, we have provided that as to the three-fourths area, the Secretary will fix a reasonable royalty at which the permittee will be given

an opportunity to take the lease of the land or leave it, so that, as a practical matter, under present regulations, the permittee, if his exploration work is successful, gets a flat 5 per cent. lease on one-fourth of the area, and, if he wants it, a lease on the balance at a fair royalty fixed by the Department.

Preference Right of Surface Claimant

While discussing the subject of permits, it may be well to refer to Section 20. I think that section contains a sample of every iniquity that can be found in the whole act. Without discussing the questionable policy of disposing of mineral under the homestead laws, suffice it to say, that this section, as finally construed and interpreted, grants a preference right to a prospecting permit to a non-mineral owner or entryman of an entry made prior to the leasing act without a reservation of the mineral at the time of entry. The theory of this section apparently is that where one made a land entry without a reservation of the mineral and thereafter was confronted with the fact that he could only get the surface, for some reason or other, he should have a preference right to an oil permit.

Leases By Competitive Bidding

Straight leases under the act are provided for by Section 17. They apply only to lands in proven structures. They will be granted as the result of competitive bidding on a bonus basis. Notice will be given that at such a time a lease on described land will be offered at a fixed royalty and awarded to the highest responsible bonus bidder. Thus far, we have been unable to offer any proven lands for lease under this section, for the reason that practically all proven lands are covered with some sort of claim under the relief sections to which I will later refer. In the course of a short time, however, these claims will be cleared up, when we will know what, if any, lands in proven structures the Government has left to lease by competitive bidding.

Conflicting Views As to Relief

This brings me to the relief provisions, that is to say, provisions of the act for the adjustment of the controversy with the existing claimants, to which I have heretofore referred, and to bridge over the gap from the old law to the new law.

As before stated, the problem presented by the relief claimants was much more difficult of solution than was the matter of mapping out a general future leasing policy. The rights and equities of the claimants and the treatment which should be accorded them were the subject of a wide difference of opinion in and out of Congress. Among some there was a disposition to view the oil-land claimants whose rights had been cut off by the withdrawals as rank trespassers who should be given nothing except what a strict interpretation and application of the law would allow them, and who had already been given everything that they were entitled to in the way of equitable consideration by the so-called "Pickett Act" of June 25, 1910. On the other extreme the contention was made that the oil-land claimants were merely the unfortunate victims of the withdrawal, the legality of which was seriously questioned by good lawyers and some courts at the time; that at large expense they had developed properties of great value by the acceptance of the Government's offer expressed through the mining law, and that as a result they should be placed in identically the same status that they would have been had there been no withdrawal made, with the right to absolute patent. It was clear that neither of these extreme views could prevail. A reasonable middle ground must be found, and that ground must be such that not only would it effect a fair compromise of the contention stated, but which would, when finally worked out, place the oil production business on a better basis and in harmony with the general scheme of the proposed new legislation. Many attempts were made to classify the claimants in the various groups on the basis of their relative rights and equities.

Possibility of fraud.

Of course, these classifications were always unsatisfactory to those who would thereby be cut out or reduced in the amount and character of relief to be received. The oil men were by no means unanimous on the kind of legislation they wanted which it was possible for them to get; finally they became convinced that the only thing to do was to leave it to Congress and take what they could get without further advocacy of their various interests. The question of fraud, actual or constructive, was involved in all these considerations, as a result

of which we find in every relief section a strict anti-fraud clause providing that

“No claimant for a lease who has been guilty of any fraud or who had knowledge or reasonable grounds to know of any fraud, or who had not acted honestly and in good faith shall be entitled to any of the benefits of this section.”

It will be noted that this anti-fraud clause differs somewhat from the general principles applicable to fraud in the location of mining claims, in that under the mining law an innocent purchaser in fact of a fraudulent location is not protected, whereas under this act he is protected, though doubtless the language I have quoted is more strict against an innocent purchaser than are the general principles of real property law on this subject.

Conditions For Relief Under Section 18

The principal relief sections are 18, 19 and 22, the last of which is applicable only to Alaska. Section 18 applies only to lands in the withdrawals of September 27, 1909, and is, therefore, the section that is applicable to the valuable developed properties. The principal conditions for relief under Section 18 are these: (a) The land must be included in the executive order of withdrawals of September 27, 1909; (b) the claim on which the right to relief is predicated must have been initiated under the placer mining laws prior to July 3, 1910; (c) the claimant must have drilled an oil or gas well on the claim to discovery; (d) the claimant must, within six months from the date of the act, relinquish his claim under the mining law to the Government; (e) the claimant must pay the Government one-eighth of the value at the time of production of all oil and gas produced up to the date of filing the relinquishment and application for relief.

Relief Granted Under Section 18

The relief granted under Section 18 is of two classes: If the land is not in naval reserve, the claimant who is entitled to relief gets a 20-year lease under the general provisions of the act at a royalty fixed by the Secretary of the Interior, but not less than 12½ per cent. If the land is in a naval reserve, then the relief claimant is entitled only to a lease on the pro-

ducing wells which he has drilled, provided that permission to drill additional wells may be granted by the President. Thus it will be seen that, speaking generally, the theory of relief under Section 18 is that the claimant settles for his past production on the basis of an innocent trespass, computed by a very liberal rule of damages, and becomes a lessee of the Government for future operations.

Relief Under Section 19

Section 19 performs a double function. It provides a basis of relief for claimants affected by other withdrawals than that of September 27, 1909, and also provides a basis of relief for those claimants who had expended some money in the exploration of unwithdrawn lands, but who had not made discovery at the date this act would otherwise have cut them off by the repeal of the placer law. Omitting details, this section provides that one who initiated an oil placer location on public lands when same were not withdrawn, and who has subsequently complied with all the requirements of the placer law except to make discovery, and has performed work or made improvements on the claim to the extent of \$250, may have a relief prospecting permit if he has not yet made discovery, or if he has made discovery he may have a relief lease. If the land is in a proven structure, the lease granted will be at a royalty, fixed by the Secretary at not less than 12½ per cent. If the permit granted is in "wild-cat" territory, the permit is subject to the same conditions and followed by the same reward for discovery as if granted under Section 13 of the act. One important provision of Section 19 is that the claimant in such a case must not be entitled to relief under Section 18, but it does not follow, under the construction of the Department, that lands in the September 27, 1909, withdrawal may not be the subject of relief under Section 19. Section 19 is not applicable to naval reserves at all.

Alaskan Provisions

The provisions of Section 22 for Alaska are substantially the same as those for the States, except for a variation in the periods of time within which the various steps must be taken and the areas that may be embraced in the permits and leases.

Relief By Compromise Agreement

Section 18a may also be deemed a relief section. In brief, it authorizes the President to adjust any claim for relief in the September 27, 1909, withdrawal, the validity of which has been drawn into question in most any way he and the claimants may agree. Primarily, this section was designed to place in the President authority to re-segregate lands within naval reserves, to the end that the Government might procure thereby a solid block of producing land in which the oil could be held in the ground indefinitely if desired. A number of claimants have made application under Section 18a, probably in the belief that they could get quicker action under that section, and thus far, where relief has been granted under Section 18a, in nearly every case it has been on the same basis as under Section 18.

Conflicting Claims and Contractual Interests

An aspect of the relief claims under which a multitude of questions have arisen is that of adverse and conflicting claims, and various contractual interests in claims of every class and description. The only specific provisions in the act on this subject are found in Sections 18 and 19; that in Section 18 reading as follows:

“In case of conflicting claimants for leases under this section, the Secretary of the Interior is authorized to grant leases to one or more of them as shall be deemed just. All leases hereunder shall inure to the benefit of the claimant and all persons claiming through or under him by lease, contract, or otherwise, as their interests may appear, subject, however, to the same limitations as to the area and acreage as is provided for claimant in this section.”

It will be noted that this language presents two distinct classes of claims: First, those which are entirely adverse and conflicting and having a different origin, that is, the ordinary case of conflicting mining claims where two or more persons claim the right to possession of the same ground under separate and different locations. The other class is not strictly an adverse or conflicting claim, but rather a claim of one who is entitled to a contractual interest or benefit in the same claim on which application is being made for relief. Settle-

ment and disposition of the first class is entirely within the jurisdiction of the Land Department, and in this connection the Department holds that an adverse or conflicting claimant, to have his claim considered at all, must either present a complete claim for relief in his own behalf, or must show a superior right to the land under some other public-land law. The provision covering the second class was inserted in the act by reason of the fact that oil properties were commonly held and worked under various forms of leases and development contracts. Under the act the party whom the Government considers entitled to relief is the one who turns in the legal title. But to take an ordinary case: Suppose another party is operating the land under lease, and perhaps has a much larger investment than the party holding the legal title. To remove any doubt as to the possibility of the holder of the legal title procuring relief to the exclusion of the lessee, or those holding other contractual interests, this provision was inserted to enable the persons holding such contractual interests to protect their rights in the courts. The Land Department will not, ordinarily, concern itself with the determination of such interests, which range all the way from grubstake contracts to heirship, but when determined by courts of competent jurisdiction they will be duly recognized by the Land Department. In practice, in most cases where such contractual interests exist, all the parties have adjusted their relative interests among themselves and joined in the applications for relief. Some idea may be gained of the importance of these questions and the difficulties arising thereunder from the fact that probably four-fifths of the Salt Creek field in Wyoming has been covered by applications for relief by from two to five claimants.

The matter of conflicts generally with various non-mineral applications, locations, selections and entries under other public-land laws, gives rise to numerous complicated questions which I shall not attempt to go into in this general talk.

Oil-Shale

An important section of the act is that relating to oil-shale, the deposits of which are supposed to contain an almost unlimited reserve supply of oil to meet the world's necessities when the supply in the earth in ordinary liquid form becomes exhausted or greatly depleted. The issuance of numerous

official and unofficial reports disclosing the enormous prospective value of oil-shales led at once to the widespread location of such deposits under the mining law, and the use of such locations as the basis of all manner of promotions—fake and otherwise—and as a means of getting money out of the unsuspecting public. There is no doubt about the oil being in the shale, and little doubt that it will ultimately be extracted on a commercial basis, but from all I can learn as to the progress that has been made in this country in the development of processes of reduction, this industry must be considered as yet in an entirely experimental stage. The preliminary investigations we have made disclose the fact that, to a large extent, the oil-shale placer locations have been made for the purpose only of getting something to sell. By this statement I do not mean to discredit in any way several concerns that are proceeding along legitimate lines with the best engineering and chemical advice to work out this oil-shale problem; in fact, they are deserving of much credit for their pioneer work. The provisions of the leasing act applicable to oil-shale are designed to give every possible encouragement to real development, and the Department is disposed to cooperate in every reasonable and proper way in the aid of such enterprises. As to the shale locations, the Department has ruled that where they are in all respects legal and regular, they may go to patent, but knowing the general character of these locations it follows that claimants seeking patent to such claims must come strictly within the law, and it seems to us that in the long run it would be preferable for those who contemplate good faith development on a large scale to transmute their claims into a lease as they are authorized to do under the act.

Phosphate and Sodium

Thus far though there has been some activity looking to securing phosphate and sodium leases, they are so few that I will not take the time now to discuss the provisions of the act relating thereto.

Operations Under the Leasing Act

In conclusion, let us note for a moment the activity that has taken place under this act since February 25, 1920. On that

day, both in the Washington office and in numerous local offices, we commenced to get applications for permits and leases, particularly for oil in great numbers. Such applications as came in before the regulations were available, no matter in what form, were returned to the applicants who were given opportunity to file a new application in accordance with the regulations. Our records show that since the passage of the act there have been filed over 7500 applications of all classes and descriptions. True, many of them were in conflict and many were abandoned. Probably 5000 or 6000 are being seriously followed up. We have already taken action on about 2700 applications for oil prospecting permits, and more than 600 permits have already been granted. In fact, under at least one permit oil has already been discovered, and application for lease filed; under the Section 18 relief provision, my last figures showed that an aggregate of \$8,633,524 (California, \$6,488,207; Wyoming, \$2,145,317) had been tendered the Government either in cash or secured by satisfactory bonds in payment of back royalties. There are only a few cases of claimants who were in litigation with the Government who have failed to avail themselves of the relief provisions of the act. We feel, therefore, that we are beginning to see the dawn of a new day in the development and operation of the public mineral lands affected by this legislation.

THE KANSAS INDUSTRIAL LAW

By Senator F. DUMONT SMITH, Hutchinson, Kansas.

No one knows the exact authorship of this law. I had something to do with it, and my presence here is due to the fact that I collaborated in the preparation of the bill. The growing interest in this Kansas experiment has caused many demands upon the time of Governor Allen, and it has fallen upon me to fill some of his dates. That is the reason why he sent me here tonight. I know more as a lawyer, perhaps, about the legal phases of this law than Governor Allen, but if he were here tonight, he could add a human touch to its history. I suppose that all of you are more or less familiar with its origin. About a year ago there was a general strike in the bituminous coal mines of the country, and we had our own special, individual and peculiar strike in Kansas. We have a man there named Alexander Howatt, who is the "boss" of that large district, comprising the bituminous mines of Kansas, Oklahoma and Arkansas. He has the distinction of having called 304 strikes in 30 months, of which 300 involved broken contracts, solemnly made. The people of Kansas were freezing, and industry slowed down. Governor Allen proceeded to take possession of the mines under a receivership, called out the militia, and called upon volunteers to work these mines. They were amateurs, but they produced enough coal to keep the people warm until the strike was broken. Out of that condition grew the Kansas Industrial Court Law.

Controversies Considered Not Actionable

At the outset we were met by the legal jurists, who tell us that the controversies are not "justiciable," that is, such disputes are not actionable in the ordinary courts, like the District Courts in Colorado. We admit that, but this Industrial Court is not a court. We call it a court, but the name means nothing. It is simply an administrative body exercising a certain portion of the police power of the State.

We were confronted with the problem whether to make this a real court, or whether we should make it an administra-

tive body. But there is this distinction that the ordinary layman perhaps does not appreciate between a court and an administrative body. A court cannot move until its process is invoked by an appropriate formula. On the other hand, this administrative body moves of its own initiative. It requires no complaint. It can move upon suspicion; it has broad inquisitorial powers; that is, it may go out and subpoena witnesses and put them under oath, and compel them to testify and to produce books and papers. So, while there are advantages in having a real court, we decided that because you cannot confer administrative functions upon a court, you can confer judicial powers upon an administrative body, and we chose the administrative body. Police power, which is so effective, is the power under which we have established the Industrial Court.

Public Health and Peace

But the two great functions of police power are the safeguarding of public health and the preservation of public peace. You have an Industrial Commission in the Esch-Cummins bill; they have tried compulsory arbitration in New Zealand, Australia, and in some of the provinces of the Dominion of Canada, but they have been more or less failures because they have not been founded upon these two fundamental rocks of the power of the public to protect health and to preserve its peace. There are other faults with arbitration, but the principal vice of arbitration is that its final conclusion does not establish the justice of the controversy. It marks simply the farthest line that the weakest party to the controversy will go to end the existing dispute. It is the peace of victory, imposed by the stronger party upon the weaker. The Kansas law starts by declaring that food, fuel and clothing are the necessities of human life. It merely recognizes an existing fact, not making it a legislative fiat, but this is one of the foundation stones of the Kansas Industrial Court law. This law says, whenever any strike is threatened, or a combination of men threaten to strike, which shall impair the production or distribution of these three necessities of life so as to endanger the public health, the State shall intervene through the Industrial Court. Then it begins to function.

Some of the powers of the court are doubted by lawyers,

but if they examine the bill they will find that every separate power of this court is segregated and set apart in a separate section, so that if the United States Supreme Court, beyond which there is no appeal, should decide that this power or that power is beyond the constitutional limits of the State, all the other powers would remain. But even if we had only the inquisitorial powers, its powers to investigate the dispute and tell the truth about it, that would be worth the cost.

Results From the New Law

Before this law went into effect, Kansas had one strike after another, but in 10 months there hasn't been one strike. During the outlaw switchmen's strike in May, in the Kansas-Missouri section the men were out in Missouri, but in Kansas they did not dare strike because of this law. The local switchmen at Topeka and the local trackmen's association have appealed to this court, and a number of other union labor bodies have appealed directly to it. They have been satisfied with its award, and have expressed their approval. The court is gradually gaining the confidence of the workingmen, as well as the employer, not because it is the workingman's friend.

It has been said that like all other arbitration, this will fail. The public is never considered. In the great debate by Samuel Gompers and Governor Allen in New York, the latter asked the former, where there is a dispute between labor and capital that threatens a strike that decreases the production or distribution of the necessities of life, or threatens a breach of the public peace, has the general public any rights in that controversy? Mr. Gompers has not answered that question yet, and no one has answered it yet, because if he had said we had no rights, he would have brought upon himself the condemnation of the general public. If he admitted, as he must honestly do, that we have a right in it, then he would admit the right of some sort of a court representing the general public—the whole State—to function in these disputes. We in Kansas say there is nothing unique in these disputes between labor and capital. They are to be judged by the same principles of right and justice as every other dispute between man and man, so we have established there a court of distinguished men, paid an adequate salary, with long terms, not dependent upon popular favor, functioning all the time,

with the door swinging with every touch of labor or capital. We have gone further than that. We have said to the laboring man: "If you have a complaint, if your hours are too long or your wages too low, or labor conditions bad, write a letter to this Industrial Court, and the attorney for the court will file your complaint without a cent of expense to you; the court will have its experts investigate these conditions without any expense to you; your employer will be cited to the bar of that court to defend himself, and an order will be made," and very gradually the laboring man is beginning to believe in this court.

In Kansas we recognize the fact that it is only by labor combinations, chiefly by strikes, that labor has brought itself out of the long night of servitude and has come out into the full light of manhood. We refused to outlaw the strike or to condemn it until we had given the laboring man a forum where he could go with his grievance and get redress.

GEOLOGY AND METAL MINING, WITH PARTICULAR REFERENCE TO THE WORK OF THE U. S. GEOLOGICAL SURVEY

By F. L. RANSOME

The work of the Geological Survey that pertains particularly to metal mining falls, for the most part, into four main classes. These are (1) detailed geologic work in well-developed mining districts ; (2) preliminary or reconnaissance geologic work in newly opened and slightly developed districts; (3) summary reports on the geology and ore deposits of entire States, and (4) statistics of metal production. There has been and probably will continue to be some kinds of work done that do not come under any of these groups; the classification is not intended to be exhaustive. Examples of the first class, detailed work in developed districts, are the well-known Leadville monograph and the professional papers on the Cripple Creek, Clifton, Coeur d'Alene, Ely, Ray and Miami and Bisbee districts. Examples of the second class, preliminary work in new districts, are less numerous and perhaps less well known. Among them may be mentioned, however, some of the early reports on Goldfield, Tonopah and other districts in Nevada, including one now in press [issued Feb., 1921] on Divide, and one in preparation on the Simon district, both in Nevada. Examples of the third class, the State reports, are the professional papers on the geology and ore deposits of New Mexico and Utah. Other similar reports are in preparation for Arizona and Idaho, but the one for the latter has unfortunately been set back indefinitely by the resignation and separation from the service of the geologist who was engaged upon it. The fourth class is represented by the well-known annual statistical reports on each metal.

It is my purpose to speak particularly, but briefly, about the first two classes of work and to try to show the essential relation between them.

Both Developed and New Districts Should Be Studied

Men dealing with the practical side of mining, especially those interested in prospecting and legitimate promotion,

have sometimes been inclined to find a little fault with the Geological Survey for giving so much attention to the study of developed districts, and have suggested that more emphasis should be laid on the study of new districts, in order that the results might be available to guide those engaged in prospecting and development. I strongly believe that both kinds of work should be done, and I hope in the present address to present the case for each, so that the mining man can see that the second type of work cannot be pursued successfully if the first type be neglected.

There can be no question that to the mining geologist, the study of a district at the height of its activity is far more interesting and gives him greater opportunities than does the study of one in which mining has barely begun. The developed district, with its miles of underground working, enables him not only to study the rocks visible at the surface, but to examine them at various depths, and to make out their structure far more satisfactorily than can ordinarily be done from the surface alone. The mines in such a district permit him to see the ore bodies themselves, not merely their outcrops, and to study the variations in their form and character at various depths and in different kinds of rock. He is able to trace the changes from the original ore, perhaps through a zone of enrichment, to the oxidized material that appears at the surface, or vice versa. It is often possible to determine the extent to which these successive changes in the ore have been determined or controlled by rock structures or other geologic features, and to predict the probable changes that will be found to take place at certain approximate depths in deposits that have not yet been fully developed, using this word in the mining sense. In most districts, faulting has played a very important part in directing the original deposition, and in modifying the original shape and position of the deposits. Unfortunately it is seldom possible to work out a fault complex from surface exposures alone. A certain amount of mining must be done before the rock structure can be satisfactorily determined, and although the knowledge gained from the earlier mine workings usually throws sufficient light upon the geologic structure to help those who come after, it is rare indeed that mine development in any district reaches such a stage that the rock structure can be

said to be completely understood. Each section of underground exploration adds something new, and the possibility of mistakes in development, while continually lessened, is never wholly eliminated.

Geology of Developed Areas of Value for Future Work

For the geologist, the developed district is the great school of experience in which he learns about orebodies. It is there that he gathers most of his facts concerning the geology of ores, and it is from the facts so gathered that he has gained such knowledge as we now possess concerning the origin and character of ore deposits. It is from studies in developed districts that geologists learn what outcrops mean, and what may be expected beneath them. To suppose that geologists without experience in deep mines could be of much use in aiding in the development of a new district is much like expecting a man to become at once a skilled surgeon without previous experience in the dissecting-room.

Lest I should seem to lay too much stress upon the educational value to geologists of work in developed districts, I wish to point out also a few of the obviously practical results of such work. The value to mining engineers of a generally reliable account of the geology and ore deposits of a region in some part of which they expect to carry out some special and perhaps detailed piece of professional work is generally acknowledged. They may in the course of their work bring out new facts or may perhaps detect actual errors in the work of the Government geologist, who, of course, is not infallible, but the main purpose of the earlier work, so far as they themselves are concerned, will have been fulfilled if it gives them a good foundation upon which to start or a faithful outline into where they can here and there supply the details.

It may be remembered also that in most developed districts that are still active there is much prospecting going on in addition to, as well as in connection with, the larger mines. A good geologic report on such a district is probably more directly useful to the prospectors within it than would be a report on a new district to those engaged in its initial development.

Finally, a geologic report on a developed district does not

by any means indicate, as some humorists would make us believe, that the wheels of material progress in that district will soon give a final groan and come to rest. From examples most familiar to me, I cite Bisbee and the Coeur d'Alene as districts where growth has continued long after the appearance of the Geological Survey reports that were based upon observations made in an advanced stage of their development and where, in consequence, the reports, although now more or less obsolete as regards their descriptions of mines, have continued to be useful as the starting points for more detailed investigations and as general guides to the unchanged geologic structure. Cripple Creek, although its production curve has long since started down hill, has survived two detailed geologic reports, and it is doubtful whether even a third, which has been suggested, would kill it. Mining districts, of course, cannot last forever, but the accounts of their death, as Mark Twain put it, are often "grossly exaggerated." They have a way of coming to life again when, in consequence of changing economic conditions or improvements in metallurgical processes, deposits once overlooked or regarded as worthless take on unexpected values. The point I would make is that a sound report on a developed district is likely to have a persistent practical usefulness in addition to its scientific value. Moreover, it is likely to be fully as useful to the small operator, or to those beginning development, as it is to the larger mining companies, who nowadays generally recognize the value of geology by employing their own geologists.

Early Reports on New Districts Desirable

I am fully convinced that the Geological Survey should pay as much attention as possible to new districts, should make available promptly an outline of the general geology, and present such facts and conclusions concerning the ore deposits as will aid in their development and prevent, as far as possible, waste of effort in unwise prospecting. Such work, however, should be done by experienced men who have the wide and varied knowledge that can come only from thorough studies of districts in advanced stages of development. Such a man would recognize the general type of the new deposits, even if, as is often, they present some novel features; he could determine their relation to the general geologic history

and structure of the district, he could predict in some respects what would be found in depth, and could probably give some suggestions, in part orally and on the ground, that would be of immediate value to the prospectors.

Both types of work should be carried on together and by the same men. The great difficulty at present is to retain in the Government service the trained and able geologists who can best do the work, but who find themselves unable to support their families on salaries that may have been adequate 20 years ago, but are certainly not so now. Notwithstanding the greatly lessened purchasing power of the dollar, the average salary paid to Government geologists, measured in that deceptive unit, is less than it was some years ago. Men are leaving the service for much more remunerative private work. At the present time the Geological Survey's staff of geologists experienced in metal mining, not to speak of oil, is so depleted that years will be required to restore it to its former strength, and such restoration will be impossible unless the ratio of salary to living expenses shows great improvement. Under present conditions the Geological Survey has not only lost thousands of dollars spent in field work from which, owing to resignations, no published results can be expected, but it finds itself utterly unable to do more than a very small part of the work that should be undertaken in the field with which I have dealt. Moreover, so frequent are its losses in personnel, that no extensive project can be undertaken with any assurance that the geologist in charge of it will remain to see it through. The spirit of those who remain is willing, but it is simply impossible for them to cover the field.

Supplementary Reports Also of Value

The ideal plan would be not only to have comprehensive studies made of developed mining districts, but also to be able to keep more closely in touch than is now possible with recent work in the larger districts, with the aim of issuing from time to time supplementary reports in which the bearing of new data on earlier conclusions, and on the theory of ore deposition in general, should be brought out. This, however, would require a larger annual appropriation for the Geological Survey, or the diversion to the study of metal-mining districts of funds that are now utilized in other fields of the survey's activities.

INDUSTRY AND GOVERNMENT

By General L. C. BOYLE, Washington, D. C.

This is a great and distinguished organization, representing an enormous industry, one that after all, represents in large measure the basic wealth of the nation.

I cannot, of course, interest this convention by discussing those technical problems that peculiarly pertain to your business. Your own experience qualifies you to speak with authority on such subjects. For me to assume that I could instruct you in this field would be to follow the path of error. In fact, business men quite generally complain of the ever-increasing volume of national and State legislation that provides artificial rules for the control of the very practical problems of business. In like manner would you have occasion to object if I were to take your time by repeating things that I had culled from books. You, gentlemen, are the creators of industrial facts. There is a wide margin between theory and practice. Industry is hedged about by custom and varying conditions, which in their final analysis control production and distribution. The everyday problem can only be met by applying the test of practical experience. In other words, the mines, mills and factories of the nation cannot be successfully operated by formula. In this I do not decry scientific research and the application of the scientific principle to production and distribution. In fact, I am frank to say that business men generally in this country have in the past paid too little attention to those abstract principles that may be found constant in all lines of endeavor. However, I am safe in saying that theory uninstructed by experience is a dangerous thing. I will, therefore, not attempt discussion of those technical matters that relate to your production and distribution. My purpose is to discuss briefly the opportunity that I conceive lies before you through associated effort.

Adjustment and Stability

In the nature of things, your industrial problems are difficult at best. Due to economic dislocation in practically all lines, the strain on your business problems has been accentuated.

ated. Time, the great healer, will bring adjustment and stability. The multiplying of new laws will not solve the situation. That which industry most needs is less governmental control, and more team-work between capital and labor. It is my purpose, as best I can, to direct attention to the essential need of co-operative effort in your line of endeavor. At no time in our industrial history was the need so great as now for the fullest measure of associated activity. This is especially true in those industries that deal with our natural resources. These great reserves of national wealth cannot be adequately and economically developed unless those who control these vital and basic elements come together in an association of this character, and from time to time make careful survey of business problems.

We have gone beyond the pioneer stage in our industrial development. Business has learned, and the public is commencing to understand that under our competitive system ignorance of industrial and economic facts is a clog in the wheels of progress. The time has gone when the man of vision and intelligent grasp deems he is best served by hiding his light under a bushel. We now know that the interest of each is furthered by the widest dissemination of the most up-to-date information concerning the basic facts of industry. The association method is the business man's industrial university. Through this medium the elbow touch is given; the barriers of suspicion are broken down, and as the result of the free exchange of thought in matters of common interest, understanding is enriched and the public interest is better served.

In this present hour, grave and difficult questions press for solution. It is urged that America must lead the troubled States of Europe in the path of readjustment. My friends, we must first solve our own problems before we can hope to instruct, lead and help Europe.

I desire briefly to direct attention to certain urgent matters that must now, at the very threshold of this new era, be solved before industry in this country can rightly function, and in this solution this organization (the American Mining Congress) is destined to play an important part.

Causes of Abnormality

In all lines of business, and with every class the question recurs: "When will we reach a stable, normal and dependable basis?" Those who have capital that otherwise would seek investment in useful and helpful lines of activity hesitate; initiative halts. Many causes are assigned as reasons for this lack of enterprise. State and national committees are making search for the underlying elements that are blocking the wheels of progress. Some of the causes urged for current business abnormality are grounded on bald suspicion, without the shadow of substance. Combinations and profiteering are mouth-filling phrases, and serve to influence the imagination and incite public anger. During pre-election days, loose and wide-flung accusations served a certain purpose connected with the ballot box. However, the occasion for oratory is behind us, and we can now indulge ourselves in sane, constructive thinking, and this to the end that we may find if we can the answer to the riddle and thereby solve the problem.

It is in the common interest that capital should flow freely and unembarrassed to useful investment; that labor be universally employed; that industrial building go forward and homes for the people be constructed; that transportation facilities be adequate, and that production and thrift be the order of the day. The grave and serious question is, How can those conditions be brought about?

To me it seems foolish to urge that the business interests of the nation, the interests that from a monetary standpoint alone would profit most by a revival of activity, would, through combinations, block the very result that an enlightened selfishness most desires. True, there may be ill-advised combinations here and there, such as the New York investigation is developing. In the main, however, I believe that the causes lie deeper and are more fundamental.

Those who have given the matter deep and careful study, assign the following as the underlying causes for our present economic lack of balance:

First—The urgency of the world's demand for our raw materials and manufactured articles during and since the war.

Second—Inflation of credit and currency.

Third—Governmental and private extravagance.

Fourth—Faulty taxation.

All other contributory factors are either of lesser effect than is frequently attributed to them, or spring more or less directly from the causes above mentioned.

It is my purpose to direct attention to the fourth factor, the tax problem, and especially the excess profits and surtax phases. I do not intend to go into this all-important subject in detail; my thought is that through suggestion I may possibly indicate an opportunity for this organization to perform a great and useful service, not alone to the interests you represent, but a service to the nation. I understand from reading the papers that this matter has been carefully canvassed and covered in your committee and group meetings, but a suggestion that I may give may be at least fruitful of thought. I do not attempt, of course, to solve the matter.

We cannot indulge a reasonable hope that business normalcy will return to anything like full measure until the tax burdens on industrial initiative be lightened and equitably adjusted. This is, indeed, a live and urgent problem, and well worthy of your earnest thought. I am talking to men who develop great natural resources, resources that comprehend in large measure the basic wealth of the nation. No industry is so seriously handicapped as is yours by unwise tax laws. The wealth of this great State (Colorado) is in large measure compassed by her rich deposits of coal and minerals. • Your industry cannot truly prosper, nor will the nation receive the benefits of the rich treasures that await development until badly adjusted tax laws are corrected. If we were still engaged in war another situation would be presented; we are now, however, practically at peace with the world.

Effect of Taxation

I will undertake to indicate a few of the outstanding evils that flow from the excess profits and surtax phases of the present statute:

These taxes penalize industry and leave untouched the man of wealth, who, fearful of the risk and willing to avoid the burden, puts his money into non-taxable securities—munic-

ipal bonds, county bonds, State bonds, farm loan bonds, and some Federal bonds that are exempt from taxation. It thus follows that the reserves from which industry heretofore has drawn its needed additional capital now seek the character of securities above indicated. Non-working and non-venturing investment offer a safe refuge to capital, as against investments in industrial securities wherein from one-half to three-fourths of the earnings are consumed in excess profits and surtaxes. This is not a matter of any technical, legal or economic involution. There is here a simple, plain, common-sense problem. Take a man who has \$100,000 of surplus money, which he does not need in his own business; he wants to loan it, he wants to invest it. Will he put it in the production of coal mines, or oil, or timber—the great natural resources that constitute the real wealth of the nation—when he is taking some chance? In the first place, he hesitates because there is risk involved in industry, and, in the second place, he is penalized by the excess profits or surtax.

It is estimated that there are from 14 to 15 billions worth of tax-free bonds and more are being issued continually. How can industry secure needed capital in face of the tax burdens that menace investment, when capital can secure the shelter of non-taxpaying bonds? True it is that the law is such that it is not possible to relieve this situation so far as tax-free securities are concerned. That is, there are constitutional inhibitions in the way that prevent the law being applied so as to make taxable the securities that I have referred to as tax free. The only avenue of relief lies in correcting the income-tax law so as to make investment more attractive to capital. Such capital as is now willing to take the risk in industrial enterprise does so at a heavy charge, thereby accentuating the basic cost of production, which inevitably reflects itself in consumption prices.

Now, here is a practical angle of this matter in which all persons are concerned. High prices are unquestionably largely influenced by allocating the tax to cost; that is, by allocating the excess-profits tax, or the surtax, as the case may be, to the cost of the article that is sold. It thus follows that although the tax is assumed to be direct, it is in effect a consumption or sales tax without the virtue of the consumer knowing just what this tax burden is. When I refer to the consumer I

mean you, and all other workers and thinkers. Considered from this angle, the tax does not serve the social need that it was designed to fill. Heavy tax burdens are here to stay until we have caught up with the waste, extravagance and destruction incident to war. The problem is, How can the tax be adjusted so as to relieve the present strangle-hold on industry?

The Government's Apparent Views on Industry

One of the basic errors of the Government is that of dealing with industry as if industry did not constitute a part of the public—a vital part.

It is urged by careful students that a possible remedy is the abolishment of the excess-profits tax and a modification of the surtax, in such form as to allow credit for investment of earned funds that are put to work in productive enterprise during the tax period. If such a course were adopted, the income tax as such would have to be increased. However, such procedure would not only relieve the burden, but simplify the process. The great difficulty with the tax situation as it stands is the complicated mass of rules and regulations incident to return and assessment.

The remedy from the evils that embarrass industry lies in the hands of the business interests of America. I am convinced that Congress will welcome well-balanced suggestions. It is impossible for industry to present constructive suggestion unless it is done through the medium of an association such as the Mining Congress. As I have already indicated, men in all lines of business should draw close together and take council, touching the correction of those matters that now disturb business. To me it is inconceivable that any of the substantial interests in your lines of endeavor should not cooperate with this association. It is useless for you to employ attorneys or a man as capable even as Mr. Callbreath unless you are willing to back his efforts. The committees of Congress want to hear from the business men themselves. The problem can not and will not be adequately met unless you yourselves are willing to make the sacrifice of time and labor. Business men are too prone to criticise Congress and too little disposed to make the necessary sacrifice in helping Congress to wise conclusions. The hour is ripe for men of vision

and understanding to render signal service to industry and the nation.

Amend the Anti-Trust Law

Another factor that requires consideration is the Sherman Anti-trust Law, which has been on the statutes for 30 years. It should be amended not to give men the right to fix prices and rob the people, not to curtail production and thereby enhance prices, but amended in such fashion that in a great, natural resource, industry of the kind we are here dealing with, waste could be avoided and economy could be indulged. Curtailment and price adjustment should be allowed by agreement, but in such a manner as to safeguard public interest.

One of the things we must teach the people of this country is that business is not criminal, but it is legitimate. The thing that Government officials at Washington, and the State officials of Colorado, must learn is that the ordinary outlook of the business men of this country is moral, patriotic and worthy.

Therefore, I trust that this association will at this meeting appoint strong, upstanding committees which will be willing to go to Washington, as time develops, and there sit down and talk to Senators and Congressmen as to the matters we have been discussing here, because you cannot expect Congress to give relief unless it is informed as to what that relief should be.

SOCIAL CONTROL OF INDUSTRIAL WARFARE

By WALTER GORDON MERRITT, Attorney, League for Industrial Rights,
New York

The National Republican platform of 1920 contained the following: "The strike or the lockout as a means of settling industrial disputes, inflicts such loss and suffering on the community as to justify Government initiative to reduce its frequency and limit its consequences." The National Democratic platform of 1920 said: "Neither class should at any time nor in any circumstances take action that will put in jeopardy the public welfare. Resort to strikes and lockouts which endanger the health or lives for determining disputes.

* * * "

These utterances, evoked by public opinion, and in marked contrast with the temper of most European nations, present the problem of the social control of labor organizations in the use of their economic power. Nothing could be of greater importance. In discussing this question we can eliminate from consideration the ordinary problems of law and order in industrial disputes, and promptly direct our attention to the more pressing and complex questions of regulating industrial warfare, regardless of whether it is characterized by violence. We can eliminate, as do the political platforms, the question of the boycott, which, so far as its familiar phases are concerned, has already been pretty well disposed of by law and public opinion. In the interests of simplicity, most of the discussion will be directed toward unions and strikes, rather than employers' associations and lockouts; but wherever the situations are parallel, the even hand of justice should comprehend both.

To what extent is it practicable and expedient to compel unions and their members, in carrying on strikes, to respect prevailing inhibitions against anti-social conduct and to conform to them as other citizens and business institutions are compelled to conform? The outstanding peculiarity of the problem is not the difficulty of bounding the areas of right and wrong action, but the broad question as to whether

respect for such boundaries should be reinforced by governmental action or should be entrusted to the more flimsy foundations of moral restraint, or what Mr. Samuel Gompers calls "voluntariness." If society should enact into law and thereafter enforce only such limitations on industrial warfare as have been considered just, by certain unions and union leaders, its present perplexities in this direction would be largely solved. But the same organizations that concur with us as to most of our definitions of illegitimate strikes, oppose any effort on the part of the State to curtail or emasculate such strikes.

There is the issue: Shall the intervention of society be limited to the suppression of force and violence in industrial disputes, or shall it extend to other anti-social activities of disciplined labor organizations, which are excessively hurtful and oppressive to the people at large? Should the law progress, as it has in other fields, to include within its prohibitions many situations heretofore left to moral restraint, but which the progress of civilization has shown to need regulation? Out of this issue has grown much discussion and many experiments, but unfortunately neither has been shaped by those who combine an open mind with long observation of the principles involved.

Respect for such fundamental social rights from other classes of citizens is not left to discretion or self-restraint, and an exception in favor of unions would be both invidious and unjustified in view of the present lack of moral restraint on the part of some. Voluntary restraint in circumstances like these seems only to be operative when exacted by the terms of plain self-interest. Grant organized labor the legal, if not the moral, right to trample on social interests whenever its apparent self-interest so advocates, and we will find ourselves confronted with progressive tyranny. That is no reflection on organized labor in particular, but a reflection on human nature. Where the right is of sufficient importance and the danger of its infringement substantial and imminent, there must be political intervention to protect the rights of the greater number.

In debating this question, the Hon. H. J. Allen, Governor of Kansas, and Samuel Gompers pursue parallel lines, each following his own particular trail with no chance of meet-

ing. The latter stands upon the national shibboleth of liberty and the right to strike, while the former asserts the paramountcy of public rights.

Where Compulsory Arbitration Fails

The extreme of social control is the prohibition of all strikes and lockouts, and the compulsory arbitration of all difficulties growing out of the employment relation. This involves the establishment of tribunals which shall take over the complex and difficult question of fixing wages and employment conditions in mining, manufacturing, transportation and public utility operations.

Concerning compulsory arbitration in Australia, the Prime Minister, Mr. W. H. Hughes, is reported to have said: "This perfect piece of legislation has turned out to be, despite the kind of ministry in office, the most inefficient and hopelessly futile effort to solve the industrial question that ever came out of the laboratory of any industrial workshop." Mr. Herbert Hoover finds the Kansas Industrial Court law a virtual reproduction of the Australian scheme and says: "My own opinion is that the act cannot succeed. In Australia the number of strikes and dislocations is as great as in other countries without it."

In the United States, in the light of present-day psychology and economic conditions, compulsory arbitration as a prevailing scheme for the settlement of industrial disputes is neither expedient nor desirable. The high-spirited, independent and self-reliant character of employers and workmen is not favorable to submissiveness before such an intrusion by the State, and attempts in that direction, as Mr. Hoover reminds us, might provoke an unfortunate contest over human rights with a divided public opinion. Laws of such character meet with a disregard and antagonism that augurs ill for the habit of obedience to law, so indispensable to the stability of any government. What would the State do if a hundred thousand men went on strike in violation of law? Probably just what Mr. Lloyd George did when during the war miners struck in violation of British laws—he hastened to Cardiff for a conference with the leaders and reached an adjustment. Hundreds of men have struck in Kansas since the passage of its act creating the Court of Industrial Relations in January,

1920, but, so far as I am aware, none of these men are in jail for striking.

However, a fair trial of the experiment in an agricultural State like Kansas, where public opinion is so heartily in its favor, is highly desirable, and should throw much light on the usefulness of such measures. The main difficulty will be the extraordinary and concentrated efforts of organized labor to prevent a fair trial and prove the futility of the law.

Strike Regulation Is Not Voluntary Servitude

The assertion that such laws involve involuntary servitude is nonsense. They only limit the right of concerted action. The right to carry on industrial warfare through collective action is no more a part of individual liberty than the right of citizens privately to organize armies. The right to strike, lockout, picket and boycott as a plan of concerted action, is a right of combination subject to more radical and drastic regulation than individual rights. Rights of combinations are relative and not absolute. The United States recognized this distinction when it passed anti-trust laws. He who confuses the right to strike with the individual right to quit work is bound to go astray.

The strike is a device to injure and coerce with a view to securing ultimate advantage. The strike, at best, is an unpleasant necessity—the lesser of two evils—and it is to be regretted that no one has yet thought of any other social expedient which will adequately strengthen the position of the great body of employed.

Only a Minimum of Regulation Is Desirable

Granting the soundness of the usual arguments against strike regulation, it does not follow that its opponents are entirely wrong. A pretty free play of the economic forces of organized capital and organized labor is desirable. They should be allowed, so far as practicable, to work out their own adjustments. To repress them unduly is dangerous; it might mean a postponement or utter failure of a reconstruction altogether desirable. The spirit of protest as expressed in a strike is, on the whole, wholesome and desirable. It has been an instrument of great social service, and has directed much-needed attention and consideration toward the problems and wants

of the workers in all industries and communities. Even employers who have never known the threat of strike are, consciously or unconsciously, influenced by the fear of it. The State cannot perform these functions of the strike through any court. It does not always have vision. The history of English labor legislation, and the manner in which the settlement of labor's grievances by the State languishes until a strike is threatened, is proof enough of this assertion. Would society have progressed as it has in its relation to the labor problem had it not been for the nuisance value of the strike?

If compulsory arbitration had been instituted by the State 50 years ago, and submission to such action had been secured from all the parties in interest, is it conceivable that either the State or the employer would have been so considerate of the rights of the workers, or that welfare legislation would have advanced with the same speed? Would not the tendency to maintain the status quo have been more dominant and controlling? If this be true as to the past, may it not also hold some hidden significance for the future? At least the possibility should give us pause.

Some Regulation Is Essential

This is not to say that all regulation of strikes or industrial warfare is inexpedient or undesirable. My convictions are just the contrary. The objective of society should be to eliminate premature, unnecessary and unjust strikes and lockouts, without closing the door to the usefulness of the strike in appropriate cases as a last resort. The time has arrived when the public, not the employers, should point out where its proper function ends and where its use becomes anti-social and intolerable. To allow men to foment, organize and maintain strikes and lockouts for any and all purposes, however corrupt and oppressive, is indefensible; to trust to mere self-restraint is ludicrous. An entire lack of strike regulation will inevitably invite attempts to control governmental action and industry through methods akin to syndicalism and sovietism; it is the most direct route to class dictation. European conditions make this clear. The duty of self-preservation demands that the Government avoid this. Minorities holding a strategic economic position should not be allowed to visit privation or disaster upon society. When public rights

and private rights clash, private rights must yield—they must be regulated. With the demands of the American Federation of Labor, that the Government keep its hands entirely off and leave the economic power of labor entirely uncurbed, we cannot agree.

The Kansas Act Is Too Broad

On the other hand, the Kansas Industrial Court Act is partly erroneous in conception, for it unfortunately extends the principle of compulsory arbitration into fields beyond any present or probable emergency, by including clothing and food. Application of that law to transportation, public utilities and coal mining is on sounder ground, but it seems unfortunate that such an experiment in Government regulation should have extended so far beyond the point of urgency and should have aimed at such a general application of the principle of compulsory arbitration. The mistake in this law, and the underlying mistake in many other suggestions which have been advanced, are due primarily to a failure to understand the philosophy and significance of the strike.

Legitimate and Illegitimate Strikes

If the right to strike and conduct industrial warfare aims to relieve the individual employe from his comparative helplessness in dealing with a powerful employer, then that right, which involves so much mischief and embarrassment, should be limited to such a function, and should not be resorted to unless it is finally necessary for the workers to pit their economic power against that of the employer. Applying this test and others, there are many clear, sound and practical principles that can be invoked for the purpose of classifying strikes as legitimate and illegitimate, and when once that classification is made, the law can effectively differentiate in its methods of dealing with them.

Heretofore the law has laid too much emphasis on the methods of industrial warfare, and has not sufficiently discriminated as to the circumstances and objects of each strike. As a general rule it is held that strikes are lawful and boycotts are unlawful, although in an overwhelming majority of cases the strike entails far greater suffering and losses for the employer and the public. In the case of picketing, some States

allow and others disallow peaceful picketing. All these activities are methods of industrial warfare at times involving anti-social consequences and, to say the least, none of them should be encouraged except when used as a last resort to further industrial justice. Whoever observes the standards of industrial peace and justice should receive the fullest practical protection from the Government, as against industrial warfare waged by those who seek to impose the rule of force and unreason.

Where the employer is willing to arbitrate, it is outrageous to permit the picketing of his establishment. Unions should not be permitted the same freedom to overthrow the principle of the open shop as they are permitted in an effort to overthrow the anti-union shop. The open shop is in furtherance of human liberty, while the closed shop, whether union or non-union, is against human liberty. Strike activities, where the object is the removal of restrictions on human liberty should be less restricted than strike activities to curtail human liberty. No attempt to force men into a union or out of a union is to be encouraged. These are but illustrations, dimly recognized in a few States, of the need of distinguishing between legitimate and illegitimate strikes. The courts made such distinctions for a long time, and some recent decisions construing labor provisions like those of the Clayton Act indicate that the privilege and liberties therein enumerated do not apply in the case of sympathetic strikes or strikes for the closed shop, because in such cases there is no genuine trade dispute within the meaning of the act.

Industrial warfare must not become an instrument of industrial injustice. Industrial justice must be the price of industrial peace. It is in line with sound public policy to permit industrial warfare for the correction of industrial wrongs, but it must be suppressed when it aims to accomplish results contrary to such a policy. We must make the conduct of illegitimate strikes so discouraging and futile and other methods of adjustment so promising and attractive, that there will be a gradual abandonment of the illegitimate strike. If we should not send men to jail for striking, we can at least deprive organizations of the privileges of organized action in furtherance of the illegitimate strike. In this way the prop

and mainstay of effective industrial warfare may be knocked out from under the illegitimate strike.

Illegitimate strikes may be classified under the following general heads:

1. Strikes that violate the fundamental principles of democracy by trying to substitute government by strike for government by ballot.
2. Strikes that unduly injure the general public, which in military war we call civilians.
3. Strikes against neutrals.
4. Strikes without first exhausting the resources of diplomacy.
5. Strikes in violation of agreements.
6. Strikes in violation of an arbitration award.
7. Strikes where arbitration is available.
8. Strikes against liberty.

[Mr. Merritt then discussed these points in detail. This is omitted, as the facts are generally well understood.—Editor.]

Public opinion would certainly be united on the proof that strikes in violation of these eight principles are in violation of sound public policy, and generally should be discouraged. To restrain organized labor in supporting them would constitute the most effective discouragement without making them illegal. It would strengthen the hands of the conservative union and union leader in fighting the recalcitrant forces within their organization, which today constitute such an embarrassment, and would clarify public opinion as to the distinction between legitimate and illegitimate union action.

Civil Remedies Only

Our proposed law, so far as it relates to private industry, would merely forbid organized support of strikes which violate our moral code. The enforcement of such a law, at least in the field of private industry, would depend on the civil remedies of injunction and damages rather than upon criminal penalties. This makes the enforcement largely dependent on the initiative of private parties, and not on political appointees.

To make these remedies effective it is important that voluntary associations, whether of employers or workmen, shall have the capacity to sue and be sued. It is not necessary or

desirable to require their incorporation. Incorporation is a privilege. To say that unions shall not exist or operate without incorporation is to provoke evasions of the law, if not actual defiance to it. English industrial history proves that it is only necessary to declare that voluntary associations can become parties to litigation. That will bring legal recognition which in these days when employers' associations and unions exercise a power for good or ill far beyond that of individuals, is altogether desirable. Collective responsibility should accompany collective action. Having thus created the element of legal responsibility, society can enforce its laws.

Injunction

The injunction remedy, however unpopular it may be, seems to be the fairest and most effective means of controlling large organizations, particularly in cases where it is difficult to fix definite standards of legality and illegality. Business men, acting co-operatively, should not ordinarily be prosecuted until the legality of their conduct has been definitely passed upon in a civil action; the same is true of co-operative action among workers. The injunctive remedy is highly beneficent in that it is preventive, and issues a warning to the wrongdoer before punishing him or mulcting him in damages. It protects the aggrieved and, by timely warning, often spares the aggressor. Its unpopularity is largely due to misunderstanding and the reiteration of unfounded statements. Few, if any, remedies have been subject to less abuse and error. Its effectiveness in labor controversies is measured by the strength of union opposition to it. However keen the bitterness it has aroused, it is not at all certain that the defeat of a strike through legal intervention creates any harsher feeling than its defeat through economic exhaustion after a drawn-out fight. Many misled and innocent strikers are, through the injunction, relieved from unfair coercion and spared much suffering and privation.

Assuming that the union employes in the coal mines decided to tie up the production of coal when afforded the alternative of arbitration, and that such action was illegal and unjustified, there was no better remedy for safeguarding the public interests than the injunction. If our assumptions are correct, the Government's mistake was not in seeking an injunction

when it did, but in failing to enjoin in advance of the issuance of the strike order. The injunction followed the true course of requiring a rescission of the strike order and an abstention from all conduct in furtherance of the strike, including the payment of strike benefits from an available defense fund amounting, according to report, to many millions of dollars.

Effectiveness of Such a Law

The extent to which such a law would protect the public from unwarranted strikes is to be measured by the extent to which organized union action is responsible for our excess of industrial warfare. The statistics of the United States Department of Labor show that most strikes are the result of organized union action. The figures for 1919 show that nearly one-third of the industrial employes went on strike, and that 93 per cent. of these strikes were by union men rather than non-union men. Considering the fact that organized labor represents less than a third of our industrial, transportation and mining employes, it can be said for the year 1919 that the liability to strike from unionism as against non-unionism was over 40 to 1. The average ratio for the last five years is somewhat lower, and would probably run 20 or 30 to 1. Even strikes of non-union men, recorded as such by the Department of Labor, are often instigated by union officials. This was particularly true during 1918.

On the whole we are forced to conclude that all but a few strikes are due to the activities of organized labor, and that the responsibility for the recent excess of industrial warfare lies at its door. It is therefore believed that most strikes are only effective through organized machinery, and that society can protect itself against anti-social strikes by regulating that machinery. This will not interfere with the legitimate use of the strike as a last resort.

The effectiveness of control of this character is testified to by the convention of the United Mine Workers which declared: "This convention realizes that through industrial legislation such as the court's interpretation of the Lever Act, the abuse of the writ of injunction with the tie-up of union funds and other oppressive measures, makes it almost humanly impossible to wage a successful battle." British unions are on record as stating that laws interfering with strike bene-

fits would "paralyze the efficiency of the institution, and are tantamount to a proposal to suppress unionism by statute."

Eugene Debs is also a witness to the efficacy of injunctions in breaking up such illegal combinations. This was during the strike of the railroad men against the hauling of Pullman cars about a quarter of a century ago, when the Government secured an injunction. When Mr. Debs was tried and convicted for violating the injunction, he testified that "It was not the soldiers that ended the strike. * * * It was simply the United States Courts. * * * Our men were in a position that never would have been shaken under any circumstances if we had been permitted to remain upon the field among them. Once we were taken from the scene of action and restrained from sending telegrams or issuing orders or answering questions, then the minions of the corporations would be put to work. * * *"

The resistance and elemental power of unorganized mobs will always have its embarrassments for the State, and no civil process will be adequate to deal with them. To such movements our suggestion has no application. It leaves them where they were, no better and no worse. But the great mass of anti-social strikes, in this country at least, and the participation of our representative unions in them, are of an entirely different character. They are not the voluntary uprisings of an unorganized mob but are systematically incited and maintained through the elaborate and organized preparations of permanent organizations. Prevent the machinery of these organizations from fomenting, managing and maintaining such strikes, which is an entirely practicable thing to do by legal process, and most of them would fail for want of instigation, leadership and direction.

These suggestions for social control are thrown into the maelstrom of discussion because the major part of them differs from other suggestions which have come to the attention of the public.

THE WAR FINANCE CORPORATION

By EUGENE MEYER, JR., New York

The War Finance Corporation was an institution formed during the war with \$500,000,000 capital stock and authority to borrow up to \$3,000,000,000. All of the capital was paid in and is now held by the United States Government. The Corporation borrowed, through the medium of a note issue, only \$200,000,000, all of which has been re-paid. During the war it functioned as an institution to furnish temporary assistance to American industries necessary or contributory to the war, as the phrase in the law ran, to furnish financial assistance under the difficult conditions existing and expected. Under its war powers it advanced in all some \$300,000,000, of which \$235,000,000 has been re-paid. Among the powers granted as a war measure the Corporation was authorized to make advances to industries necessary and contributory to the war, to banks that had financed such industries, and in general in the public interest to savings institutions, building and loan associations, and fiduciary institutions of that character in case of need.

When active hostilities ended with the armistice in November, 1918, it became evident that, except as to operations necessary in connection with demobilization of troops, the war powers of the Corporation were necessarily at an end, and consideration was given to its possibilities as a reconstruction agency. Many suggestions were made, but the only one that the directors adopted, and ultimately recommended to Congress, was the proposal that for a short period after the proclamation of peace the corporation might make advances in aid of exports, since it was evident that some time would elapse before the normal processes of international trade could again function.

This suggestion was adopted by the Congress, and by Act signed by the President on March 31, 1919, the Corporation was given further powers by Section 21, the reconstruction amendment.

This was the biggest reconstruction measure, in the amount of funds involved, passed by any nation, and it was passed in recognition of the fact that during the reconstruction period, difficulties in the export trade of the United States would inevitably arise, not only until the formal proclamation of peace, but for some time thereafter. The amendment carried no new appropriation, but authorized advances in aid of exports to the amount of \$1,000,000,000 outstanding at any one time, out of funds previously appropriated or out of moneys to be raised by the issue of the Corporation's bonds. Its powers under the amendment were to continue in effect for the period of one year after the proclamation of peace by the President, which proclamation has never been issued.

Government Loans to Europe

During the period immediately following the armistice, the powers conferred upon the corporation were not used, since aid was given to exports through other channels. The United States Government made direct loans, following the armistice, to the extent of \$2,500,000,000 to the countries associated with us in the war, and the newly-constituted republics of Europe. A certain amount of financing was provided by foreign loans floated in America. There were also large speculative investments in foreign securities in this country. Gradually also, the production of Europe was restored, improving to that extent their buying power because of production for export.

Towards the end of the year 1919, and particularly in the spring of 1920, more difficulty was experienced in making satisfactory arrangements for longer term financing in connection with exports, and the aid of the War Finance Corporation was sought by substantial borrowers. Advances in aid of exports were made to the extent of some \$46,000,000, and a substantial volume of promising business for the future was indicated by tentative applications before the Board.

In May, 1920, the Secretary of the Treasury requested the Board to discontinue making advances in aid of exports, except pursuant to commitments already made, and as he was chairman of the Board, and because of certain powers conferred upon him by the Enabling Act, possessed an effective

veto power over the Board's activities. We acquiesced in his request and discontinued our activities in aid of export trade. The consensus of opinion of the Board was by no means unanimously in accord with the Secretary of the Treasury on this policy—speaking for myself I may say I was strongly opposed to it, and that I resigned from the Board of Directors shortly thereafter.

In requesting us to discontinue our activities, the Secretary of the Treasury gave among his reasons his construction of the law and of the intent of the Congress, also his idea as to sound financial policies. He took the position that the delay in the promulgation of formal peace had extended far beyond the time that the Congress might have expected, and that therefore he would undertake to interpret the intentions of the Congress as to time; furthermore, he voiced his interpretation of the intent of the Congress by referring to current high prices and large volume of business, accompanied by exports large in dollar-value. As to this, I said then, and say now, that only the Congress should attempt the interpretation of its own intentions, and that it was outside the proper functions of the Board of Directors of the Corporation to govern its actions by its supposition of intent.

Slowing Up of Business

During the past few months there has been a continual decrease in the volume of business and prices of commodities have declined. In many cases, prices of important mineral and agricultural products have done worse than decline—they have collapsed. Business has been greatly unsettled by an existing and threatened decline in exports of certain fundamental basic commodities; failing of export, these commodities back up at the ports, and backing up at the ports, they back up all the way down the line, through the exporters, the manufacturers, and in the last analysis to the producers—the farmers and miners; and if any one single thing could be done to break this blockade I am sure that the most helpful thing that could be done would be the revival of the activities of the War Finance Corporation in aid of exports.

Referring again to the suspension of the Corporation's activities last May at the request of the Secretary of the

Treasury, he gave at that time among his reasons, to use his own words, "Business is prosperous, and involuntary unemployment is negligible." If that statement covered impelling reasons at that time, certainly it cannot govern today, for who today will say of the business of America that it is prosperous and that the existing large and growing unemployment is voluntary? Mr. Forgan, in testifying before the Senate Committee on Reconstruction and Production at a recent hearing in Chicago, stated that last May he was in accord with the policy of the Secretary of the Treasury in discontinuing the Corporation. I asked him if he thought business was prosperous now: He stated that he did not. I asked if he thought unemployment was negligible now: He said he knew there was considerable and increasing unemployment. I asked him his present views as to policy with respect to the War Finance Corporation: He said that he thought it should function at his time. If the action of last May was taken because of the then existing conditions which now no longer exist, evidently the question of reviving the Corporation's activities should receive entirely new, and independent consideration based on the conditions of today.

Powers of the War Finance Corporation

All of the legal powers conferred upon the Corporation by the amendment of March, 1919, exist today. It has an organization, and it is in full possession of all of its paid-in capital stock. It has the power to issue bonds in excess of the amount which can be legally advanced under the amendment, and has cash on deposit with the Treasurer of the United States to the amount of some \$370,000,000. All that is required to put it again into helpful functioning in aid of exports is that the Secretary of the Treasury ask the Board to commence functioning again. In this connection you will note that the activities of the Corporation were only suspended last May, not permanently stopped; the word "suspend" in itself implies only temporary cessation, so that activities may be renewed when the occasion demands.

I find a general agreement with the idea that the activities of the War Finance Corporation should now be revived. The National Board of Farm Organizations has endorsed the idea, and manufacturers, wherever I have had the opportunity of

interviewing them, are of the same mind. I interviewed a large number of bankers at their annual convention at Washington and found a preponderant opinion in favor of the Corporation assisting American export trade. I think the mining industry is the only large group that has not expressed itself on this question. Meeting as you do, and as Mr. Davis so happily pointed out, in a solemn place, and, I think, at a very serious moment in our affairs and in the affairs of the world, I believe that in addition to the list of problems already on its program, the Mining Congress might well consider the question of the marketing conditions which are handicapping mineral production; and if after such consideration you see fit, I should be very glad indeed if this convention would express itself in favor of the revival of the activities of the War Finance Corporation.

The amendment under which the Corporation was functioning when its activities were suspended last May was passed with the support of the mining industry. Producers, exporters and bankers interested in the mining industry expressed their views through Congressional representatives in the House and Senate. Furthermore, representatives of labor employed in the copper-mining industry, which was particularly affected by the sudden ending of the war and the unusual difficulties of the readjustment period, happened to be meeting in Washington at the time, and also gave substantial support to the passage of the amendment by expressing their opinions in favor of the Corporation's assistance to export trade. The good work done by the mining interests in connection with the passage of the amendment could well be followed by action in connection with the proposed revival.

If, by resolution of the convention, after consideration, or by appointment of a committee through the convention, you should desire to investigate the question further, I shall be very pleased indeed to hold myself at the service of such a committee, or at the service of the convention, to go into details and furnish any and all information that is within my power. The Secretary of the Treasury has taken a firm stand on the matter, and I hardly think that there is any possibility of his changing his mind before Congress meets on December 6. There will be legislation introduced on the subject without any question when Congress meets, and if you have made up

your minds, after careful consideration, that you are in favor of the War Finance Corporation's assistance to foreign trade, believing that it is not only in your interests and the interests of your industries and the people dependent thereon, but also in the interests of the whole nation, in fact, of the whole world, I think that your support would be most valuable. I should welcome it, and I am sure that your support in addition to that which has already been pledged would settle definitely the policy of the country.

THE GENERAL COAL SITUATION

By J. D. A. MORROW, Executive Vice-President National Coal Association,
Washington, D. C.

The present coal situation really began a little over a year ago with the strike of the coal miners with which you are already sufficiently familiar. When that strike started, stocks of coal in the United States were 53,000,000 tons, practically all bituminous. During the course of the strike, 40,000,000 tons in production were lost, and most consumers had to use their accumulated stocks. During the winter, production just about kept pace with consumption, so that on April 1, 1920, coal stocks in the country were at the lowest figure of which anyone had record on that date, totaling only 23,000,000 tons. These were not, properly speaking, stocks at all; they were merely the country's working coal capital; by that I mean the small quantities of coal that every industrial plant has on hand to tide over irregularities in its coal receipts.

Coal Stocks Low Instead of High

About April 1 of each year, it is the natural wish and effort of every industrial consumer to begin storing coal for the following winter. That is particularly true in the Northwest, where coal is shipped by way of the Lakes, and in New England, Northern New York, and so on. But the outlaw switchmen's strike in April so interfered with the movement of coal that it was not possible to ship even coal enough to meet ordinary demands in the eastern half of the United States. About June 1, instead of consumers having built up their coal stocks they had lost ground, so that on that date stocks of bituminous coal were only 20,000,000 tons. Thus this country faced a deficit of 20,000,000 to 25,000,000 tons, chiefly bituminous. It faced that deficit with a disorganized transportation system upon which it had relied for its shipments. There has been no time in the history of the country, so far as we have any adequate record, when as bad a condition prevailed.

Fortunately, the railway people understood their situation

very well, and the coal men understood theirs fairly well; and while they did not have complete figures, they had enough information to know what the position last June meant. Accordingly, they went to the Interstate Commerce Commission and insisted that coal must have preference in transportation, because there were not facilities enough to haul everything which people wanted to carry in open-top cars, so it came to a question of deciding whether the United States was to have all the coal it wanted, or whether it should have all the sand, gravel, lumber and thousands of other things it wanted. All were not possible, so some choice had to be made as to what should be sacrificed. The suggestion and position of the Interstate Commerce Commission was that preferential car supply be given the mines, and the Commission issued such an order in the middle of June. After that, coal production which had been at the rate of 9,500,000 tons of bituminous per week, began to rise. In spite of that order, however, shipments did not reach those required. By September we were still behind, and the Commission realized that some final and drastic action should be taken. At that time it put another order into effect and canceled its permits to other shippers to use open-top cars, when the production of bituminous rose to 12,000,000 tons a week, and that figure has been maintained ever since.

In consequence of keeping up that high output, the deficit of 20,000,000 tons on June 1 has dropped now (November) to 5,000,000 tons, and the output is so increased that we feel confident there is no danger of any acute shortage for this winter, barring unforeseen circumstances. Substantially, the worst is over, and the country is safe from any coal shortage this winter.

The condition of extreme shortage of supply and inability to obtain adequate current shipments was one that produced perfectly natural consequences. There is nothing mysterious about it, and nothing that justifies some of the charges that have been made.

How Some Firms Got Coal

Some industrial consumers sent their purchasing agents into the fields to get coal at any cost. It was not a matter of price; the agents were advised that if they did not obtain

fuel, thereby compelling the factories to shut down, they would be fired. One railroad, I am advised, had four men buying coal at the same time; and I know of one instance where those four men bid against each other on 400 cars of coal, and raised the price \$1 a ton. This increase was, of course, wholly unnecessary, and could have been avoided if that business had been conducted sensibly.

I know of one manufacturer who contracted for coal under those same circumstances for a year at \$20 per ton, including a freight charge. Why did any ordinarily sane man take such action? He said there was nothing mysterious about it. He said, "I am satisfied that coal bought at that price will enable me to get the production of the mine, and if the particular mine I get it from strikes, or something else happens, there will be enough profit in it for those people so that they will go out and get me the coal." Now, how much difference did that price make to him? His manufactured product sells at \$100 per machine, and at \$20 per ton, his coal cost would be only 30 cents per machine. Figured on the basis of 30 cents per unit, he could have afforded to pay \$100 a ton for coal rather than shut down.

The competition of men such as that, and other similar buyers of coal, afforded an opportunity for the speculator to bid up the price against the poorer buyer, and to make a price that was almost prohibitive for the consumer who had to use large quantities of coal.

Coal Speculators

Let me speak of speculation: It is a new thing for the coal industry; we never had an experience of that kind before. During the war there were speculators in poison gas, shells, and a hundred other commodities. Men who knew nothing about such things before made what they could; and the same thing happened in coal. Some coal speculators in New York—it is the only type of description they deserve—who were quite a factor in the business, were traced to find out who they were. We found that they were corset manufacturers, cigar-makers, bootblacks, anybody and everybody. They had no interest in the coal business except this: that if they could get hold of a few cars of coal they would sell that coal to the man

who needed it the worst, for the highest price. Of course, that brought disrepute upon the industry.

With the return of prices to normal there is no opportunity for such a man to do that kind of business; and I want to point out at this time the fact that a price situation of this kind can arise simply and solely through the force of competitive influences, without any manipulation or combination; and that is exactly what happened last summer. Just reversing the process, when you get an over-supply of coal that nobody wants prices go down out of sight.

The distinctive phase about the action of the Interstate Commerce Commission was this: For the first time in its history it took prompt, effective, business-like action to solve an administrative problem, and solved it. They conferred with a few of the responsible men from the American Railway Commission, headed by Daniel Willard of the Baltimore & Ohio Railroad, also with committees of the National Coal Association, who agreed as to the facts and as to the action that should be taken. The Commission adopted the recommendations outright in most instances, and put them into effect, giving preferential cars for the movement of coal to the Northwest, because it had to be hauled to the Lakes before they froze, otherwise the people in Wisconsin, North Dakota, and those States would have been without enough coal.

Conditions in New England

Another section of the country that was in a bad way for coal was New England. The reason for that region being in such a condition was different. The Northwest gets the greater part of its coal by water, while New England, before the war, got the most of its coal, or a little more than half of it by water. The coal went by rail to Philadelphia, New York, Baltimore and Hampton Roads, then to New England by water. The remainder would go by rail across the Hudson River. In the spring of 1920 there was a material difference in New England, in the delivered price of coal, depending on how it was shipped. If it went by water, the people there would pay \$1.50 to \$1.75 more per ton than if they took it all by rail. You people are probably fairly well informed as to some of the outstanding characteristics of New England people. A difference of \$1.50 per ton in coal prices would

cause anyone to stop and consider, but for a New Englander such a variation is a matter for prayer. New England tried to buy all of her coal for all-rail delivery. It could not be done. Its railways were not able to handle that business; they were already hauling more coal than ever before. However, that was not enough for New England, and they were steadily accumulating a deficit on account of the \$1.50 difference in freight rates which was going to create disaster this winter, and yet at the same time they were "hollering" for the appointment of a fuel administrator to look after the coal. We met the committee representing the New England Governors, explained our views to them, and worked out a plan for New England coal relief. That scheme protected them in part from the effect of foreign bidding for coal in Atlantic ports by seeing that the coal consigned to New England could not go elsewhere. They were protected against outside bids, and were enabled to buy that coal at a better price than they could in the open market. The New England wholesalers and distributors agreed to take that coal in and start a campaign of education with their customers, explaining that this was their opportunity to get coal, and if they did not embrace it, even at the high-water freights, then heaven help them, for no one else would.

We had to say some very pointed things to that committee of New England Governors. They wanted 1,250,000 tons of coal monthly, and they wanted to distribute it through State governmental machinery. We told them frankly, "No sir. If you propose to put the New England State governments or the Federal Government into this game of coal supply and distribution you will do it without our help and against our opposition. We will do everything to give you coal if the ordinary business agencies of New England will handle it, but we will not encourage socialism in the United States, and least of all, in New England." They agreed to let the New England business men handle the coal, but being Yankees, they vigorously insisted that they must have 1,250,000 tons. While we were confident that 1,000,000 tons was all they needed, we gave them 1,250,000 tons. We said, "We are satisfied you cannot use all of this coal, but we are going to give it to you and bury you under it before we get through," and we did so. In six weeks their hands went up and they

said: "You are going to have to reduce those shipments because we cannot take the coal."

It was somewhat the same condition with the Northwest. It took some persistent effort there too, but they are now out of the woods also.

What the National Coal Association Helped Do

That indicates the kind of work we had to do, in a broad way, through the National Coal Association, in the past six or seven months. It is gratifying to tell you that the industry has solved those problems and overcome those difficulties by co-operating with the appropriate branches of the Government, but without resort to extensive and far-reaching resumption of Government control of the coal industry.

What is the situation we face today? You have a concrete illustration of it right out here (Colorado). A distinguished member of the United States Senate comes to your city (Denver) and gives his views upon what ought to be done in connection with the coal situation in the next few years, and for all time to come. His ideas embrace national control of operation of the coal mines and the sale of their product. But we are opposed to Government control or regulation. One of the worst instances of this is the law in respect to coal in Indiana. This put the State in complete control of the coal industry; gave it authority to fix prices; required the operators to produce coal at the prices named, and ship the quantities required for the needs of the State at those prices to consumers named by the State, regardless of any other considerations. Please observe the vicious neatness with which they thought they avoided interference with interstate commerce: They said, "We don't refuse these operators the right to ship their coal in interstate commerce we don't transgress their constitutional guarantees; they can ship all the coal they want in interstate commerce, just so long as they ship all the coal we want in Indiana to Indiana consumers at Indiana prices." That law is going to be fought by the coal operators. This case will be taken to the Supreme Court, and we hope, of course, that the State will be defeated. We think that this legislation will be declared unconstitutional.

Those are some of the reasons why these coal people regard this present situation with a good deal of concern. We feel

that we have faced an extremely acute situation, and got out of it remarkably well. It is conclusive evidence of the fact that practical branches of the Government working with practical men in business, in any business, can meet these economic problems as they arise, and that ought to be enough. If the Government is to take a hand in business, we should meet that issue right now and be done with it. It is a condition that requires the co-operation not only of coal men, but also the co-operation of all business interests, and certainly of all the mining industry.

DENVER AND THE OPEN-SHOP

By L. WARD BANNISTER,
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In considering the open-shop condition in Denver, I have made a brief classification: open-shop—machine-shops, packing plants, stores, terra-cotta manufacturers, meat-cutters, automobile shops, woodworkers, elevators, and railroad officers; entirely or almost entirely closed—building trades (17 crafts), patternmakers, railroad shops, barber shops, transfer and storage-houses, billposters, brickyards and candy manufacturers. As for the foundries, there are about 20 in Denver, 12 open and 8 closed. As for public utilities, they are run upon the open-shop plan, and the recent strike of tramway employes ended undoubtedly in maintaining the open-shop. The Denver Civic and Commercial Association, and such semi-commercial organizations as the Kiwanis Club, the Lion's Club and the Optimists Club, have resolved unanimously in favor of the open-shop. Undoubtedly, the tendency in Denver is in its favor. The leading organization in support of the movement is, without doubt, the Employers' Association. This is said to consist of 400 members. It has a card index list of 4500 employes who are willing to work on the open-shop plan. It has a legal department; it has a secret service, and it tends to promote, as far as it is possible, the open-shop movement in this city. We acknowledge the inestimable benefits of unionism to labor; in fact, to society at large, yet the principle of the open-shop is based on the soundest principles, as conditions now are, and we say that the position of labor in favor of a closed shop is socially wrong.

Capital and Labor in Society

I do not like to argue the case of the open-shop by making use, as is so often done, of the right of non-union men to work. It has always seemed to me that this is a disingenuous ground furnished and employed by employers to maintain their cause. It seems to me that capital has a legitimate position in modern society, and it can present a defense in its own rights, and

that it need not rest upon the rights of the non-union men. In the first place, the employer has a right in bargaining with a union for the delivery of certain human service, to bargain with a union whose funds and assets are like those of the employer or any private citizen, and are amenable to judicial process. As the law stands at the present time, these assets cannot be reached in any way that is feasible, because the old common law rule prevails in this respect in Colorado and in most of the States of the Union, under which a union which is treated as a voluntary association, and requiring, in order to hold the assets of that association, the services of summons or process upon every member of the union. Now, it has been suggested that there is relief from that situation by requiring labor unions to incorporate. That would be a relief, but, on the other hand, such requires an affirmative act on the part of organized labor, and to require an affirmative act of that kind savors of a species of tyranny. The general situation can be reached much more simply by amending the statutes relating to the service of process upon voluntary associations, by changing the law so that the service upon an officer of the association, instead of upon all the members of the association, is a complete service upon the association, so that in case of a judgment against it, the assets or funds of the association may be held. That is simple. That has already been done in Colorado, where it happens that the voluntary association is a business men's association. Let us change it again so that the same rule will apply where the association is one of workingmen, just as in the case of the business man. In the next place, it seems to me that it is axiomatic that an employer has the right not to commit suicide, but the right to live. If we believe in individualism, as I do, then I repeat it, that capital is a useful, a legitimate and a much-needed agency in modern industry and in social life, and the employer who has capital invested and is engaged in production, has the right in his own behalf and on his own feet to demand that he be not compelled to commit suicide. And yet, what happens? Union labor is, as I say, of the greatest value to labor, the greatest value to us all, and yet it is fast becoming a great trust. It numbers today between 4,000,000 and 5,000,000 members; it collects and it dispenses money by the millions; it has its secret service; it has its legal

departments; it even has its departments of economics. All of that is very well—excellent—but what we have the right to object to, which right the employer and public have also, is the fact that this great labor trust is without sufficient control on the part of public authority. If a controversy exists between labor and employing interests, there is no power to limit the price that this trust may demand from these interests for the human service which is to be supplied.

Is Human Labor a Commodity?

I know that it is argued by Mr. Samuel Gompers and other labor leaders that labor is not a commodity; that it therefore ought not to be subject to regulations. I do not say whether human service is a commodity or not, but whatever it be, I know one thing, that a trust in human service can be just as vicious in its effect upon industry and upon the general welfare as can a trust in the form of a trust of commodities. When the labor organizations of this country, along with the organizations of employers, will consent to have their controversies when they cannot be settled among them themselves in some way disposed of by some Governmental authority, then the labor trust need not be feared so much. But, for the employer now to enter into a closed-shop contract with a labor union is to extend the power and the influence and add to the membership of organized labor. Let him beware in the meantime of creating a great agency which may fall upon the creator. We see the danger a little more clearly when we reflect upon this, that in the ranks of organized labor now under a fairly conservative control there is a high percentage of Socialists, and if in the course of labor evolution these Socialists obtain control of this organized labor, how easy it will be to do that for which the Socialists hope, or most of them hope, namely, to seize by violence at some concerted moment the factories and the mines of this country. So I say that the employer has ample ground, under conditions as they exist at the present time, not to enter into a contract with a union for a closed shop.

Open-Shop Only One Phase of Industrial Disputes

The open-shop controversy is only one phase of the larger industrial controversy. At the present time it occupies the firing line, but in time other phases will take their turn. Mod-

ern invention, with its accompanying increase in production, with its division of labor, its great diversity of interest between the employer and employe, not so much in the matter of production as in one of distribution, with a possibility that monopolies and other evils will, as a consequence, be endangered, is the cause of most of the troubles of an economic difficulty that afflicts us. But the future is not entirely without hope. Most employers are honest, and most employes are honest; most of the men in both classes are industrious; most of them are men that want to be honest and do justice to each other; and then, too, the future is a little more hopeful when we consider that the problems that beset us, the ills among which we find ourselves, are, after all, the result of our own greatness. If we did not possess the genius for mechanical invention, these things never would have come, and if we have the genius to invent such appliances, we probably can solve the problems that have resulted from them.

Supremacy of the Law

We have also made up our minds that we are going to stand for the unequivocal and absolute supremacy of the law. There is no room for compromise between the law of a democracy and any of the violators of that law who live within that democracy. We have also made up our minds to do one thing more: We will stand by the bases of the present economic system of regulated individualism as against the opposing system of Socialism. We are willing to compare the superior production under individual initiative, of regulated individualism, with the inferior production under Socialism, and we are willing to compare the freedom—the economic freedom—that exists under individualism, with its multiple centers of control—for every employer is a center of control—and the producers who number hundreds of thousands, with the tyranny of a single centered system of control which is characteristic of Socialism. We will stand by the main principles of our present system of regulated individualism. We know that that system is faulty, and if we are wise we will see to it that these defects are so far corrected that the great mass of our people will enjoy the benefits of individualism which are ours, for if we are politically sagacious we know that unless any given economic sys-

tem which obtains in a democracy has the support of the great majority of the people who live under it, it will not survive. When we consider those defects, we find that nearly every one is a defect, not at all essential to the system, but susceptible of cure.

Low Wages

In the first place, one of the great defects of that system—and the one which I think is more involved in the controversy about the open-shop—is the tendency to low wages manifested by individualism unless it is regulated. The advantage is with the employer. He is the one who has the vision of the industry, the opportunity to create some new wealth or transport it in some new way, or distribute it in some new fashion, with more advantages than before; he controls the raw materials; he controls the markets; he attends to the financing. He is in the position that is not occupied by the employes, who are obliged to sell their service. To do it, they compete one with the other, to sell to this man who by his genius holds the key to the situation. Competition naturally bears down the wages, but in spite of that there is a remedy, and it is to be found in the very device claimed by labor; one, I am glad to say, that others here believe in, that of collective bargaining. The individual man cannot alone go up against the power and resources of the employer, but if we are to have collective bargaining, it will come under one or other of two methods, either with the union—in which event it will be with a union whose assets are amenable to judicial process, and whose controversies are subject to decision by public authority—or else it will come through the form of co-operative management or employe representation, which has been discussed so ably at this Convention. This latter system to me seems to be an ideal system of meeting the problem of collective bargaining. The unions, as unions, have always been strong on the distribution of wealth, but weak on its production, just as the employer has tended to be strong on production and weak on the distribution; but under the plan of the co-operative management or employe representation, both sides will sit down together and work out the necessities, the needs and the future of the individual plant, and in that way labor will have its collective

bargaining and the employer gets what he is after, and what society needs, steady and uninterrupted production. So I say that the low-wage problem, which results from modern industry, is not beyond remedy.

Individualism Should Be Regulated

Unregulated individualism results in monopoly. Sometimes it is city-wide in its influence; sometimes State-wide, sometimes nation-wide; but even that will yield to the treatment of price regulation. We complain sometimes of inheritances, but all of this may be reached by the inheritance tax. We complain of the fight among utilities companies, the unnecessary duplication, but this situation likewise may be relieved by public control; and I merely wish to point out that the great system of individualism, regulated individualism, is sound at heart, and that the defects which it possesses, and for which many people challenge the system itself, are all defects which are amenable to cure.

The relation of man to industry we begin to perceive. Men are not made for industry any more than for the Sabbath, but as the Sabbath was made for man, so was industry. The mining industry is a great business, and so are railroads and banking; but there is one business that is even greater, and that is the social business, the one in the management of which you and I join, the one that is for us all, and has for its end the development of a masterful, achieving, well-fed, well-housed, well-clothed people, the people of the America to be.

EDUCATION AND PUBLIC SERVICE CONFERENCE

THE PLACE OF ENGLISH IN THE TRAINING OF THE MINING ENGINEER

By H. H. STOEK

Professor of Mining Engineering, University of Illinois, Urbana, Ill.

There are three parts in the training and education of every technical man: first, the experience gained by doing something personally, or by seeing others do it, commonly called practical *experience*; second, knowledge gained by reading and study commonly called *theoretical training*; and third, the crystallizing and clarifying of this practical and theoretical knowledge by writing and speaking.

By writing and speaking I do not mean only the more formal and elaborate preparation of books, papers for technical institutes, articles for the technical press and such formal addresses as may be made from a lecture platform, but include under the same head the various reports, instructions, specifications, etc., either written or verbal, which every engineer must make in his daily work.

Value of Experience, Study, and Writing

It is not necessary to argue for the value of practical experience, reading and study, although different ones may give a different proportionate value to each of these forms of preparation. The value of clear writing and speaking is not, however, appreciated as fully as it should be by most technical men. Many men probably fail to be promoted to positions of greater responsibility, not because of their lack of technical knowledge and experience, but because they cannot impart information to others so that other men can carry out their ideas. A Chinese student in mining at the University

of Illinois several years ago answered the question, "What is the value of English speaking and writing to a mining engineer?" by saying "The man who knows how to ask for what he wants generally gets it." I believe, therefore, that ability to handle English, both by writing and speaking it clearly, should be given a fundamental place in the training of every engineer.

This was never more true in connection with mining than it is at the present time, when everyone in authority about a mine plant must act as instructor to the foreign element that is carrying on most of the mining labor, and which has come to us from southeastern Europe without a knowledge of our language and with no background in the way of preliminary mine training. Also with the increasing number of conferences between employers and employes, there is a greater necessity, not only for clear thinking but for clear expression.

Of what value is writing and speaking to the writer and speaker? One of the points of greatest value in technical writing is the fact that it necessitates careful and minute observation. Let anyone attempt to describe in writing some machine or some operation about his plant with which he thinks he is perfectly familiar, and he will immediately find out how many things there are about it which he knows in a general way but which he cannot describe in such detail that he will be willing to have his description go before others for their criticism; moreover, he will be surprised how often he has to look up details with which he thought he was perfectly familiar. There is no better way for a person to find out how little he knows about a subject than to start to write an article about it.

Observation and Thought

Another illustration: attempt to describe to a bright boy 12 or 14 years old how a certain machine works, and see how quickly he will call upon you for greater detail and clearer expression. *No one can describe clearly what he does not understand himself.* Technical writing necessitates, therefore, not only careful observation, but it necessitates clear and systematic thinking in order to be able to present to others an idea, even after that idea has been thoroughly mas-

tered by ourselves. It therefore trains the eye, the brain and the hand.

While there are many good men who cannot write or talk, the man who can clearly, logically, and accurately express his thoughts has a decided advantage in the industrial race over the one who cannot do so. A great need today is careful observation and the reporting of this observation.

If we admit that training in English expression is of value, how can it best be secured? Naturally, such training should begin low down in the grade schools, and it is an unfortunate fact that too much of the training there is given by improperly prepared teachers. In the college or university the usual classes in rhetoric are common and fairly standardized, though frequently very unpopular, because taught by those who look upon English entirely from the cultural standpoint and fail to impress their students with the fact that rhetoric is a fundamental for an engineer.

The choice of subjects for English essays is often another form of discouragement to the technical college student. The teachers of English, however, are by no means the only and probably not the greatest sinners in this respect, for the teachers of engineering set a bad example frequently by their own slipshod and too often slangy expression in the classroom; by accepting any kind of slovenly English in quizzes, examinations, etc.; by failing to call attention to inaccuracies and also by failing to impress upon technical students the value of correct and clear expression.

Requirements of Engineering Students

At the University of Illinois no student in engineering is permitted to enter the Junior Class until he has completed the requirements in rhetoric for the first two years; and if, at any time during his course, he shows that he is backward in English expression he may be required to take extra courses in English. A Senior who presented a petition in which many words were mis-spelled was very much peeved when he was required to take a course in Freshman spelling. However, I believe that the requirement was good, not only for his English, but as a disciplinary measure also.

An instructor should, I believe, make a list of common forms of inaccurate expression that he sees in quiz and exam-

ination papers, and call attention to them in the class; not giving publicity to the individuals so as to mortify them, but so that the whole class may benefit by such criticism.

A requirement of a theme or paper upon a technical subject connected with each course given in mining is one method that is being used to strengthen English training at Illinois.

Sumarizing these hurried suggestions:

English expression should be looked upon as a fundamental for an engineer and he should be impressed with this at a very early stage in his course. This idea should be emphasized by his engineering teachers rather than by members of the English faculty.

Teachers of technical subjects should be much more careful in their own language and in their requirements of written and spoken English from their classes.

The writer hopes that these few suggestions may bring out many others from those who are attempting to accomplish the same end.

THE PLACE OF MATHEMATICS IN THE TRAINING OF THE MINING ENGINEER

By ROBERT PEELE

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This is a subject regarding which there must be, I think, substantial unanimity of opinion amongst practicing engineers, as well as teachers in schools of mines. It seems unnecessary for the present purpose to discuss the value of mathematics as a means of mental training. That view has general acceptance. Any study requiring precision in the statement of problems, and which furnishes definite, exact methods for their solution, is obviously useful for all students, whatever their aim in life may be. For the engineer who deals chiefly with matters of fact and who must subject his professional problems to rigid analysis, such training is of especial importance. There can be no doubt that mathematical studies stimulate the reasoning powers.

Engineering and Mathematics

Mathematics, from arithmetic to calculus, is the foundation of a large number of subjects comprised in the course of study leading to all the engineering professions, including that of mining. It is the tool of the engineer. Without a sound working knowledge of the different branches of mathematics, few of the elementary and introductory engineering subjects can be efficiently and successfully studied.

Take, for example, the numerous applications of steam power, or the electric transmission of power for mine service. Although a mining engineer is not expected to be able to design a steam engine or an electric motor, it is highly desirable, if not essential, that he should be acquainted with the types of engines and motors suitable for different purposes, and with the basic features of their construction and operation.

On the purely mechanical side, therefore, he must have studied the elements of mechanical and electrical engineering.

To comprehend these matters, he must be familiar with the phraseology and terms used in discussing the elements of machine construction. The successful study of these subjects depends directly upon a working knowledge of mechanics on the one hand, and descriptive geometry on the other. Effective study of mechanics is impossible without a sound training in mathematics. In accordance with the principles of descriptive geometry, a given subject is portrayed by mechanical drawings. To show the object fully and precisely, the drawings are not made in perspective, but in two, three or more orthographic projections, together with separate views of each part or detail, also in several projections. To make mechanical drawings, or to read them with facility, the engineer must have knowledge of geometry and trigonometry.

Next, in discussing the action of steam in the operation of a steam engine, or the theory and practice of air compressors, or of internal combustion engines, acquaintance with the principles of thermo-dynamics is necessary; a study of which requires the use of algebra and analytical geometry, and at least an elementary knowledge of the differential calculus. The study of thermo-dynamics is largely based, also, on physics, in which mathematics play an important part.

In the study of electrical plant, mathematical relations are met at every turn, demanding the use of algebra, trigonometry and analytical geometry. This is particularly true of alternating current machinery now so important in connection with the power plants of mines and metallurgical works, and the transmission and distribution of electric current. While no mining engineer would be expected to design or build generators and motors, some acquaintance with their principles is desirable.

The problems of surveying, both surface and underground, demand familiarity with algebra, geometry and trigonometry. The theory of centrifugal fans and pumps involves the use of all branches of mathematics, including the calculus. The design of framed structures is based on the principles of mechanics, graphic statics, and the rules and formulas of properties of materials (often called resistance of materials), all of which subjects have a distinctly mathematical basis.

It is unnecessary to go further in tracing the intimate dependence of engineering studies upon mathematics. Doubtless some practicing mining engineers will feel, even if they do not say, that they have attained success in their professional careers without possessing a working knowledge of any more mathematics than is included in say, arithmetic, algebra and plane trigonometry.

Mathematics Fundamental in Engineering

Others who have been engaged more in the business management of mines than on the technical side of the profession, may question the necessity of knowing any mathematics beyond arithmetic and elementary algebra. But even these will acknowledge that engineering problems must be tackled and solved by someone, and the superintendent or manager who has insufficient engineering training, or whose mathematics have grown rusty, is obliged to engage the services of a technically trained man to help him out; or, if the organization is a large one, the superintendent may have to rely implicitly on his engineering staff for everything connected with the technical operation of the property. Furthermore, men who adopt such a viewpoint are likely to have lost sight of the beneficial training they received from their mathematical studies. The quickness of perception and mental acuteness developed by these studies may remain long after the details of rule and formula have been forgotten. It has been well said that the engineer should be accurate in his calculations, thorough in his investigations, lucid and concise in his statements, and logical in his deductions. All of these qualities are fostered and developed by the study of mathematics.

The fundamentals of mining engineering are mathematics, chemistry, physics, mechanics, mineralogy and geology, and the greatest of these is mathematics. A broad view of the matter forces the conclusion that the study of mathematics is not only useful in itself, but is the indispensable basis of all scientific engineering as distinguished from the methods of the rule-of-thumb practitioner.

FEDERAL CO-OPERATION

By DAVID WHITE

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Experience covering many years has shown that in geological, as well as in other enterprises, co-operation is, in general, the most practicable way to make two blades of grass grow where but one grew before. True co-operation doubles the product without duplicating the effort. It assures increase in quality or quantity of output or both. Ethically and materially it is beneficial to all concerned.

Co-operation Between the Federal Government and Mining Industry

Genuine and effective co-operation such as should exist between the Government and the mining industry in the formulation of legislation relating to the development, operation, and taxation of mineral lands and property will have been discussed in a special session of this conference. What seems to be needed in the field of mining legislation is co-operation—not antagonism. Better teamwork between mine owner and Government would, no doubt, result in fuller mutual understanding, more widespread sympathy, less suspicion and better laws effecting mining.

Between the scientific branches of the Federal Government, the State bureaus and the mine operators of the United States, the earnest purpose to further the mineral development of the country is mutual. In the discovery, development, mining, recovery, utilization and marketing of the mineral resources in the ground, co-operation is in force with a widespread spirit of earnest helpfulness. It is hoped that this discussion may lead to its extension with still greater benefits, both for the mining industry and the public.

The United States Geological Survey comes into closest contact with mining interests of every kind through its work of compiling and publishing reports of mineral production. This work with which all State bureaus and members of the Mining Congress are familiar is purely and pre-eminently a co-opera-

tive enterprise in which most of you, both State officials and producers, take parts that are both active and essential. These reports, though necessary to the public, are mainly for the producers, and on them depend the accuracy, the promptness, and to some extent, the adequacy and the value of the periodic statements issued by the Survey.

The branches of the Survey at Denver, Salt Lake City, San Francisco, and in Alaska are maintained for closer work with the industry. They also serve as points of conference as well as local sources from which publications and other information may be obtained. They are in charge of highly-trained and experienced men known to all and enjoying the complete confidence of the mining men of the West.

Publications of the Geological Survey

To meet the needs of the country in war, the work of compiling and publishing reports of mineral production was greatly enlarged. Quarterly and monthly reports were prepared to cover the principal war minerals, and even weekly reports on a few metals; the status of our oil supplies was reported monthly, and the situation as to coal was published weekly. At the same time the statements were made more comprehensive and more fully suited to the requirements of the mining industries. Later, the anticipation that the emergencies of the period of domestic readjustment and of the competitive struggles of world commerce following the war would require the continuance of this work, so far as it affected our supplies of coal and oil, has been more than realized. It has been necessary to add monthly reports of stocks of domestic and imported oil on hand, to differentiate more fully and clearly the distribution of oil; and to account for the movements, stocks, and market conditions of coal, as well as for the amount mined and the industrial conditions affecting its production. In this larger undertaking the Survey has enjoyed the good-will of other governmental agencies, and of mining organizations, particularly of the war bureaus and commissions which have rendered great assistance in the initiation as well as in the accomplishment of the task.

It is much to be regretted that the post-war dissolution of some of the more effective among the latter has, especially in the case of coal, deprived the Survey of substantial, material

assistance, as well as of unfailing and generous counsel, and forced it to stretch to the limit an appropriation kept far too slender for the sake of Federal economy. The Division of Mineral Resources, under the immediate direction of Mr. G. F. Loughlin, is in the hands of experienced specialists, is well organized, and is as effective as the sources available for the work permit. We need \$75,000 more, and the increased public investment in this work surely will not fail to bring large returns. That a service so important to the country as the current reporting of our mineral production and supplies should be too restricted by lack of funds, is, to say the least, lamentable.

Frequency of Reports

The experiences of the war have taught us much for the improvement of our mineral resources reports; but these reports should be made still more valuable to the industry and to the public; and, since for the basic data we are indebted to the mining men, and the reports are primarily for them, it is more than proper that both the members of this Congress and the State bureaus should offer suggestions and recommendations conducive to the improvement of these reports. Surely they will be welcomed in the best spirit. Presumably your recommendations will relate mainly to the form, scope, basic data and frequency of issue of the reports, or to the classification and interpretation of the production statistics. It is anticipated that suggestions as to frequency and promptness of reporting will be most numerous. The great value of more frequent reports of current production of certain mineral commodities has been conclusively shown during the last two years. But for the weekly reports on coal the country must have witnessed disastrous emergencies in the industries, in transportation and in the home. It now seems not unlikely that the prospective uncertainties of the future will demand further elaboration of the reports of the production and stocks of petroleum. Accordingly, it seems likely that recommendations will be offered regarding the monthly oil statements, and especially as to the classification of the data, and greater promptness, if not frequency, in reporting. In this connection, attention may be directed to the more complete and clearer

differentiation of stocks and net imports as set forth in the statement for September, 1920.

In this matter, which I regard as urgent, efficiency and co-operation are notably indispensable. The oil man probably does not need to be reminded that not only the frequency, but in particular, greater promptness in issuing the monthly statements of petroleum production depend not merely collectively, but individually, on the producer. They cannot be speeded up without his help in more punctually reporting the company's oil production and stocks. However, it is but fair to say that a comparatively small number of producers cause the principal delay. The published report takes the date of the last received return.

In this connection it may not be out of place to suggest that in certain cases, where the company records so differ from the forms used by most other companies and in the Government reports, as to require special compilation of the essential criteria in the offices of the companies in order to fill out the questionnaires, consideration be given by the company either to conform to the prevailing usage or to the adoption by the oil companies in general of a standard form of record for office use, as well as for use in reporting to the Government.

Scope of the Survey

The province of a Geological Survey covers every field of geological investigation and thought. It embraces the form, structure, composition, properties, origin and history of the earth and its component parts, and it includes the qualitative and quantitative distribution and mutual relations as well as the genesis of these parts.

The scope of the Federal Survey co-operation through the topographic, the water resources, and the geologic branches with the States, with other departments and bureaus, and with scientific institutions and universities you will find outlined somewhat fully in the annual report of the Director of the Survey, reports that, except as certain parts of general public interest are re-published by some journalist, are probably as unfamiliar to most of you as is the annual report of St. Elizabeth's Insane Asylum at Washington, which also is administered through the Interior Department.

The mapping of the lands, the surveys of our water re-

sources and water powers, and the geological investigations by the Survey all affect the interests of the mining man.

In its quantitative and qualitative studies of the water supplies, both surface and underground, the work of the Water Resources branch of the Survey reaches from the undeveloped power-site to the ranch-house and the city home. This branch is endeavoring to secure more and cheaper power for the miner while assisting in promoting the health of many of his communities through developing better water supplies.

Results From the Survey's Work

During the 25 years of activity of this branch, standard methods have been developed which have been adopted throughout the world wherever systematic stream gauging has been accomplished. A force of about 80 engineers is employed in the field work and in preparing the results for publication in the series of water-supply papers. The results are accepted as standard by engineers, financiers and courts, and on them as a basis developments in water power, irrigation and other hydraulic uses have been made.

States and other governmental agencies are attracted to co-operation with the Geological Survey in order to obtain the advantages of its trained organization, of the standing thus obtained for the results of the work, and of the publication of the data in Government reports. Wherever the co-operative funds are sufficient, a district office in charge of a district engineer and corps of assistants is established and maintained in a co-operating State, thereby securing close contact with and supervision of the work, the opportunity for frequent exchange of ideas with co-operating State officials and resulting cordial relations.

Federal and State Co-operation

As the Federal law appropriating funds permits co-operation with other Government agencies, it is only necessary that the State appropriations permit co-operation with the U. S. Geological Survey, and that the State funds be not restricted to payment of statutory salaries. The State funds are disbursed in accordance with State regulations and by State officials. Under such conditions, if the responsible State official is favorably inclined, co-operation can generally be

arranged. It may be provided for by formal contract, or informally, by exchange of letters setting forth the conditions of the co-operation.

Complete control of the technical phases of the work of surveys by the Water Resources Branch, and of the personnel employed therein is retained by the Federal organization, even though part or all of the salaries may be paid from State funds. Stream-flow records are collected at stations mutually agreed upon. Records are always open to and available for the use of State officials.

The need of stream-gauging work has been so great that more co-operation has been offered than could be undertaken by the Geological Survey. Fortunately, many States do not require co-operation on a dollar-for-dollar basis, and the State officials have thus been able to allot larger amounts of money than could be offered by the Survey. The few States that still retain dollar-for-dollar legal requirement have been at a disadvantage because of the inability of the Survey to meet the full amount of State funds. Out of 32 States which co-operated in stream-gauging during the last fiscal year, only 3 are restricted to equal allotments of State and Federal funds. The total State funds made available for co-operation in stream-gauging during about 16 years have been \$1,500,000. The annual co-operation has increased gradually during the last 10 years, from \$50,000 in 1911, contributed by 13 States, to a maximum of \$175,000 in 1920, contributed by 32 States, with an average of 22 States contributing annually during the 10-year period.

The topographic mapping of the country is proceeding with efficiency and economy of administration, and in accordance with standards constantly raised to keep pace with the advance in public requirements.

The total area of the United States covered by topographic maps on July 1, 1920, was 1,301,136 square miles, or 42.9 per cent. of the entire area. Approximately 15 per cent. of the area mapped is in need of re-survey to bring it up to the present standard of accuracy.

Cost of Topographic Surveys

Since the establishing of the U. S. Geological Survey in 1879, Congress has appropriated, in round numbers, \$12,655,000

(\$12,654,988.98) for topographic surveys to be expended by the U. S. Geological Survey for the following special purposes:

Topographic surveys, U. S. G. S.....	\$9,125,769
Survey National Forest.....	2,234,219
Military Surveys, War Department.....	1,295,000
Total.....	\$12,654,988

The various States have co-operated with the U. S. Geological Survey during the last 35 years by allotting the total sum of \$2,870,820.07 for topographic surveys, making a grand total of \$15,525,809.05 expended for topographic surveys in the United States to date, or approximately \$12 per square mile mapped. During the present year, 1920-'21, co-operation is being maintained in 21 States and one territory, \$228,300 being allotted by these States for topographic surveys. It is estimated that the topographic mapping of the United States can be completed on a scale of 1:62,500 in about 13 years at approximately a cost of \$50,000,000.

The conference of the representatives of the Federal map-making organizations, convened by the President in August, 1919, recommended that the U. S. Geological Survey prepare the standard topographic map of the United States.

As a result of that conference a Board of Surveys and Maps was appointed by Executive order on December 30, 1919, in order to co-ordinate the activities of the various map-making agencies of the Executive Departments.

This Board is proceeding in its work with the general plan under which the Coast and Geodetic Survey will execute the primary control work, and the Geological Survey will execute the secondary control and topographic mapping for all of the Government departments, looking forward to covering the entire area of the United States with standard topographic maps.

Under this plan the States must assist by sharing in the expense. So long as the Federal appropriations are limited to small amounts, it is only good business to expend the Federal appropriation where it can be met by State funds. The usual procedure is co-operation on the half-and-half basis.

It is, therefore, evident that in the next few years very little topographic work will be done by the Federal Government in States which do not co-operate.

During the present year \$228,000 has been allotted by 22 States. Congress will be asked to appropriate \$600,000 for the next fiscal year, and the Survey would like to have the State allotments increased to at least \$400,000.

The Survey will be glad to accept new co-operation or increase in old co-operation in amounts ranging from \$5000 to \$50,000 per annum, contingent, of course, on Congress making Federal appropriations sufficiently large to meet the State allotments. In case the total State allotments exceed the Federal funds available to meet them, the Federal funds will be pro-rated on an equitable basis between the co-operating States.

Mapping the Country

Co-operation with various map-making agencies of the Government and the public has been greatly facilitated by the establishment of the "Board of Surveys and Maps," and the U. S. Geological Survey is actively co-operating with the Engineer Corps and Air Service of the U. S. Army, the Soil Survey, Bureau of Public Roads, Reclamation Service, National Parks, Forest Service, and there is also proposed co-operation with the River and Harbor Commission in surveying the Tennessee River basin in connection with the improvement of navigating on the Tennessee River.

It is, on some accounts, to be regretted that the organic law of the Survey does not sanction direct co-operation with private corporations and individuals as it does with strictly public institutions and organizations.

Of the strictly geological activities of the Geological Survey, those probably of most interest to mining men are the studies of the regional geology, the structure and mineral deposits, and of the ore genesis of the various mining districts. The work of the Survey in the study of the geology of metalliferous regions will have been specially discussed by F. L. Ransome. [This will be found on page 407 of the Proceedings.]

In these studies, several of which are conducted in co-operation with the States, the Survey enjoys the fullest co-operation of the mining companies, and it is a pleasure to take advantage of this opportunity for a public expression of its deep appreciation. The Survey is also under special obligation to the State Geologists and to the University economic geologists for

unflagging and unselfish assistance in the qualitative and quantitative census, made during the war, of the resources of the country in certain war minerals.

Value of Geologic Investigation

It is probable that geology now is and will for some years to come be of more value to the fuel and particularly to the oil miners than to the miners of metals or salts. This, naturally, is due to the relative youth of the oil industry and, consequently, to the relatively small progress made in the solution of the geological problems of the origin, conditions of migration and accumulation, and of the mutual relations and the distribution of oil, gas and water. The tremendous value of the competent and experienced oil geologists to the oil company, to which most of the oil companies were for many years stupidly blind, is now generally recognized. In fact, we must now take some care that we are not over-estimated. Against this, however, stands the fact that geology will later be of still more basic importance to the oil producer.

In common with the State surveys, and in co-operation with most of them, the Federal Survey is giving much attention to the problems of the discovery and development of new oil supplies. The methods of structural study and mapping in the field developed by the Survey are now adopted by all American and the leading foreign oil companies. This is a compliment coupled with a curse; for, appraising the training and experience as well as the method, the oil companies have robbed the Survey of a considerable part of its oil and gas staff to take charge of their searches for new oil fields and the more economical definition of those already discovered.

The task of defining the probably productive areas of producing anticlines or domes in the public lands imposed on the U. S. Geological Survey by the Leasing Law recently passed by Congress, could hardly be accomplished with its sadly depleted staff of oil geologists were it not for the most hearty co-operative assistance universally extended by the oil companies and their geologists. The same generous response and help are met in the Survey examinations of the stratigraphy and structure of other regions in the effort to bring to light new oil reserves.

A new field for mutual co-operation and the avoidance of

duplication between Federal and State Surveys is seen in the progressive adoption of blue-sky laws by one State after another.

Co-operation of Oil Companies

It is germane to note with intense satisfaction the growing tendency on the part of many of the oil companies really to co-operate with one another. This spirit which has been manifested for some years through joint co-operation with the different geological surveys and the bureaus of mines, is now demonstrated through joint wildcatting by several companies in new regions, in boring to deeper sands, and in water prevention; road building, etc. Such enterprises will become more common when, as the oil deposits of the country are more fully discovered and exhausted, the hazards of wildcatting are consequently greater, and the necessities for economies and a more complete recovery of the oil in the ground are more apparent. At the same time closer teamwork will surely be found between Federal and State bureaus and the drillers in the search for and development of new reserves, and in guaranteeing the future of our country so far as concerns its oil necessities. Meanwhile, it is to be hoped, for the good of the public as well as for their own good, that more oil companies may be led either by Heaven's grace or by the law to co-operate in the prevention of the wasteful crowding of wells.

Both economy and efficiency in the discovery and in the development of new oil reserves would, in large measure, result from the pooling without restriction by the oil companies of all information relating to the results of drilling, especially wildcat drilling. This joint information should include logs of the strata in the greatest detail possible, with authentic records as to complete results respecting water, oil and gas, and their detailed relations to pay streaks. Such data should be mutually available to all companies and logically and most practicably, should be deposited with the State bureaus or with the Government. The information temporarily held in confidence should be reduced to a minimum and released as soon as possible. No phases of any European spy system have ever been more burlesque and ridiculous than is the spy system maintained by many of our leading oil com-

panies. Is not the system essentially wasteful and nearly outlived?

Study of Fossils from Oil-Wells

Many oil operators do not know that the Geological Survey, in connection with its assembling of logs of wildcat wells, co-operates freely with the drillers through the examination of fossils collected and the paleontological determination and correlation, so far as possible, by the Survey paleontologists of the fossiliferous horizons penetrated by the drill. These correlations are promptly communicated to the driller, but the public auspices of the service do not permit making the information confidential or exclusive. A more widespread utilization of this service which is extended to petrologic examinations of drill cuttings, would be of great benefit to the industry. In view of the very limited number of specialists in the different fields of paleontology and the sporadic distribution of these among the surveys and colleges, the value of a systematic organization of this work on a co-operative basis is evident and deserves early attention.

Other lines of investigation now in progress in the Survey that relate directly to the problems of the oil operator include: (1) observations of the temperature gradient in deep wells bored in different parts of the country, these observations bearing upon the depth at which oil will volatilize in different regions, and upon the relative recency of diastrophic movement or vulcanism in different regions; (2) gravity measurements conducted through the co-operation of the U. S. Coast and Geodetic Survey, with the object of developing criteria from which deductions may be made as to the depths of the unaltered sediments in different regions, as to local buried folds in which denser rocks are brought nearer the surface, and possibly, by which the presence or absence, at a given point, of buried salt plugs of large size may be predicted with a helpful degree of probability; (3) studies of oil sands with reference to the texture, mineralization, size and shape of grains and pore spaces, as bearing upon the sterility or tightness of the sand and the productivity and the life of the well and pool; (4) studies of the petrology and micro-paleontology of the stratigraphic sections in certain of the oil regions, with the object of providing the company geologist and the driller

with data by which the beds encountered by the drill in those regions may be recognized and correlated with certainty and relative ease. The latter field, in which excellent work has already been done by the Texas Bureau of Economic Geology and Technology, under the direction of Dr. J. A. Udden, a leader in this line of study, is one meriting consideration by bureaus of other States. Co-operation in this line would probably be connected with the studies of drill cuttings already mentioned.

In all of these investigations the fullest co-operation is extended by the engineers and geologists in the field, but additional increase in the scope and progress of the work would, in many cases, result from instructions from company headquarters to the driller, or the authorization of little added expense for the purpose of supplying the materials needed in the investigations.

The researches regarding the cementation of oil sands by deposition of salts through evaporation by expanding gases in the rock, initiated by the Survey, again with assistance in the field from the oil companies, have been taken over by the U. S. Bureau of Mines in connection with its investigations of oil-well production and conservation.

Other studies offering possibilities of great value to the oil industry, but in which it does not appear practicable for the companies to co-operate at the present moment, embrace geophysical laboratory experiments as to the dynamo-chemical origin of oil from the fossil mother substances; also the microscopical and micro-chemical examination of oil-shales of different formations and regions with reference to the origin and characteristics of these fossil residues that decompose in the process of distillation at different temperatures, yielding oil distillates of different characters. The examination aims at determining the correlation between the type of fossil residue and the type of distillate obtained at a given distillation temperature. These studies, which are a part of the investigations by the Survey of the oil-shale deposits of the country, can hardly fail to be helpful not only as explaining the qualities of some of the distillates already under chemical and technological investigation, but also in the solution of some of the

problems of retorting the shale and in the refining and successful utilization of oil made from oil-shale.

Mineral Deposits of Foreign Countries

Another line of Survey activity conducted for the practical benefit of the American mining man is the information service regarding the distribution, geological occurrence, characteristics, qualities, extent and developmental conditions of economic mineral deposits in foreign countries. This service, founded for the information of the American representatives at the Peace Conference, has such great possibilities of helpfulness to America through its aid to the mining public that it has been made as complete as possible with the available resources. The compiled data relating to oil in foreign countries have been in tremendous demand and the value to our country accruing from this service in petroleum alone, i. e., the consequent betterment of our future position in oil has more than a thousand times justified the total cost of the undertaking.

Not for many years past and probably not for a century to come, will the opportunities for American investment in foreign mineral deposits or for acquiring foreign concessions, have been so favorable as at the present time. The payment of crushing war debts, the re-building of industries and transportation, the re-creation of commerce, the stabilization and even the survival of Governments; in fact, the fundamental requisites of food, clothing and shelter, if not the hope of existence itself, in some of the newly-established or rehabilitated countries, demand all that human labor can produce in these countries. All that can be won from the depths of the earth as well as from the soil must be thrown into the void. All resources must be drawn on to the utmost.

The compelling situation is recognized by the Government in most countries, if not by the laboring classes, and it is further realized that it is absolutely impossible to succeed without foreign capital. Such capital is besought and must be had, and, accordingly, concessions of the greatest value are to be obtained at any sacrifice.

Opportunities hardly less important are found in some of the semi-barbaric regions of other continents now opening up for civilization and development, while the spirit of awaken-

ing has extended to the South American countries and the Far East.

Opportunities in Mining

In common with other capitalists the American mining investor now faces unprecedented opportunities, including those for the acquisition of copper, oil, iron, silver, gold, platinum and other mineral properties. Many of these are far richer and more extended than those now in American control. Further, these are, so to speak, marked down in price, corresponding to our extraordinary, though temporary, advantage in trade discounts. Not soon again will such chances be opened up to us, and no capital is more welcome than ours for the development of these resources. On the other hand, the almost incredible activity of the nationals of our late allies, now our most aggressive competitors in the new war for world commerce and financial dominion, in securing as much as possible of the best of the very rich pickings, notwithstanding their stupendous handicaps, should warn Americans. We must beware not only of a prospective serious impairment in our commercial position, but also of the danger to our country of the loss in the not distant future of world control of copper, as well as of oil, and of a possible loss to our present commercial position in iron and coal, if a larger participation in the control and development of some of the exceedingly rich deposits now available and destined soon to be developed in other parts of the world is not acquired by American mining men.

The United States must take a part in the acquisition and development of the rich mineral deposits of copper, oil, silver, iron, coal, etc., now being opened in many parts of the world, if the mineral products can be produced in foreign lands and delivered to our foreign markets more cheaply than they are produced at home; if larger profits await the mineral investor abroad; if our trade balance is to be sustained in growing national wealth and exports; if tariff walls and growing commercial isolation are not to replace successful world competition in commerce, and if our merchant marine is to carry our own commodities in trade rather than those of our commercial rivals. A more extended use by metal and coal mining men

of the information available in the U. S. Geological Survey respecting foreign deposits, is much to be desired, and cannot fail to be of benefit to the investor, to the world trade and prosperity of this country, and to the country in which the mineral resources may lie.

ACTIVITIES OF THE WYOMING GEOLOGICAL SURVEY AND ITS RELATIONSHIP TO THE GROWING MINERAL INDUSTRIES

By G. B. MORGAN, State Geologist, Cheyenne, Wyo.

In Wyoming, the department of State Geologist has always been practically a one-man affair, there being no provision for deputies or technical assistants. However, we hope the next Legislature will enlarge the office and give us sufficient funds to carry on a real campaign of research. It is also desirable that good, workable oil and gas conservation laws be enacted in Wyoming with the creation of the office of Oil and Gas Supervisor in our department, and we are working toward this end at the present time.

Meanwhile, the activities of the office are confined to general publicity work; examinations and reports to the State Land Board, and enforcement of the oil and gas laws, such as we have. The general publicity work consists of collecting and distributing information on oil and gas fields and other mineral deposits of the State; the publication of geological bulletins and maps; and advertising the mineral wealth of the State to the people at large. It is needless to say that one of the most important features of publicity work is answering inquiries and advising prospective operators and investors. For the greatest good of the State, it is just as important to advise unfavorably on propositions without merit as it is to induce capital to come into the State on propositions where the prospects are favorable. Worthless schemes in which stock has been sold broadcast are bound to re-act against the best interests of the State in the future and they will obtain no support from this office.

Work Accomplished in Wyoming

No regular field surveys have been made by this office since 1917. Prior to that time the office had published 8 mineral, 14 oil and gas, and 5 miscellaneous bulletins. Since August 1, 1919, which is the date I went into office, we have published 10 press bulletins on the new oil fields and miscellaneous matters, and have issued two editions of the State geological map.

The work for the State Land Board is of a confidential nature and embraces the following functions:

1. Examinations and reports on the geology and mineral character of State lands, both developed and undeveloped.
2. Examinations and reports on operations of various kinds on State lands, including mining, drilling and prospecting.
3. Reports on the production of oil, gas and minerals from the various State leases and recommendations by which the production and consequently the revenues of the State may be increased.
4. The power to act in a consulting capacity to the State Land Board and advise it in all matters relating to oil and minerals when called upon.

The oil fields covered in these reports in the last two years include Salt Creek, Grass Creek, Lance Creek, Big Muddy, Rock Creek and Elk Basin. In addition, reports have been made on prospective oil and gas lands, coal, potash and other mineral-bearing lands.

Although the State land work does not at present occupy all the time of the State Geologist, it is rapidly becoming heavier and more important. The State has immense holdings in the oil, gas and coal fields within its boundaries, and the royalties from them amount to great sums annually and are becoming larger each year. To protect the State's interests in the various fields often necessitates exhaustive investigations and requires expert knowledge of the technology of petroleum production as well as of mining and geology. Within the next few years this work will probably require the entire attention of one man, especially if conservation laws are passed.

Enforcement of the oil and gas laws of the State is only a small part of the duties of the office. The only conservation laws now on the statute books are the ones prohibiting the waste of natural gas and oil at the wells, and requiring abandoned wells to be plugged. These laws are sufficient for a State in the beginning of the development of its oil and gas fields, but do not at all meet the conditions now existing in Wyoming.

The conservation of petroleum, both in the fields and in the

various processes of production and refining, and the greatest ultimate production of the oil from the sands are the two most serious problems facing this great industry today, and there are no industrial problems before the American people which have a more vital and economic interest to the people at large.

Keeping Ahead of Mineral Development

One of the most important things for any State Geological Department is to keep pace with and, if possible, to be a little ahead of the mineral development in that State.

I am sorry to say that this is not always possible. Financial encouragement from the law-making bodies is not always to be had. We need to do a great deal of educational work to arouse the proper interest in mineral development; to bring home to the people what mineral production is now doing for the State and what the industry may be made to do.

Practically every State in the Union with substantial mineral wealth has built up its geological survey along with its mineral development, and I think it is the experience that the best and most extensive development is being done in the States where the most comprehensive Geological Survey programs are being carried out.

The importance of the mineral industry to our State can hardly be over-estimated, embracing as it does the production of oil, gas, coal, iron, copper and other minerals.

The total production of crude petroleum in Wyoming this year will exceed 16,000,000 barrels, worth more than \$45,000,000 at the wells. The annual coal production amounts to about 8,000,000 tons, valued at \$20,000,000 at the mines. The natural gas produced and consumed in the State amounts to about 21,000,000,000 cubic feet per annum, worth about one million dollars. The average output of iron ore is about 500,000 tons, worth \$1,500,000 at the mines. The copper production aggregates at least \$200,000, and the combined production of other ores and minerals, such as gold, silver, uranium, and platinum, will increase this figure to \$250,000. The gross receipts of the annual production of the less valuable minerals may be set out as follows:

Clay, brick and fire.....	\$105,000
Bentonite.....	10,000
Gypsum	200,000
Soda and magnesia.....	10,000
Phosphate	5,000
Mineral waters.....	5,000
Total.....	\$345,000

Adding to this total the value of our quarry output, our limestone for flux and in beet-sugar mills, our building stone, and our Sherman Hill gravel for railroad ballast, we have a new total of approximately \$500,000 for the less valuable minerals. These totals may be re-assembled for convenience as follows:

ANNUAL GROSS VALUE OF WYOMING MINERAL PRODUCTS AT PLACES OF PRODUCTION

Petroleum	\$45,000,000
Coal	20,000,000
Gas	1,000,000
Iron	1,500,000
Precious metals.....	250,000
Less valuable minerals.....	500,000
Grand total.....	\$68,250,000

Putting this on a per capita basis, it means that the annual mineral production amounts to about \$350,000 per inhabitant, the State having less than 200,000 population.

In addition to the money paid for the raw mineral products of the State, it is well to consider the comparatively large number of men working in the oil fields, in the coal, iron, and other mines, and in the refineries; and also the men engaged in transporting these mineral products and the materials and equipment used in the industry. Millions of dollars in wages are paid to these men yearly. There are three large refineries and a number of small ones in the State, having a total capacity of 78,000 barrels of crude oil per day. By the process of refining, the value of a barrel of oil is increased from \$2.85 to approximately \$7.50 at wholesale prices. Thus, the value of our crude production is increased almost 300 per cent. by the refineries in the State.

Resources of Wyoming

Our undeveloped natural resources are scarcely exceeded by those of any other State of the Union, and of these the mineral resources are by far the most striking. Estimates of the

intrinsic value of our great mineral resources would indeed be very crude and probably misleading, for in the present state of undevelopment there is no market for a great portion of our mineral deposits. The coal measures of the State contain roughly 1,078,620,100,000 short tons of workable coal. The royalty value of this incomprehensible amount of coal at 10 cents per ton is \$107,862,010,000. It will be hundreds of years, however, before the bulk of this coal is mined. With petroleum and gas it is somewhat different. The oil will be largely exhausted in the United States inside of 20 years, and that is also probably true of the oil fields of Wyoming. In that time Wyoming may produce 400,000,000 and possibly 500,000,000 barrels of crude oil. The gas fields of this State appear to be practically inexhaustible, but of course they are not. They are capable of producing about 700,000,000,000 cubic feet of gas annually, while actual consumption is only 3 per cent. of that amount. Much of this gas contains a high gasoline content. Ten million gallons of casing head gasoline are produced yearly, and this can be multiplied many times if industrial utilization of the resultant dry gas can be obtained. Another vast, undeveloped source of crude oil, gas and by-products is the shale. The formation in which our oil-shale is found covers approximately 3500 square miles of territory in Southwestern Wyoming. Some of the deposits are rich in oil and contain considerable gas and ammonium sulphate to the ton of shale. It was estimated by the United States Geological Survey that the shale beds of Northwestern Colorado, which are similar to those of Wyoming, are capable of producing 20,000,000,000 barrels of crude oil. If that is the case, undoubtedly Wyoming shales are capable of producing at least that amount when we consider that the shale area in Colorado is only 1900 square miles, as compared to 3500 square miles in Wyoming.

The State has also many other rich and undeveloped mineral deposits which include those of iron, copper, gold, silver and other precious metals, asbestos, asphalt, bentonite, clay, cement materials, epsomite, fuller's earth, glass sand, granite and other building stones, graphite, gypsum, manganese, mica, mineral waters, phosphate, potash, salt, soda and sulphur, all of which are described in *Press Bulletin* Number 10, pub-

lished October 1, 1920, by the Wyoming State Geologist's office.

Oil-Shales

From data that have been sent in to my office I believe the typical section of the Green River shale deposits to be about as follows:

The surface is sandstone, averaging about 100 feet thick. Underlying the sandstone is a thin but very persistent band of black waxy shale which contains from 60 to 110 gallons of oil to the ton. This bed runs from a few inches to about five feet in thickness. Below the black seam is a brown sandy shale about 12 feet thick, which will average 45 gallons of oil, the oil being very high in gasoline. Then there is a bed of massive paper shale 50 to 150 feet thick, which contains about 20 gallons of oil on an average. Underlying the paper shale is a sandstone member from 40 to 60 feet thick. This is in turn underlain by paper shale from 50 to 200 feet thick, which also contains about 20 gallons of oil to the ton. The whole is underlain by barren shale.

The above section is the result of work done for a distance of about 20 miles south of Green River. Lateral variation of the formation is very pronounced, and there are also a number of faults in this area. It was noted that where the outcrops were abrupt the richest shales were found. As a general rule the paper shales contained a zone of enrichment from 40 to 50 feet thick where the oil content was a barrel or more to the ton of shale. Some of these zones were massive shales of similar character, and in others thin, high-grade seams were found which brought the oil percentage up to considerably more than one barrel per ton.

MINING WELFARE WORK IN UTAH

By C. A. ALLEN

Mining Engineer, United States Bureau of Mines, Chief Mine Inspector for the Industrial Commission of Utah, Denver, Col.

In 1917, the Legislature of the State of Utah passed the Workmen's Compensation Act providing payment of compensation for injuries and creating the Industrial Commission, of three members, to carry out the provisions of the law. The Industrial Commission is both authorized and commanded to take whatever steps are necessary to protect the lives and welfare of the industrial employes in the State. In fulfilling its obligations, the Commission realized that it must not only carry on the inspection of working places, as had previously been done, but that it must go further and combat accidents and disease among employes in every practical way. The members of the Commission selected their chairman, Mr. P. A. Thatcher, to take charge of the safety part of their work, and his efforts and interests have been largely responsible for what good has already been accomplished.

In the fall of 1918 the Industrial Commission entered into an agreement with the U. S. Bureau of Mines whereby the writer was given charge of the inspection work in mines, mills, smelters and quarries.

Education and Accident Prevention

We have realized fully in Utah that the problem of accident prevention is largely a problem of education. For several years public sentiment has been so strongly in favor of placing life and health above the dollar that practically every operator has accepted it as a creed. The miners accept it also, but there is still too large a majority of them who, for the sake of increasing their day's earnings, will take a chance on working under unsafe conditions. This is especially true of contract employes. The question then is to educate the company officials as to how they can best safeguard their men, and to educate the men so that they will not take those chances which sometimes prove fatal. The education of the company offi-

cials, especially foremen and shift bosses in metal mines and foremen and fire bosses in coal mines, is probably more necessary now than ever, for the reason that the scarcity of labor has made it necessary for operators to choose men as bosses who have not had a thorough training in mining. The same, of course, can be said of the miners themselves. A miner who understood every detail of mining, used to be a skilled artisan, talked the language of the miner, and took great pride in his ability as a miner. We can all remember when, if a man could say he was an old Gilpin county miner, or Butte miner, or Leadville miner that it was undisputed evidence that he could not only do anything around a mine, but frequently it was evidence that he could superintend a mine or make a mine examination and report. I believe that we have, today, better miners than ever before, but unfortunately they constitute probably not more than half of the total number of mine employes, and the other half are very seriously lacking in the fundamental training that makes real miners. It is this lack of training in the school of experience that we must now try to make up for by education in other ways.

In Utah, our work so far has been largely with the operating officials, but we have done something with the miner and are planning much more for him in the future. For the officials we have prepared a set of safety standards for metal mines and for coal mines, and in this work I desire to acknowledge the benefits that have been derived from the efforts of the American Mining Congress.

Safety Standards in Utah

In the first place, our safety standards for metal mines were based on the recommendations of a committee first appointed by the American Mining Congress. This committee, as many of you know, worked on a model metal mine inspection law for a number of years and finally it was given the support of the U. S. Bureau of Mines, and its report was published by the Bureau in Bulletin 75. Not only did we base our safety regulations on this bulletin, but after the first draft was prepared it was submitted to a committee consisting of operators and miners, and the operators were chosen by the Utah Chapter of the American Mining Congress.

The safety orders for coal mines were standardized, as far

as possible, with other State laws and with the requirements of the Associated Insurance Companies. These companies had previously standardized their inspection work to compare with the accident reports of the U. S. Bureau of Mines. The coal mine regulations were also passed upon by a committee of operators, and as with the metal mine regulations, the high standing of the operators' committee and their careful consideration of the industry's needs were largely responsible for the value of the regulations.

As before stated, I believe that the safety standards or regulations which we have adopted will be more valuable as a means of education than in any other way. We endeavored to make them sufficiently complete so that all the vital points affecting safety would be covered, and we have expected all bosses and other officials to become familiar with them. It is impossible to make a rule that will cover every case properly, and occasionally we find instances where a certain regulation does not improve the safety at all; but even in such instances the particular regulation in question has caused the mine foreman or some other official to think on the subject, and in that way it has served its purpose by suggesting some way of securing the results desired.

While Utah's fatal accidents are not as low as we might wish, yet a careful analysis of the fatalities shows that not over 15 per cent. were due to unsafe physical conditions at the mines. Our work with employes has practically only been started, due to the fact that we first wanted to deal with the operators and company officials so that we could go to the miners with clean hands and tell them, "We have placed responsibility on the operators to do everything we could think of to make their mines safe, and we now want you to do your part." We have issued an occasional letter to the miners which has been called "Utah's Safety Record," and the interest of the miners has been very gratifying. We have also resorted to the arrest of certain miners who took a contrary view and refused to do what was required of them in keeping their places safe.

Co-operation With, and Education of Miners

In the future, we plan to spend a great deal more time in securing the co-operation of the miners and educating them

as to what are dangerous practices. The "Utah's Safety Record" will be published more frequently, and the Industrial Commission will co-operate with the Bureau of Mines in conducting safety rallies at those mining camps which do not have organized company safety departments. In conducting these rallies, we plan to reach not only the miners themselves, but the women and children, and free use will be made of moving pictures, in addition to personal talks.

As most of you know, Utah stands in the first rank of States from the standpoint of its educational laws. These laws are liberal in providing for Americanization schools, and the State Board of Education, in co-operation with the University of Utah, have already started the Americanization work at the larger mining camps. They are also planning on giving courses in practical mining, which will lay great stress on safety. The lectures for these courses, it is hoped, may be mostly prepared by local men in the industry who are well versed on the different mining subjects which they will present.

PUBLIC SERVICE WORK OF THE INDUSTRIAL COMMISSION AMONG THE MINES AND QUARRIES OF WISCONSIN

By F. W. HUELS

Educational Deputy, Industrial Commission of Wisconsin, Madison, Wis.

This paper chiefly concerns the public service work of the Industrial Commission of Wisconsin, as related to the mineral industries of the State. From this brief outline the contact that the Commission has with Wisconsin's mines and quarries and other mineral enterprises may be judged. It touches these industries in many ways and at various points.

Wisconsin As a Mineral Producing State

Wisconsin does not rank high among the mineral-producing States; less than 1 per cent. of the nation's mineral output being produced within its borders. Yet it is an important mineral producer. It ranks fifth in the production of iron ore, third or fourth in zinc and fourth or fifth in granite. There are something like 350 mines and quarries operating in Wisconsin and about 7000 persons are engaged in mining and quarrying. The mineral production of the Badger State approaches \$30,000,000 annually. The chief mineral industries are: (1) The mining and reduction of ores, such as iron, zinc and lead; (2) the quarrying of stone, such as granite, sandstone and limestone; (3) the digging and working of clay for making brick, tile, etc.; (4) the digging of sand and gravel; (5) the bottling and sale of mineral waters.

Industrial Commission Law

The Industrial Commission devotes itself almost entirely to the conservation of man. The law creating the Industrial Commission provided that "all employment" and "all places of employment shall be made safe." It empowered the Commission to make investigation as to what places are not safe and to provide such safeguards and issue such orders as will make them safe.

In accordance with the powers granted to it and the duties laid upon it by law, the Commission prescribes standards and issues orders for their enforcement. These orders then have the force and effect of law. They are published for the use

of all citizens who may be interested. Any interested party may petition the Commission for a hearing on the reasonableness of any of its orders, and if the petition is denied, he may appeal to the Circuit Court. Violation of any order is punishable by a fine of from \$10 to \$100 per day for each offense, and each day is a separate offense.

The Workmen's Compensation Act

All the mines and quarries of the State come under the Workmen's Compensation Law. This law provides an orderly method of compensating injured workers. Every employer of three or more persons comes under the provisions of this law, which is administered by the Commission. The law specifies in considerable detail the schedule of payments to be made for injuries, methods of computing indemnity, provides for the insurance of liability, gives methods of procedure in hearings, and provides for the awarding of compensation.

In 1919 the provisions of the law were extended so as to include, in addition to accidental injuries, all injuries, including occupational diseases, growing out of and incidental to employment.

The liability of most employers is carried by insurance companies, but some employers, by reason of their financial ability to do so, are allowed to carry their own risk.

A notable feature of the law is the 15 per cent. provision. Where an injury is caused by the failure of the employer to comply with any statute of the State or any lawful order of the Industrial Commission, compensation and death benefits are increased 15 per cent. And this increased compensation must be paid by the employer; the insurance company is not permitted to pay it. Where injury is caused by the wilful failure of the employe to use safety devices where provided by the employer, or where injury results from the employe's wilful failure to obey any reasonable rule adopted by the employer for the safety of the employe, or where injury results from the intoxication of the employe, the compensation and death benefit provided may be reduced 15 per cent.

Orders Affecting Mines and Quarries

The Commission's requirements for safety and sanitation are embodied in various orders and codes. Those which are

applicable to the mining and quarrying industries are shown below:

General Orders on Safety. These cover the safeguarding methods applicable to all industries in general. They relate to such matters as the guarding of belts, pulleys, emery wheels, gears, shafting and all machinery.

General Orders on Sanitation. Including ventilation exhaust systems, toilet rooms and general sanitation.

General Orders on Fire Prevention. Relating to the prevention of fire.

General Orders on Zinc Mines. This will be more fully described in another part of this paper.

Building Code. This is a code of rules and orders specifying standards in regard to the construction, repair and maintenance of places of employment and public buildings, which will make them safe places in which to work or assemble. It relates to such matters as fireproof construction, fire stops, fire escapes, structural design, etc.

General Orders on Existing Buildings. This code has been in effect since 1915 and covers buildings that were in existence at that time and which are not covered by the building code.

General Orders on Building Construction. Safety requirements for workmen engaged in the construction of buildings are covered by this code. It refers to scaffolds, openings and floors, ladders, elevators, derricks and other machinery, piling of material, etc.

Lighting Code. Lighting standards for factories, mills, offices and other work places are prescribed by this code.

Electrical Safety Code. Safe electrical construction is covered by this code. The grounding, guarding and protecting of electrical machinery, distribution system and transmission lines from the standpoint of safety to employes and other persons is governed by this code.

Boiler Code. The frequency of boiler explosion, with the resulting loss of life and damage to property, caused the formulation of a boiler code. It covers the installation, operation and inspection of steam boilers.

The General Orders on Zinc Mines

Since January 4, 1915, the Commission has had a set of general orders on zinc mines. These were originally drafted

by a committee of practical mine engineers and operators appointed by representatives of a majority of the mine owners of the State. In working out this code the committee endeavored to base the standards on actual experience and what was considered by mine owners as good practice. Before their adoption, the orders were submitted to all zinc mine companies in the State for their criticisms and suggestions.

As the code on zinc mines now stands it comprises a group of safety orders relating to shafts, ladders in shafts, railings around top of shafts, hoisting equipment, signal systems for hoists, etc. A section of the orders covers sanitation, including ventilation. Another section gives rules for all employes which are intended to promote safety. Rules for the handling of explosives are given. The code also contains a summary of points of safety and sanitation common to all industries and applicable to all places of employment.

These orders, however, covered only a portion of the hazards in the industry. There have been numerous changes and advances in the arts of mining and quarrying and the code is now somewhat obsolete and inadequate. Consequently, at the present time a new code is being compiled, which will cover mines of all kinds and quarries.

Mine and Quarry Inspection and Accident Prevention

The Commission maintains a safety and sanitation department in which a corps of engineers and deputies is constantly at work inspecting places of employment in regard to matters of safety and sanitation.

These deputies also look for violations of any of the orders of the Commission. The investigation of accidents is one of their important duties. Their work, however, is not that of policemen, but is educational in character. Whenever they can assist employes in making their places of employment safer, they do so. The Commission gladly responds to requests from employers for the services of its deputies and engineers to advise them regarding the specifications and requirements of the safety standards.

Almost from the organization of the Commission it has given attention to accident prevention in mines. Until 1919, however, the Commission did not have any deputy on its staff who had a practical knowledge of mining and mining

methods. The regular district deputies of the Commission inspected the mines in their districts, but since they were not miners, they could do very little more than to inspect the machinery used in connection with the mines. They were not familiar with the underground hazards to which accidents in this industry are principally due.

To cope with the alarming accident rate in this country, a mining inspector was employed in October, 1919. His work to date has been merely preliminary, but he has examined all of the mines in the State and has sought to interest the operators and the mine foreman in safety.

Accidents in Mines and Quarries

Mining is one of the most hazardous of all occupations. Lead and zinc mining in particular has had a bad accident record, and insurance rates for this industry are among the highest known in Wisconsin. Mining was responsible in 1918 for a total of 397 compensative accidents, of which 10 resulted fatally. In 1919 there were a total of 295 accidents, of which 9 resulted fatally. The total loss in working days from these liability accidents in mining in Wisconsin was 93,684 in 1918, and 74,127 in 1919. The reduction in the number of accidents in the latter year seems to have been due to the fact that there were fewer mines operating. The iron mines of the State, with approximately the same number of employes as the lead and zinc mines, have a much better accident record.

The most serious aspect of the high accident rate in mining, and specially in lead and zinc mining, is that a large proportion of these accidents could have been prevented. This could have been accomplished through better mine arrangements and more thorough education of miners in safe practices. Many accidents would not have occurred had the best methods of timbering, handling of explosives, tramming and hoisting been followed. Shaft accidents, which usually result fatally, can be almost entirely eliminated through better equipment in shafts, better hoisting facilities and the rigid enforcement of good operating rules. Buckets and cars in hoisting shafts should be replaced by cages, and continuous ladderways with no landings should be changed for those with landings. Haul-

age accidents can be reduced through the installation of better haulage equipment, and closer attention to its maintenance and operation. Stope accidents and injuries from falls of ground can be greatly reduced through a more careful selection of the men designated to do this work.

The mining practice that is followed in the lead and zinc mines of Wisconsin is the result of years of experience. The fault is not with the practice, but with the abuses of the practice. Most of the operators know how mining should be conducted in different formations, and our miners know how to do the work, but the trouble is that they do not always act in accordance with this knowledge. Men engaged in mining underground soon forget the great hazard in their vocation, and special efforts are needed to protect them against becoming victims of their own carelessness and of unsafe practices. Another difficulty is that many of the mining operations are on so small a scale that it is not practical for them to employ a man to look after safety work. Consequently they need the help of the Industrial Commission in accident prevention much more than most other employers.

The quarries of the State employ approximately the same number of persons as do the lead and zinc mines. They have a much lower accident rate, however, with only 79 compensative accidents all told in 1919. These accidents included two fatalities and caused a total loss of 15,379 working days. Even this rate, however, is high, when one considers that most of the quarrying in Wisconsin is done in the open and is, consequently, free from such dangers of metal mining as falls of rocks and transportation of material in narrow tunnels. There is no doubt that with more intensive work in this field it will be possible to reduce this accident rate greatly.

Compensation paid to injured employes in mine and quarry accidents in Wisconsin during 1919 was as follows:

	Indemnity.	Medical Aid.	Total.
Iron mines.....	\$8,740	\$1,790	\$10,530
Lead and zinc mines.....	37,693	11,021	48,714
Quarries	9,367	1,517	10,884
	\$55,800	\$14,328	\$70,128
Total.....	\$55,800	\$14,328	\$70,128

Other Departments of the Commission

Child Labor Department. Under the terms of the Child Labor Law, the Commission has jurisdiction over the employment of children in industry. The law is intended to safeguard the life, health, safety and welfare of minors. Employment of minors is prohibited under certain conditions, and there are certain prohibited employments. Minors under 18 years of age are prohibited from working in or about mines or quarries. A fine of from \$10 to \$200 is provided for each violation of this law. Furthermore, a minor injured while employed at prohibited work is entitled to treble compensation—three times what he would ordinarily be compensated. The insurance carrier is not obliged to pay the extra compensation, but twice the compensation must be paid by the employer direct and the regular compensation by the insurance company.

As a result of the provisions of this law, no children below 18 years of age are employed in the mining and quarrying industries of Wisconsin.

Women's Department. Employment of female minors and adult women in or about any mine or quarry is prohibited by the laws of the State.

Employment Division. The Commission operates 11 free employment offices in co-operation with the United States Employment Service. During the year ending June 30, 1920, this division found employment for 94,770 persons, of whom 76,774 were men and 17,996 were women. Only a small part of the activities of this division related to mines and quarries, the employment statistics for mines and quarries being as follows:

Applications for work.....	88
Help wanted.....	131
Referred to positions.....	88
Positions secured.....	73

THE WORK OF THE STATE GEOLOGICAL SURVEY AND MINING CONDITIONS IN NORTH CAROLINA

By COL. JOSEPH HYDE PRATT

Director, North Carolina Geological and Economic Survey, Chapel Hill,
North Carolina

The North Carolina Geological and Economic Survey was authorized by an act of the General Assembly of 1905 to make special investigations of the mineral resources of the State; investigate and study mining conditions, and examine the geological formations of the State with reference to their economic products. The State geologist is also authorized to arrange for and accept such co-operation from the several bureaus of the Federal Government as can be obtained from these bureaus. He is also authorized to study conditions in other States and co-operate with other States in any way which will be of advantage in the development of the mineral resources and mining industry in this State.

The State Survey also co-operates in every way possible with the other departments of the State, and tries to arrange its program in connection with investigations so that examinations can be made of such mineral products as certain of the State departments and other interests of the State particularly desire. Thus, during the past year, at the desire of the State Highway Commission and in response to the requests from contractors and builders throughout the State, the Survey has been making an elaborate investigation in regard to the location and extent of structural materials, including stone, gravel, sand and certain types of clay. The State Highway Commission is furnished with advanced copies of the field reports of the investigator as they are sent into the home office. The Survey makes it a point to notify the owners of the properties that are being investigated as to the character of the mineral examined, its probable value, etc., and when inquiries come into the office for such minerals, the writer is referred direct to the owner of the property. The owner also, if he desires, is furnished with an advanced copy of the investigator's report on such property. The Survey does not under-

take to make a complete engineer's report on these properties, but where such is desired the owner is referred to competent mining engineers or geologists for such report.

Mining and Treatment Methods Studied

Similarly, in connection with mining methods and treatment of ores for market, the Survey only attempts to make complete investigations in such instances where it is not feasible for the interested parties to have this done by a mining or metallurgical engineer. In many cases the Survey will make a preliminary investigation, determining whether or not something more complete is advisable, and if so the owner is referred to a competent engineer for the work. In other words, it is the policy of the Survey not to undertake such work as is unquestionably the work of the engineer in private practice. There are plenty of investigations and examinations for the Survey to make without undertaking this other type of examination, although there is, of course, some overlapping in its work. In this way, there are the most cordial relations existing between the mining operators and engineers and the survey. This is also true in connection with the other branches of work of the survey in forestry, hydraulics and drainage, and the Survey has the support of practically all the engineers of the State.

In carrying out the provisions of this act, the State Survey has first devoted its time to the investigation of the location of sources of supply of such minerals and rocks as were believed to occur in commercial quantity and for which there was a large market. As these reports were completed, the Survey has devoted more time to more purely scientific investigations relating to methods of mining and treatment of ores. The Survey has also taken up the questions of marketing its mineral products and their utilization in manufacturing industries within the State. With the construction of new railroads into various sections of the State, mineral deposits that were formerly not of commercial value on account of their isolation have become profitable sources of supply of certain minerals, and this often leads to new investigations regarding these particular localities, and the State Survey has always made a special effort to investigate just as early as possible

these areas in order that the people, as well as the railroad company, may reap as full advantage as possible from the construction of the railroad.

Iron Ores of North Carolina

During the past two years the Survey has been making a special investigation of the iron ores of the State in regard to their quantity and present commercial value, due to increase in price of pig-iron and also due to the construction of railroads into certain of the iron fields of Ashe county. These investigations have been made in co-operation with the United States Geological Survey. The State Survey, in addition, has made topographic maps of the areas in which the present commercial iron ores occur in Cherokee, Ashe and Avery counties. The Survey now, in co-operation with the Bureau of Mines, is making an investigation in regard to improved methods of mining and treatment of the iron ores in these two districts.

The Survey has just completed and has in press a report on the limestone deposits of the State.

Each year, in co-operation with the United States Geological Survey, the State Survey collects statistics regarding the mineral production for the current year, and the results are published as an economic paper of the Survey publication. In addition to the statistics, information that is considered of interest is given in regard to the condition of each mineral industry and information is also given in regard to any new methods of mining or quarrying, and when new deposits are opened and developed a description is given of the location of such deposits. In connection with these statistics, a list is given of the names and addresses of producers of these several minerals, the Survey desiring to bring in every way possible the producer in touch with the consumer. The Survey has and is assisting in every way possible the producer to advertise and bring before the public his mineral product. The Survey keeps in touch with the character and quality of the product produced, and is often called upon by the consumer for a statement in regard to the mineral product produced.

The Survey is preparing a new geological map and collect-

ing data and information for a general volume on the mineral resources of the State.

Another phase of the Survey's work that is found to be of value in advertising the mineral resources of the State is co-operating with the State and county fairs in exhibiting the State's mineral resources. The Survey is also authorized to co-operate with expositions in making exhibits.

VISUAL INSTRUCTION OF THE MINING INDUSTRY AS CARRIED ON BY U. S. BUREAU OF MINES.

By M. F. LEOPOLD,

Safety Engineer, Bureau of Mines, Washington, D. C.

The old proverb of "Seeing is believing" is realized more and more each day through the medium of the motion-picture film. Japan, for instance, in educating her people, has abided by the old saying, "One look is worth a thousand words." This is characteristic of every Japanese who seeks information and knowledge of the world's great industries, so that he may bring the same home to his own shores for development.

Education by Moving Pictures

Americans are beginning to realize this same fact, and many industrial organizations have been formed in this country in the past few years whose purpose is to bring before the public the importance of visual instruction and education. From information received by the U. S. Bureau of Education, it is shown that 84% of the universities and other educational institutions in the country are provided with motion-picture apparatus to be used for instruction purposes. At the present time the Military and Naval Academies devote one period each day for the purpose of instructing students in various phases of their military training through the use of motion-picture films. Thirty-seven States have well-organized societies for visual instruction, and through these films are being distributed throughout their respective States. This includes service to every educational institution, from kindergarten to university.

One of the duties of the Bureau of Mines, the Government representative of the mining industry, is to gather and disseminate information to the best of its ability both to educational institutions and the public in general. This has been done in the past in many ways—such as exhibits; publication and distribution of bulletins and miners' circulars; and collecting, pro-

ducing and distributing motion-picture films which show practically every phase of mining and metallurgical industries.

Value of Pictures to Students

Until several years ago there were few of these films in existence, this being due partly to the fact that Congress failed to provide funds for the Government to make such films, while few were produced by mining organizations. When we take into consideration that 1,000,000 men are employed in the mining industry of America, and that many young men are preparing themselves yearly in our colleges to engage in this occupation, we realize fully the necessity of bringing before the student every means that may better acquaint him with the knowledge of the profession.

Recently there was produced by the Bureau of Mines a film called 'The Story of Coal,' and we are informed by coal people that this has done more to acquaint the student and the layman with conditions that enter into bringing the coal from the mine to the consumer than any other means which has been used in regard to this phase of instruction; and although there are about 20 sets of this film in circulation at the present time, the requests now reaching the Bureau cannot be complied with for at least one month after they are received. This will give some idea of its popularity, it being estimated that there are about 30,000 people each month who see this film. The cost of producing it was \$12,000. Funds were provided by the National Coal Association, and the photography was done under the direct supervision of engineers of the Bureau of Mines. This same arrangement has been used in producing various other films, such as 'The Story of Petroleum,' 'The Story of Ingot Iron,' 'The Story of Sulphur,' 'The Story of Asbestos,' and several other subjects now in course of preparation. In each case the funds are being provided by the organization whose mines and factories are photographed, and credit is given them by having the main title of the film read as follows:

Produced under the direction of the United States Bureau of Mines in co-operation with—(name of company providing the funds).

In producing these films, all expenses in connection with the services of the engineers of the Bureau who supervise the work

is paid by the Government. The distribution of films is handled entirely through the Pittsburgh office, the only cost to those borrowing them being the payment of postage from the Bureau and return. However, it is expected that the films will receive proper care and handling, and that they will not be shown at any meeting where an entrance fee is charged, where the Government film is the only one to be shown. Of course, films are often loaned to organizations where an evening entertainment is planned by the use of other films in addition to the Government film, and a small admission fee is charged to defray expenses, such as the rental of the hall, cost of motion-picture operator, etc.

Danger to Photographers

In producing films of the mining industry, it is often necessary to penetrate such places as will require the utmost care, and the matter of safety plays a large part in their production. By this I mean that, should we enter mines containing dangerous gases, it is necessary that the powerful arc-lights that are used shall be equipped with all safety devices. To do this work successfully it was necessary to obtain the co-operation of a film-producing company that has provided itself with the necessary equipment. In the production of 'The Story of Coal' it was necessary to have the full approval of the State Mine Inspector before we could enter the mine, and before producing 'The Story of Petroleum' it was necessary to have the approval of the proper State official of the State in which the refinery was located, as in each case there was the presence of gas, and the matter of safety had to be considered from every angle.

Distribution of Pictures

In the production of a motion-picture film there are several points to be taken into consideration, such as the quality of the photography; the subject should be handled in a careful manner, and after the film is made provision is necessary to see that it is given such distribution as will produce the highest benefits.

In bringing this subject before the sessions of the American Mining Congress I have in mind the matter of seeking closer

co-operation between the Bureau of Mines and schools of mines and mining throughout the country, toward making the films that we have in our possession at the present time do the most work possible from an educational point of view. The large mining companies and organizations that have co-operated with the Bureau up to this time are to be congratulated for the spirit they have shown in providing funds for this work, as not in one single case that I have approached so far has the matter of advertisement been mentioned by them, their first thought being to educate the student and layman in the various activities of the mining industry. In many cases, when I have suggested placing their name on the film for the part they took, they stated that they are not after publicity, but for higher education in the mining profession.

Library of Pictures

If the excellent co-operation that exists at this time between the Bureau and the industry continues, it seems certain that before long the Bureau will have the best existing collection of motion pictures of the mining and metallurgical industries. All engineering schools and similar organizations should be informed of this service offered by the Government, and should avail themselves of the opportunity of using them to the best advantage of all concerned.

It is quite difficult to select all phases of mining and metallurgical industries, and at the same time visit officers of the companies to ask their co-operation, and I feel sure that your help will assist the Bureau greatly in obtaining subjects of great interest. I want all present at this session to feel at liberty to request the loan of these films whenever you desire them, and you may feel assured that the Bureau will co-operate with you in this educational undertaking and I hope that in future you will co-operate with the Bureau toward enlarging its library, as it must be remembered that this library belongs to you and is for your use.

At the present time the Bureau has about 63 motion-picture subjects, some taken as far back as eight or ten years ago. We want to renew these at as early a date as possible, so as to have as complete a set as possible, which will be used not only by schools and colleges, but other organizations as well.

Demand for Films

I received a letter from the Pittsburgh office in regard to calls from the various colleges, and I received a letter from the engineers there that six colleges—Massachusetts Institute of Technology, Cornell University, Columbia University, Lehigh Institute of Technology, University of Illinois and University of Pennsylvania—have applied for the newest films. You may have to wait a month or so to get them.

I hope that we can see our way clear soon, no matter what company produces a film dealing in any way with the mining industry, that they will produce such a picture under the direction of the Bureau of Mines, and those showing it in schools will feel assured then it is correct from an engineering standpoint.

We are also endeavoring to get a safety film that will carry safety to the miner. Our mine-rescue cars are equipped with a picture screen, and we show safety methods to the miner in that way.

All schools of mines are invited to call on us for these films. Columbia and Cornell have had copies of our films printed at their own expense so that they are always available for use without the necessity of borrowing and returning ours.

OIL-SHALE CONFERENCE

THE NEXT MINING PROBLEM

By **MARTIN J. GAVIN**

**Refinery Engineer, United States Bureau of Mines, Salt Lake City, Utah
(Presented by Permission of the Director, United States Bureau of Mines)**

The next mining problem which we are already facing is that of extracting oil-shale. Its importance can be readily indicated by the fact that practically every one who has estimated the costs and profits in the potentially great oil-shale industry, agrees that the cost of mining the shale will probably be the greatest single item in the total cost of producing crude or refined products from oil shale. This general agreement holds whether the whole tone of the estimates are high or low. Addressing this Congress last November in St. Louis, I mentioned the fact that in 1919 the cost of mining oil shale in Scotland represented 53 per cent. of the total cost of placing refined shale products on the market. I also stated as my belief, that mining methods and the possible reduction in the cost of mining oil shale should be given serious consideration, as a reduction of 10 per cent. in mining costs will probably be equivalent in value to a reduction of 10 per cent. in all the other items contributing to the cost of producing refined shale products, or a reduction of 5 per cent. on the total costs. In other words, a reduction of 10 per cent. in mining costs might well be equivalent to a reduction of 25 per cent. in retorting costs.

No Shales in America Mined on Large Scale

Oil shales have not as yet been mined on a commercial scale in this country and therefore we must, to a certain extent, theorize as to the conditions and problems to be encountered in commercial oil-shale mining. Many believe that much of our oil-shale mining can be done by steam shoveling, open-pit or quarrying methods, but official evidence indicates that this

can hardly be the case except in probably rare instances, because shale seams of sufficient richness to be commercially treated are too thin or covered with too much overburden to make steam-shovel mining or other open-pit work economically possible, particularly speaking of the shales of the Green River formation of the Rocky Mountain district.

The only official data available as to the thickness and richness of shale seams are those supplied by D. E. Winchester in bulletins of the United States Geological Survey. Assuming a 25-gallon shale to be commercial, Winchester's reports indicate that the greatest thickness of shale of this quality sampled and tested by him was 23 feet. It is usual to find seams varying from less than 1 inch to 5 or 6 or even 10 feet thick yielding 25 gallons of oil and more per ton. The particular 23-foot seam, sampled across the face yielded, in the laboratory report, nearly 34 gallons of oil to the ton, but this seam occurs between practically barren beds much thicker.

In Mr. Winchester's work, however, he found it quite impossible to measure accurately or to secure samples from the practically inaccessible shale cliffs, which in many places form the top of what remains of the Grand River formation. Those who have visited the shale district along the lines of the Denver & Rio Grande Railroad, are familiar with these great and practically vertical cliffs. In one case, Winchester has reported on a section of the shale strata at a point on Parachute Creek, ten miles north of the town of Grand Valley, Colo. In his report, he estimates the thickness of the overburden which forms the top of the cliffs, as about 150 feet. Below this is 125 feet of oil shale which he estimates will yield 15 gallons of oil to the ton. Below this is 75 feet of shale estimated to yield 30 gallons to the ton on the average. Next is 25 feet of rich shale, a sample of which taken from a 5-foot seam near the middle yielded on test, 42 gallons of oil to the ton, and below this seam is a 30-foot bed of shale estimated to yield about 30 gallons per ton. Below this is the usual sequence of narrow strata of fairly rich material separated by barren or low-grade beds. In this particular case we have 130 feet of shale which Winchester estimates will yield in excess of 30 gallons of oil to the ton on the average, covered with 275 feet of practically barren overburden, according to his estimates.

If these estimates are correct, and if this section is representative of any great part of the upper portion of the Green River formation, the matter of mining takes quite another attitude. It would seem, in a case such as the above, quarrying or steam-shovel methods could be used which would reduce the cost of mining shale far below that which could be expected if underground methods had to be used, although there is a great thickness of overburden to contend with.

Unfortunately, it was not possible in all cases for Mr. Winchester to secure samples of the shale strata. Many of his figures are estimates, both as to thickness of the bed and oil yield, and the majority of his samples, when they were taken, were from near the outcrop, and therefore may not indicate accurately the richness of the shale a few feet back from the surface, a point brought out by Mr. Winchester in his reports.

Underground or Surface Methods

It seems to me highly important, in view of the relative magnitude of the cost of mining oil shale and the difference in cost between underground mining and quarrying or steam-shovel operations, that the thickness and quality of the oil-shale deposits of the country be ascertained as speedily as possible, preferably by examination of samples obtained by core drilling. The cost of core drilling is such that with the present appropriations the Bureau of Mines cannot undertake to do the work, and I doubt if the Geological Survey, to which such a problem properly belongs, is any better able than the Bureau to do the work for the same reason. However, we are doing all we can to have examinations of this nature made in some manner, either by private or governmental action or both, because we believe the results of such work will be invaluable at the present time and a matter of great interest to everyone concerned with oil shales in this country. Core drills should also give a good idea of the persistence of individual shale seams, many of which, according to Winchester, vary in thickness a great deal from place to place.

From the data we now have at our disposal, it seems that while preliminary mining, in many cases, may be carried on by benching and quarrying methods, possibly followed by a period of stripping operations after a short period of large

scale development, practically all the shales will be mined by underground methods.

Oil-shale is the raw material from which shale-oil is produced. Therefore, important consideration must be given to the relative position of the retorting plant and the mine and to the transportation of shale from the mine opening to the plant. In one way, mining methods are related to the retorting of the shale. The method used for mining will, to some extent, possibly depend on the type of retort used. If the retort is designed or operates best on coarse material, the mining method should be one which produces a minimum amount of fine material. If fine can be treated in the retorts, except for disadvantages in handling, there will be no objections to producing fines.

Mining Shale May Be Similar to Mining Coal

The methods used in mining shale underground will probably be very like those employed in coal mining, but until shale is mined in quantity the exact details or methods are impossible to predict. It is probable that the room-and-pillar method commonly used in mining shale in Scotland and in mining coal in the Western States will be largely used. This method consists in driving entries from which rooms are turned at suitable intervals. Pillars of size sufficient to support the roof are left, but the amount of shale recovered by this method and the size of pillar left are indeterminate until actual shale mining operations have been carried on. Naturally, the size of pillars necessary to support the roof will vary in different localities and on different seams. Many of those planning to mine oil shale in this country have informed me that they expect to use the room-and-pillar method after a short period of open work.

The room-and-pillar method is used generally for mining shale in Scotland, although the longwall system is used to some extent. Commonly, a shaft or incline is sunk to the main shale seam, and galleries are extended from the bottom of the entry in all directions ultimately to the limits of the deposit which it is decided to take out through the one opening. Proper provision is made for ventilation, drainage and shortest haul to the main gallery. A shale working must be provided with two openings, as it is unlawful for the men to use the same entry

as that in which the shale is hauled. In the most modern mines, the shale is raised to the surface in cars hauled by endless ever-running steel cables.

After the galleries have been extended to the limits previously indicated, the pillars, which are usually much larger in cross section than the galleries, are removed, working from the outside back towards the entry. About 25 per cent. of the shale is left in the ground in the form of small pillars and finally divided refuse mixed with shale of poor quality. The roof gradually sinks in behind the maximum removal of shale and in most cases the movement is transmitted to the surface of the ground.

Methods in Scotland

In Scotland there are several shale seams overlying one another. In general, there are at least three workable seams extending over the whole area. It is the usual practice to mine out these seams in sections from the same entry. Electric power and lighting are used throughout the mines.

On an average, a man working at the face, mines about $4\frac{1}{2}$ tons of shale a day. The miners and their helpers—a miner has one helper, sometimes he has more—are considered as men working at the face. The miner furnishes his own powder and lamps. The company sells him powder and oil for his lamps at cost. The company furnishes the drills and dresses them free of charge.

With few exceptions, holes are drilled by hand-operated ratchet drills. Electric-driven drills have been used, but for an unexplained reason have not been generally adopted. Usually gunpowder is the explosive used in breaking down the shale, its slow combustion causing a rending action and reduces the amount of fines produced to a minimum, an important consideration in the working of a Scotch retort. About three-quarters of a pound of powder is used per ton of shale mined.

According to Caldwell (Page 119, Oil Shales of the Lothians), the gases found in shale workings though not of the volume of those in coal seams, are of explosive and dangerous character. The most common is fire-damp or methane, which is given off by the strata. This gas, being lighter than air, is found in the raises and in holes and cavities in the roof. It

also accumulates in large quantities in the waste, especially in old workings, where it is subject to expansion by a fall in barometric pressure, causing it to come out to the haulage-ways. Ordinary precautions in regard to ventilation in such circumstances are sufficient to deal with these outbursts, but if the precautions are neglected, there is grave danger of explosion. This gas is not often found in the levels, but its presence there is accounted for by fissures. In cross-cut driving it often escapes from these fissures, especially when approaching the shale seam, and it may be found necessary to do this work with closed lamps instead of the naked light invariably used in shale mining.

Another gas, carbon dioxide or black damp, is found in the shale seams, but not in sufficient quantity to be harmful.

Professor Gray of Glasgow Technical College has analyzed gases found in the shale mines. Three samples taken at a working face averaged 0.16 per cent. carbon dioxide and 0.037 per cent. methane. In the return airway ten samples averaged 0.158 per cent. carbon dioxide and 0.049 per cent. methane. These quantities are, of course, too small to cause concern.

The dust of Scotch oil shale is not explosive and is non-flammable in the presence of mine gas explosion, but rather tends to be a retarder of gas explosions.

The mining of oil shale in Scotland is subject to the same laws that regulate the mining of coal in Great Britain, and these laws are rigidly enforced. It is undoubtedly due to the enforcing of these laws that so few accidents have occurred in Scotch shale mining.

Drilling Machines for Shale

I would call attention to the use of hand drills in Scotch mines. It would seem that power drills can and will be used to advantage in American shale workings. Some believe that percussion drills will not be satisfactory in mining shale on account of its toughness, but no doubt coal-drilling augers of various types should be satisfactory. Other modern mining methods will undoubtedly be applied to American shale mines. Already I have had called to my attention two or three proposed new types of undercutters and breaking-down machines, especially designed for working oil shale. Mechanical shovellers and car loaders will undoubtedly be used. In place of

using black powder, the American oil-shale miner will probably use some of the low-grade ammonia dynamites, or other slow powders. American shale, as a rule, it would seem, can be shot harder than Scotch shale, particularly as it is less brittle than the latter. In general, it is to be expected that every effort will be made to cheapen operations by the use of modern methods, many of which, however, cannot be economically applied except on large scale operations.

The output of shale per man in Scotland seems very low compared with the output of coal per man in America. It is generally recognized, of course, that the American miner is the best in the world, and the American coal miner produces much more coal than the average British miner. In the case of shale in this country, conditions are much more favorable for cheap mining than they are in Scotland, in as far as the shale itself is concerned. The Scotch shale seams are comparatively thin, extensively folded and faulted to a considerable extent. Most of the shales in this country lie practically horizontal and evidently are not faulted or contorted to more than a minor extent. All of this makes for cheaper mining and the application of modern mining methods should tend to reduce costs still more. On the other hand, the cost of mine labor in this country will undoubtedly be somewhat greater than the similar cost in Scotland.

Eventual Labor Required for Shale Mines

The question of securing mine labor is a problem that must be given consideration. From every indication the oil shale industry is ultimately going to be one of great extent and importance. It has been calculated that in order to replace the crude oil produced in this country with shale oil, there will have to be mined half as much shale per year as the amount of coal extracted annually. Of course, no one expects the American shale-oil industry to replace petroleum over night. It will gradually grow from comparatively small scale developments, but ultimately the industry will be such that the labor necessary will be comparable with that required in our coal mining industry. This labor will be secured, housed, fed and negotiated with, probably through the same types of organizations as are now employed by our coal miners. In most cases this labor will be obtained from districts remote from the shale

fields and they will have to be housed near the mines in a region generally sparsely populated. When the shale industry reaches one of national importance, there will be many small cities scattered through the shale districts for the housing of labor employed in the mines and retorting works.

It has been common to assume that there is no danger of encountering explosive gases in shale mines. As long as the Scotch mines have been well ventilated, as I have mentioned, there has been no difficulty on account of gas—likewise no trouble has been experienced on this account in the Australian shale mines, many of which yield shales much richer [up to 100 gal. per ton] than those so far noted in this country.

It would not be safe, however, to assume that because gas has not been found in dangerous quantities in working shales in foreign countries that it will not be found in working American shales. In the first workings, at least, care should be taken to provide the same precautions against gas as are provided in coal mines. This would seem to be especially pertinent in view of the fact that gas seepage near the shale deposits are not at all uncommon.

As to the explosibility of shale dust, I am able briefly to report on tests made at the Pittsburgh laboratories of the Bureau of Mines. A sample of Colorado shale, which contained 0.35% moisture, 37.27% volatile and fixed carbon, and 62.38% ash was received at the Pittsburgh station and pulverized to approximately 200 mesh. This sample, according to our investigations, would probably yield about 38 gallons of oil to the ton. It was tested in the regular horizontal dust explosion gallery. The conclusions of the experiments indicate that the oil shale cannot be considered as a highly flammable dust. The dust will probably not be ignited by the flame from an ordinary blown-out shot, but is fully capable of propagating an explosion once started. It would be interesting to have similar tests made with richer shales, and it is my purpose to have such work done at as early a date as possible.

Shales in the Eastern States

In considering the rich and enormous shale deposits of the West, it will not do to neglect consideration of the lower grade black shales of the Eastern States particularly Missouri, Illinois, Kentucky and Ohio. While these shales apparently

are very much poorer in quality than much of the shale in the West, a great part of them can be mined by stripping or quarrying operations, which, by reducing cost of mining, may make them nearly, if not quite, the equal of some of the Western shales. The Bureau of Mines is paying considerable attention to the shales of the Eastern States. Other conditions than the relative ease of mining some of the Eastern shales tend to offset their low oil yield. Many of the Eastern shale deposits are situated in densely populated regions, well provided with transportation, close to a market and also well provided with labor.

In concluding, I wish to quote from "The Kerosene Shale Deposits of New South Wales," by J. E. Carne, regarding the mining of the very rich Australian shales, not because I believe the conditions at all comparable with those in this country, but because I believe you will all find it a very interesting condition of affairs:

Shales in Australia

"Both "longwall" and "pillar and stall" systems of extraction have been adopted; in the latter the pillars are subsequently removed. In the present working mines—Genowlan and New Hartley—the workings are on the "longwall" system. Here explosives are unnecessary for breaking down the seam; on the contrary, great danger is experienced from the continuous cracking and shooting of the kerosene shale as the roof settles on the face. The unyielding nature of the top-holing, which consists of a band of hard cannel forming the top of the shale seam, affords no relief to the vertical pressure. Where soft bituminous coal forms the roof, it gives or crushes under stress, and thus, to some extent, relieves the enormous pressure of the superincumbent coal measures and overlying Hawkesbury Series on the tough, semi-elastic kerosene shale. Where lateral expansion is rendered possible by open spaces, i. e., working-faces, the tension is so great that cracking and shooting are almost continuous as settling proceeds. Further release by holing is therefore attended with considerable risks to the miners who are compelled to work behind breast-boards and cover their eyes with wire-gauze guards as protection against flying fragments of keen-edged shale. The tendency of kerosene shale to conchoidal fracturing under stress at

right angles to the stratification increases the development of sharp edges, which cut like knives. Numerous accidents have resulted, some unfortunately attended with serious impairment of sight.

Similar phenomena have been noted by Mr. E. C. Andrews, geological surveyor, in connection with the "kicking" or "spitting" slate of the Baker's Creek Proprietary gold mine at Hillgrove, where an unfortunate miner was cut in two by a large flying fragment which had previously passed through a 3x2-inch scantling. The slightest disturbance of the apparent equilibrium between compression and expansion, caused by drill or hammer, in this instance, also caused sharp-edged conchoidal fragments to fly off with extreme violence.

At Joadja, where the overburden is greatly less, and where also in the early workings soft bituminous coal formed both top and bottom holing, the tension of the face was so slight that no trouble was experienced from "shooting." In the present workings under heavier cover, with the pressure unrelieved by a yielding coal medium on roof or floor, a tendency to "shoot" is being manifested. Explosives (gelignite) are used for breaking-down, as it is also used at Genowlan, together with compressed powder for "brushing" or deepening the roadways, the latter being used in the New Hartley workings.

None of the kerosene shale workings have been troubled with fire-damp, naked lights always being used, in which paraffin wax or heavy oil is burned. Scotch shale-mining is similarly free from natural gases. Ventilation in all cases is by air-shafts and furnaces."

From the oil shales of the United States we receive the comforting assurance that the nation has a domestic source of hydrocarbon oils and thus will not be dependent on foreign sources of supply for a product of such great economic importance as petroleum. The sooner the oil-shale industry becomes commercial, the better, but it does not seem possible that it can be developed rapidly enough to have an appreciable effect on the present acute petroleum situation.

MINING OIL-SHALE

By HORACE F. LUNT, State Commissioner of Mines, Denver, Col.

I hope none of you expect me to tell you how to mine Colorado oil shale; if you do I must disappoint you. All I can do is to try to outline the problems that are likely to be met and their possible solutions.

Extent of Shale Mining in Colorado

It is true that oil shales have been and are being successfully mined in Scotland and elsewhere, but the physical qualities of the shale, the manner in which they occur, and the general conditions are sufficiently different to make it impossible to rely on them for definite data by which to guide our embryo Colorado industry. The only mining work in our shale fields thus far has been digging assessment holes and gophering out a few hundred tons here and there. As yet no one in Colorado has really started to develop a mine, and until systematic mining is actually started we can only rely on experience drawn from other more or less similar forms of mining.

Practically everyone capable of judging intelligently who has investigated the possibilities of the commercial utilization of our oil shales is convinced that to make the operation profitable, it will have to be conducted on a fairly large scale, say at the rate of 1000 tons or more per day.

If there were only one stratum of oil shale it would be comparatively easy to figure out how it could best be attacked. As it is, the Green River formation extends for hundreds of feet vertically with strata of oil shale varying in thickness from a few inches to scores of feet scattered all through it. Their dip is only a few feet to the mile. Present information is not sufficient to enable us to say how much oil the shale must yield to make it workable, and data as to the exact content of the various strata is far from complete. Mining may be started on a 6-foot stratum or on a series of strata 50 or 60 feet thick. Obviously, the methods that would be used for mining a deposit 8 or 10 feet thick would not be suitable for one of 50 feet. Under the circumstances any discussion of

mining methods must be based on a more or less uncertain assumption.

There has been considerable talk about mining Colorado oil shale with steam shovels, but the best information at present available seems to indicate that any deposits which can be so mined are too inaccessible to make it probable that they will be exploited in the early days of the industry. Consequently, I feel reasonably safe in assuming that, in the beginning, underground methods will be used. I also believe it unlikely that the first operations will extract deposits more than 8 or 10 feet thick. The richer shales will naturally be worked first, and to mine the thicker beds would mean, almost certainly, that lower-grade material would be obtained. This points to the use of coal mining methods. As the shale will have to be crushed before going to the retorts, there will be no reason for following the under-cutting methods usually practiced in mining coal; it will be "shot off the solid," to use the coal mining term.

Little Timber Required

The oil shales, as well as the other Green River shales, are strong rocks which will stand well in mine workings, so that a minimum amount of timbering will be required. The shales show no tendency to swell and the workings, once opened, will probably remain in good condition indefinitely. This quality precludes the use of longwall and suggests room-and-pillar methods. The great area of the deposits will obviate the necessity of pulling the pillars in the early stages of the operations; they can be left to preserve the workings until experience shows how far this is necessary or desirable.

As the shale beds are practically flat, there will be no natural air currents through them and artificial ventilation will be necessary. Here again we have a similarity to coal mining practice.

I can speak more definitely in regard to breaking the oil shale. Although systematic mining has not yet started, the matter of drilling and blasting has been investigated by a number of competent people, and the preponderance of opinion is that the oil shales can be more effectively drilled with an air auger than with any other type of machine. Permissible explosives, which have a strength between that of ordinary

dynamite and black powder, have been found most suitable for similar types of rock elsewhere and will, doubtless, be used in the oil-shale mines.

The subject of costs is interesting and important, but until commercial operations are actually under way authoritative data will be unavailable. However, reasonably reliable estimates have been made. These point to a total mining cost, including equipment, development, operation, repairs, and all the overhead expense properly chargeable to mining, of between \$1.50 and \$2 per ton on an operation of not less than 1000 tons per day. While the actual expense of breaking would be little or no more in operating on a smaller scale, the overhead per ton would undoubtedly be greater. Personally, I believe the cost will be nearer \$2 than \$1.50. This, of course, refers to underground mining. It steam-shovels can be used the cost should not exceed 50 cents per ton.

No Gas in Shale

Present information indicates that oil shale gives off no gas, flammable or otherwise, and that no danger may be anticipated from that cause. However, there is a possible source of danger from the vast quantities of natural gas known to exist in the underlying formations. It is quite possible that there may be crevices by which this gas can find its way into the oil-shale strata; if such a crevice should be cut by mine workings, and the gas released, a disastrous explosion would be almost sure to result unless precautions be taken to detect the presence of flammable gas before it can be ignited. Preliminary experiments by the United States Bureau of Mines indicates that the oil-shale dust is not explosive, but that it will propagate an explosion. Further experiments will be necessary before the explosive properties of the dust are fully determined. The fact that the oil shale is easily ignited will make it necessary to guard against setting it on fire in the mines.

Wastefulness has generally been an unfortunate characteristic of new mining operations. The first-comers have taken what they could save and allowed much material that might have been used in the coming years to be dissipated or destroyed in one way or another, when more forethought might have preserved it to add to the wealth of future generations. Thousands upon thousands of ounces of gold and silver, not to

mention the base metals, have been carried down our streams in the form of what would now be considered high-grade tailings. Thousands and thousands of tons of coal have been destroyed by the careless methods of early-day mining. In many cases, in both coal and metal mines, the cost of mining today is greatly in excess of what it would be if these mines had been properly planned and opened in the beginning.

I do not wish to blame the pioneers for what they did in the past, but I do want to do all that I can to prevent a repetition of their mistakes. What can be excused in the past would be inexcusable in this more enlightened age. I do not mean to imply that we should, in starting the Colorado oil-shale industry, leave the richer shales for our children, but I hope that the possibility of the future use of the poorer shales and the less accessible rich shales will not be lost sight of. In starting this new industry, which seems destined to become one of the greatest in the State, let us look forward and lay our plans so that those who come after us may have no cause to find fault but rather be forced to commend the wisdom and foresight of their predecessors.

THE OIL-SHALE INDUSTRY IN SCOTLAND AND ENGLAND

By DR. VICTOR C. ALDERSON, President, School of Mines, Golden, Col.

Introduction

In Scotland, oil shale is an established industry, operative since 1850, and embraces the mining of the shale, the retorting or production of crude shale oil, the refining of the oil into its various commercial products, and the marketing of these products. The profit on each ton of shale mined is approximately two shillings or, under normal exchange, 50 cents. For each ton of shale mined there is one employe, i. e., the total number of employes of all kinds is virtually the same as the number of tons of shale mined each day. The oil-shale problem in Scotland embraces the cost of supplies, cost of labor, efficiency of labor, and selling price of the marketable products; in other words, the margin between the cost of production and the selling price. In England, the problem is quite different. There are no commercial oil-shale plants, as like in the United States, there are extensive deposits of oil shale, rich in oil, but, unfortunately, with an excess of sulphur, 6 to 8 per cent. or more. This makes the resulting oil virtually worthless for any purpose except for fuel. For this reason, the great problem before the oil-shale industry in England is a method of removing this sulphur from the shale during the process of retorting, or from the crude oil, without spoiling the oil. Until this technical problem is solved, the oil-shale deposits of England are commercially worthless.

Scotland

The Scottish Oils, Ltd. is a consolidation of the six original Scottish oil shale companies—the Oakbank Oil Co., Ltd.; the Pumpherston Oil Co., Ltd.; the Broxburn Oil Co., Ltd.; Young's Paraffin Light and Mineral Oil Works, Ltd.; James Ross & Company; Philiptown Oil Works, Ltd., and the Dalmeny Oil Co., Ltd. The capital stock of Scottish Oil consists of 4,000,000 shares (par value £1=\$5), divided into 1,000,000 ordinary (common) shares and 3,000,000 preference (preferred) 7 per cent. non-cumulative shares.

In giving the American equivalent for English money \$5 has been assumed to be the equivalent to the English pound sterling. In order to get the exact value the prevailing rate of exchange should be considered.

The Anglo-Persian Oil, Ltd., controlled by the British Government, has acquired a controlling interest in Scottish Oils, Ltd., and has agreed to furnish from January 1, 1923, supplies of crude petroleum in such quantity as may be needed, in addition to the crude shale oil produced, to keep the present refineries of Scottish Oils running at full capacity. Of the six constituent companies in Scottish Oils, the Broxburn and Youngs are engaged in mining, retorting, refining, candle making, and the manufacture of sulphuric acid; Oakbank and Pumpherston are engaged in mining, retorting and refining. James Ross & Company and Dalmeny are limited to mining and retorting.

Statistics for 1915, 1916, 1917, 1918

Employes.	1915.	1916.	1917.	1918.
Underground	3,856	3,821	4,582	4,153
Above ground....	702	702	742	767
Total.....	4,558	4,523	5,027	4,920
Total production (long tons)....	2,992,676	3,009,232	3,116,529	3,000,317
Average price re- ceived per ton.	\$1.39	\$1.71	\$2.05	\$2.47
Total value of an- nual product...	\$4,176,000	\$5,161,470	\$6,395,000	\$7,640,390

In 1919 the total production of crude shale was 2,758,555 long tons.

	1915.	1916.	1917.	1918.
Average yield of crude oil (in gallons)...	20	20	20	20
Ammonium sulphate (in pounds).....	44	44	40	40

Dividends Paid (fiscal years):

Pumpherston:	1914-'15.	1915-'16.	1916-'17.	1917-'18.	1918-'19.	1919-'20.
	%	%	%	%	%	%
First preference.....	6	6	6	6	6	6
Second preference..	6	6	..	..	..	..
Ordinary	10	25	40	40	40	60
Oakbank:						
Preference	6	6	6	6	6	6
Ordinary .....	..	10	15	15	15	10

Broxburn:

Preference	6	6	6	6	6	6
Ordinary	7.5	15	15	15	12.5

Youngs:

Ordinary	5	6	6	2.5
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On February 10, 1920, the Scottish Oils, Ltd., the consolidation of all the Scottish oil-shale plants, paid a semi-annual dividend of 3.5 per cent. on its preference shares.

Mining

At the Westwood pit of the Oakbank Company shale is now being mined from the middle Dunnet seam at a depth of 640 feet. Upper seams were worked from a shaft now abandoned. One large fault with a throw of 300 feet and many small faults have been found. A vertical shaft was opened four years ago, after numerous bore holes had been put down, the exact location of the deposit determined, and a complete plan of development mapped out. The main shaft is circular, 16 feet in diameter, double compartment, brick-walled 14 inches thick. Double cages are used, with room for two cars on each deck. From the bottom of the shaft four main drifts are run, each 12 feet wide, 12 feet high, bricked on both sides and the roof. The working faces are 1680 feet from the shaft. The main drifts are large, well ventilated and lighted by electricity. The seam of shale now being mined is 12 feet thick, on an average, and dips at an angle of 18 degrees. The roof and floor are good, very little timbering is necessary. Cars of shale are drawn by electricity from near the face of the working to the main drifts, then by gravity to the shaft and back to the working faces. This entire plan for moving the shale from the working faces to the surface is particularly efficient and economical, and was worked out carefully before the shaft was sunk. The daily production is 640 long tons. The mine is so free from gas that open lamps are used. The mined shale goes in freight cars to the retorting works at Oakbank. The method used in mining at the Westwood pit is the room and pillar and retreating system. The main drifts are driven and pillars 120 feet square are left. During this stage of operation from 15 to 20 per cent. of the shale is taken out. The extreme boundaries of the ground to be mined through

this shaft are previously determined. When these boundaries are reached the retreating system is followed and the blocks are taken out. Each of the blocks, 120 feet square, is divided by cross cuts into four small blocks; these are then taken out in order. The loss in mining is approximately 10 per cent.

Gas, Gas Explosions and Accidents

No serious gas explosion has ever occurred in any Scottish shale mine. Large gas explosions and fires are virtually unknown. The laws governing the operation of coal mines apply to shale mines, and the same care, method of ventilation and the safety of workmen that prevail in coal mines are enforced in shale mines. A fireman makes the rounds every morning watching for fire damp. Reports of the conditions of the mine are kept and are inspected regularly by Government officials. No gas is ever found in the new workings. Marsh gas (CH_4) is sometimes found in small pockets in old workings. Protection is given by hanging up an open lamp. Occasionally a small fire may occur in one of these old workings and a miner may be slightly burned, but the fire is always local and easily extinguished. Such gas explosions and fires as have occurred in this country where an entire coal mine has been on fire and completely ruined have never occurred in shale mines of Scotland during their 70 years of working. Fatal accidents are also rare. In the past three years only one man has been killed in the Westwood pit. He was killed by the fall of shale at the face.

In the past 12 years, at the Mid Breich Pit of the Pumpherson Company, only three deaths have resulted from accidents.

1. A man was killed by the fall of shale at the face.
2. A careless boy was wound around the drum of an engine.
3. A careless boy fell under the wheels of an ore car.

During these 12 years only one man was burned by gas.

Hours, Wages, Production

At the Westwood Pit mining is done in three shifts of seven hours each; from 7 A. M. to 2 P. M.; from 3 to 10 P. M.; and from 11 P. M. to 6 A. M. All mining is done on the contract or leasing plan. One man is given a block of ground to work, i. e., a lease. He hires his own men, provides all tools, powder and supplies of all kinds, mines the shale, puts it in the cars,

and delivers it to the nearest main haulway. The company then hauls it to the surface. For this the lessee receives from the company four shillings and seven pence, or \$1.14 a ton. The minimum wages guaranteed to each miner is \$3.12, the pre-war rate, plus \$1.25, the war bonus, or \$4.37. If for any reason beyond his control, like a thinning of the seam of shale of encountering a fault, his production at \$1.14 a ton yields him less than \$4.37 a day, the company makes up the difference. If, however, he can increase his production, he is at liberty to increase his daily wage as much above the minimum as he pleases. The average amount of shale mined per day per man is 4.75 tons, i. e., one miner and one man for shoveling and tramping will, on the average, mine 9.5 tons a day; two miners and one trammer will produce 14.25 tons a day. Throughout the shale mines of Scotland the practice is to mine the shale with hand augurs, first with a 1.75 inch and then with a 1.5-inch augur. Black powder is used. The law does not allow an intoxicated man to work and forbids the sale of liquor about a coal or shale mine. Shale miners regard themselves as being on a higher plane than coal miners. They are a self-respecting class, generally married, live in company houses, "dress up" when not working, and generally maintain a good method of living. The methods, wages and features of the Westwood Pit of the Oakbank Company are characteristic of all the shale mines in Scotland.

The Oil-Shale Strata

The oil-shale deposits of Scotland consist of 21 different strata. The yield of oil and ammonium sulphate varies greatly in these different seams in the same seam at different localities; also with the depth of the seams, for example the Torbanehill Mineral, the highest in the series, has given the greatest yield of oil, 130 gallons to the ton, but only a few pounds of ammonium sulphate. In the succeeding strata a diminution of oil and an increase of ammonium sulphate is noticed till at the lowest stratum, Pumpherston No. 5, the oil yield is only 20 gallons to the ton, but the ammonium sulphate has risen to 60 pounds to the ton. Also, the Raeburn stratum was best developed in a very small area in the southwestern part; the Fells stratum was best developed in the western part where other strata gave less oil; the Broxburn stratum

is best at Broxburn; the best part of the Dunnet seam is in the eastern part of the area.

The following tests of Broxburn shale show the gradual decrease in oil content and gradual increase of ammonium sulphate as depth is reached:

	Vertical Depth in Feet								Greatest Depth
	Outcrop	Near Outcrop	438	821	912	—	965	1077	
Gallons of crude oil	31.8	29.6	30.7	24.1	25.8	24.8	22.5	17.3	13.5
Ammonium sulphate (pounds)	9.3	10.5	10.4	15.4	11.6	13.4	9.0	16.6	17.1

Thus, in a depth of approximately 1200 feet, the oil content has decreased from 31.8 to 13.5 gallons, but the ammonium sulphate produced has risen from 9.3 to 17.1 pounds.

The Origin and Nature of Kerogen

Prof. Crum Brown, F.R.S., was the first to give the name "kerogen" to the "carbonaceous matter in shale that gives rise to crude oil in distillation." The exact nature of kerogen and its origin is a matter of controversy among scientific men. The practical bearing of a solution lies in this: If the exact nature of kerogen can be determined, this knowledge may have a practical bearing on the best method of destructive distillation. If the nature of kerogen can be so determined, that it is a foregone conclusion that in the destructive distillation a large amount of unsaturated hydrocarbons (80 to 90 per cent.) will always be formed, then it is a useless task to seek for a retort that will produce only 20 per cent. If, however, the kerogen is shown to be of such a nature that a large production of unsaturated hydrocarbons is due to unscientific methods of distillation, and not to the nature of the kerogen itself, then the successful treatment of shale would not be accomplished until a retort was constructed on such lines as would yield crude oil which contained the minimum amount of unsaturated hydrocarbons.

Organic Theory

In true oil shale there is no crude oil. A very small amount of oil may be obtained by such solvents as carbon disulphide, but the amount is so small as to be negligible in determining the nature of the oil shale itself. Since carbon and hydrogen

compounds produced by inorganic reactions are soluble in carbon disulphide, ether or similar solvents, it seems very probable that kerogen, the source of the oil in shale, since it does not yield to the usual solvents, must be of organic origin. The organic theory of the origin of kerogen assumes that the contents of a shale stratum were laid down in lake bottoms, lagoons or estuaries of the ocean, i. e., fairly quiet waters. By the denudation of the land the clay and sand would be deposited along with the remains of vegetal life from the land and animal life from the water. The very large amount of fossil remains found in the oil shale supports this theory.

The Inspissation Theory

E. H. Cunningham-Craig takes exception to the organic theory. He is a geologist of world-wide experience, has investigated the nature of kerogen by the microscopic study of thin sections, and has correlated oil shale strata with coal seams and petroleum deposits in all parts of the world. His arguments are chiefly geological. His conclusion is that an oil-shale stratum should be regarded as the remains of a former oil-field; that oil-shale fields and oil-fields are not two phenomena entirely unrelated, but are closely associated in origin and development; that kerogen is "not the mother but the daughter of petroleum." American scientific men and D. R. Stewart, the Scottish authority on oil shales, generally favor the organic theory, but the wide geological observations of Cunningham-Craig and his keen analytical powers demand careful consideration of any theory he may propound. The whole question is one of supreme practical importance, and much additional observation and research are necessary before the nature and origin of kerogen can be regarded as accurately determined.

Retorting

The Scotch retort now in use is a double-chambered vertical retort designed not to produce the maximum amount of crude oil, with ammonium sulphate as a secondary consideration, but for the purpose of securing the maximum yield of ammonium sulphate, with the yield of oil a secondary consideration. Since most of the American oil shale thus far tested gives a high yield of oil and a comparatively small amount of ammo-

nium sulphate, the present Scotch retort cannot be advantageously copied, *in toto*, with a reasonable expectation of satisfactory commercial success. The older Scotch Henderson retort, which was designed primarily for the production of oil is more likely to meet the conditions of American shale than the present type. This type, with modification, or some form of a horizontal retort not yet perfected, is most likely to be successful on our American shales.

The present Scotch retort is composed of two chambers, one above the other. The upper chamber is made of cast iron, 11 feet high, 2 feet in diameter at the top and widened to 2 feet 4 inches at the bottom, so that the shale may drop down without clogging. The lower chamber is 20 feet high, enlarged at the bottom to 3 feet in diameter. Shale is fed in at the top from a hopper and descends gradually by gravitation through the retort, and is removed as spent shale at the bottom. Heat is applied around the retort from the non-condensable gases produced by the retorting. Generally, enough gas is produced from the shale itself, but when lean shale is being retorted, the amount of gas is insufficient. At such times an auxiliary coal-fired gas producer is used to supply the necessary amount of gas. The gas enters at the bottom and is forced to circulate around the retort. Into the lower chamber exhaust steam is injected and a temperature of about 1800° F. is maintained. Here the ammonia is formed by the combination of the steam and the nitrogen in the shale. The oil and gas are formed in the upper or cast-iron chamber at a temperature of about 900° F. Thus the raw shale enters at the top, is subjected to a heat of 900° F., oil and gas are formed; the shale then drops gradually down through the retort; in the lower chamber it meets the incoming steam, it is subjected to a heat of 1800° F. and ammonia is formed. The entire product, consisting of ammonia, water, vapor, oil and gas, sweep upward through the retort and pass out through a large pipe to the condensers. Here the permanent gas is drawn off and goes to the scrubbing tower. The crude oil and water, containing ammonia, flow into separator tanks where, by the difference of their specific gravity, the oil and water assume different levels and can be drawn off separately for further treatment. These retorts are erected in groups of four; a series of these groups forms a bench; the daily (24-

hour) capacity of a retort varies from two to four tons of shale; the time required for the passage of shale varies with the amount of oil produced; the richer the shale, the longer the time required; poorer shale is retorted in less time. No basic changes have been made during the past 25 years in the type of retort now in use. Improvements made have been of a mechanical nature in connection with the feed and the discharge, and in the change of the horizontal section of the retort from a circular form to an elliptical or rectangular form.

Refining

The products of retorting and condensation are as follows:

(a) GAS:

Permanent gas is drawn to the tower to be scrubbed and then returned to the retorts to be burned in heating the retorts and retorting more shale. In the scrubbing process in the tower, crude naphtha is obtained. This is treated with acid and soda and distilled to get motor spirits and finished naphtha, both ready for the market.

(b) CRUDE OIL AND AMMONIACAL LIQUOR:

These go from the condenser first to the receiving tanks and are settled—crude oil (c) at the top and ammoniacal liquor (d) at the bottom.

(c) CRUDE OIL IN THE RECEIVING TANKS:

This goes to the refinery and in the first stage is distilled to get green oil (e).

(d) AMMONIACAL LIQUOR:

This is distilled and put through sulphuric acid boxes to get the mother liquor; this is concentrated to get the ammonium sulphate ready for the market.

(e) GREEN OIL:

This, in the second stage, is distilled and gives:

(f) A little naphtha.

(g) Crude burning oil.

(h) Heavy oil containing paraffin.

(h) HEAVY OIL CONTAINING PARRAFFIN:

This is frozen and pressed to get blue oil (i) and crude paraffin (j).

(i) BLUE OIL:

This is treated with acid and soda and distilled. The distillate is fractionated into gas oil, medium oil and lubricating oil. The gas oil is ready for the market.

The medium and lubricating oils are treated with acid and soda, are settled, and are ready for the market.

(g) **CRUDE BURNING OIL:**

This is treated with acid and soda and is distilled. It gives as finished products ready for the market:

1. Power oil for internal combustion engines (gasoline, petrol).
2. Lamp oil.
3. Lighthouse oil.

(j) **CRUDE PARAFFIN:**

This is run on the top of water in pans and cooled. The water runs off leaving the paraffin. The doors of the sweating-house are closed and the heat is turned on. The gentle heat sweats off the excess of oil out of the paraffin. The melted paraffin wax from the sweating-house is mixed with charcoal and put through the filter-press. The charcoal is separated from the paraffin. The paraffin is then put into tins for the form and size and becomes a finished product ready for the market. The Henderson sweating system has been used, without material change, for the past 30 years.

The residues from the feed boilers (stills) go to the coking stills and run to dryness. Coke if left. The heavy portions of the distillates, besides coke, are sent to the proper part of the plant. The coke is sold to the aluminum works, is used for fuel in smelting works, or as carbons for lighting purposes. It has less than 1 per cent. of volatile matter.

Tars from the acid washings are neutralized with tars from the soda washings and the resultant tars are burned in the furnaces.

All residues are sent to their proper places in the plant. The acid and soda treatments take out the unsaturated hydrocarbons and unstable bodies and improve the color. There is a good market for all the products. The refining loss is approximately 25 per cent.

General Observations

Very little has been published about the Scottish oil-shale industry in recent years; little that is new has been developed; standard practice has been adopted and followed; the criterion has been the declaration of dividends; the scientific side has not been studied to any great extent; the early days were

the days of rich shale; the Henderson retort was designed to treat these rich shales—30 gallons or more. This retort was discarded, the present double-chambered retort adopted, and shale yielding less oil was treated, not because deposits of richer shale were exhausted, but because the leaner shale was easier to retort, gave a crude oil that was easier to refine, produced better commercial products and contained more nitrogen and, consequently, more ammonium sulphate. Thus the leaner grade of shale gave better commercial and financial results, i. e., made more money. Ammonium sulphate now brings £22 (\$110 normal exchange) a ton at the works for home consumption; for export it brings £56. It is used largely by the sugar beet and cane sugar growers.

The methods used in the Scottish laboratories to determine the oil and nitrogen content are simple, but check closely with large scale results.

Oil Content.—Two pounds of broken shale are placed in an iron tube, sealed at one end, 7 feet long and 2 inches in diameter. The sealed end is pushed gradually into an oven. The gas and oil vapors coming out of the tube are simply caught, weighed and measured roughly.

Nitrogen Content.—An iron tube 3 feet long and 1 inch in diameter is filled with raw shale and placed in an oven. Heat is applied slowly and steam is injected. Vapors are drawn off and sulphuric acid is added to get the ammonium sulphate.

The purpose of the Anglo-Persian Company in acquiring the oil-shale properties in Scotland was apparently to secure the extensive and well developed organization, i. e., the refineries, the trade-marks, the distributing machinery, customers, technical men, skilled workmen and the market.

The Oil Shale of England

The oil shales of England occur as well-marked strata in the formation known as the Kimmeridge clay. This formation takes its name from the little village of Kimmeridge, in the south of England, two miles from the coast line of the English Channel, near which the formation outcrops and where it was first studied. The formation, about 900 feet thick, has been determined by bore holes and outcrops over a large area of England, viz.: in Dorset, Kent, Sussex, Yorkshire, Lincoln-

shire, Norfolk, Cambridgeshire, Buckinghamshire and Wiltshire. The formation is not continuous, but has been eroded in many places before the overlying Upper Cretaceous rocks were deposited. The oil-shale strata occur as basins in the upper division of the formation, notably in Dorset, Norfolk, Lincolnshire and Yorkshire.

The Oil Shales of Dorset

The oil shales at Dorset have been known for many years. The Kimmeridge "coal money" was made from the oil shale and was used as currency in very early days, even before the Roman occupation of Britain. Later the shale was used as fuel by the inhabitants of the region. It lies about 300 feet below the top of the Kimmeridge formation. The first commercial effort to utilize these shales was made in 1848 by the Bituminous Shale Co. The company continued in business for six years, but ultimately failed. Six successive attempts were made up to 1879 to utilize these shales commercially, but each failed, chiefly because of the large sulphur content.

The outcropping of the Kimmeridge shale forms a notable feature of the shore-line cliffs on the English Channel for several miles east and west of Kimmeridge Bay, in a well-defined anticlinal with some minor faults. The oil shale appears in two well-marked strata, the Blackstone and Main Bed.

Complete Analysis

	Kimmeridge Blackstone.	Corton Main Bed.
Carbon	37.94	26.75
Hydrogen	4.19	3.67
Nitrogen	1.03	0.57
Sulphur	4.51	5.57
Oxygen (by difference).....	3.88	2.79
Ash	48.45	60.65
	<hr/>	<hr/>
	100.00	100.00

The specific gravity of the shale from the Kimmeridge was 1.775; from the Corton, 1.645, at 15.5° C. The old shaft, tunnel and bore holes near Kimmeridge have long been abandoned. The present workings are at Corton, near Weymouth, in an outcrop of the Blackstone seam. Six adits 1000 feet apart are being driven. Four are each 350 feet long and two 60 feet long. Here the Blackstone seam consists of two strata

—3 feet and 2 feet 6 inches thick, with a clay stratum 2 feet thick between.

The Oil Shales of Norfolk

The Kimmeridge clay formation in Norfolk county has been well explored by open cuts, bore holes and shafts in the region south of King's Lynn and east of the Ouse. The oil shale appears in two series; the upper, called the Smith's series, and the lower, the Puny Drain series, virtually at the top of the Kimmeridge clay. An open cut or quarry on the property of the English Oilfields, Ltd., shows a 7-foot stratum of oil shale, wet and oily, beneath an overburden of from 13 to 30 feet in thickness. The dip is 5 degrees to the east. The deposit has been tested by pits and bore holes over an area of two square miles. A 50-foot shaft, 6x12 feet, has been sunk to an 8-foot stratum of oil shale. This ledge consists of two distinct layers; the upper, or black shale, 3 feet 6 inches in thickness; and a lower stratum, 4 feet 6 inches thick. The roof is soft, so that the walls and roof of the main drifts need to be bricked.

English Oilfields, Ltd.

The English Oilfields, Ltd. is the largest oil-shale company in the Norfolk district. It owns, or controls by long lease, 60 square miles of territory: It is capitalized at £1,500,000 (\$7,500,000) in shares of one pound sterling each. The company is making extensive improvements on its property, consisting of a branch from the main line of the Great Eastern Railway to its property; houses for workmen; retorts, condensers, scrubbers, refinery shops and by-product plant, with the intention of establishing a plant complete in all details. Besides it has erected and tested several retorts for the distillation of its shale.

The Removal of Sulphur From Oil Shale

Fortunately for the oil-shale industry in the United States, sulphur in the oil shale here has not yet been found in quantity to be detrimental to the oil produced. Also there is little or no sulphur in the Scottish shale. But in England the known beds of oil shale all carry so much sulphur as to make the oil unmarketable except for fuel. During the war, the British

Admiralty raised the allowable limit of sulphur in oil to 3 per cent., but paid a low price for any above 2 per cent. The one great obstacle standing in the way of the development of the oil-shale industry in England is the desulphurization of the shale without spoiling the oil. Logically, there are three methods of attack:

a. During the retorting of the shale an attempt may be made to remove the sulphur by such agents as lime and caustic soda.

b. As soon as the oil vapors and gas are evolved, and before condensation, they may be passed over desulphurizing agents.

c. After the vapors have been condensed the oil may be desulphurized by some chemical means.

Many patents have been taken out to cover processes, and many individuals claim to have a solution; yet no process has yet appeared that satisfies commercial and industrial requirements. During the Great War the need of a domestic supply of oil was felt so keenly by the British Government that it investigated every possible source of supply. In the case of oil shale the presence of an excess of sulphur stood as an insurmountable obstacle. It remains the great unsolved problem before the technical men of Great Britain. When its solution comes, as it probably will some day, great quantities of oil shale in the Kimmeridge formation now commercially valueless, will become a source of great wealth to the British Empire and of economic importance in supplying an additional domestic supply of oil.

Besides the technical point of view, it is to be observed that in an utilitarian age like the present, the aesthetic objection to the odor of sulphur-bearing oil may have to be ignored because of grim industrial necessity. Also sulphur-bearing oils may have to be mixed with non-sulphur-bearing oils to reduce the average percentage of sulphur below the objectionable point. However, the only solution that will be permanently satisfactory will be the production of sulphur-free oil.

Sulphur occurs in shale oil and petroleum in the form of organic and inorganic compounds, and even as free sulphur dissolved in the oil. The sulphur in inorganic compounds may usually be removed without much difficulty, either in the process of distillation, or by treatment of the distillate. Some

organic compounds of sulphur are more or less decomposed by distillation, so that a part removal of the sulphur is easily effected; but the complete elimination of organic sulphur from an oil may prove very difficult commercially, and, in fact, a perfectly satisfactory solution of the problem has probably not yet been found. The exact conditions or combinations in which the sulphur exists, which are not definitely known, and which may vary in different oils, add to the difficulties of the case. Many methods have been proposed for the elimination of sulphur and some have proved successful with certain oils. Unsaturated organic compounds containing sulphur can be removed with sulphuric acid, but ordinary sulphur-free unsaturated compounds are more easily attacked and therefore, if the oil contains a large percentage of the latter, the process becomes too expensive. Also, it is possible for sulphur to be actually added in the process by the formation of sulphonic acids. Liquid sulphurous acid has been used in the Edeleano process to remove sulphur. It combines with the unsaturated sulphur compounds and settles out of the oil. But not all of the sulphur is necessarily in combination with unsaturated compounds. Metallic oxides, such as cupric oxide, have been employed to combine with and eliminate sulphur. This is done, either by bringing the hot vapors of distillation in contact with the oxide, or agitation of the latter with the hot oil. The above and other methods are employed with more or less success according to the nature of the oil, but the problem as a whole is apparently still unsolved. Among the forms in which sulphur has been found in shale oil or petroleum may be mentioned free sulphur, hydrogen sulphide, thiophanes, alkyl sulphides, mercaptans (in Baku oil), carbon disulphide, alkyl compounds of carbon disulphide.

Investigations By the British Government

On account of the shortage of petroleum and its products during the Great War, especially fuel oil for the Admiralty, the British Government directed its attention to the possible production of petroleum from home supplies, i. e., from Scotland and England alone. First of all, efforts were made to increase production from the known deposits of oil shale in Scotland by speeding up the mining of the raw shale, by using to full capacity the retort in use, and by putting in use older

retorts that had been lying idle. By these efforts the output was increased but not to a degree sufficient to meet the pressing needs.

Investigations were then carried on with the deposits of oil shale that were known to exist in Dorsetshire, Norfolk and elsewhere; but on investigation these shales were found to produce an oil too high in sulphur for Admiralty purposes, and various retorts and processes were tried in order to produce a suitable oil from these shales and an oil which was free from sulphur. In 1917 the Inter-departmental Committee carried out experiments with the Del Monte retort, a low temperature distillation process, on the Kimmeridge shales which gave an output of 45 gallons a ton, but carried 6.67 per cent. of sulphur. An endeavor was then made to find a process for eliminating this sulphur, and from June to October, 1917, experiments were carried on and investigated by a process invented by Heyl which failed to produce the results obtained by the inventor. Other processes examined were Burnet's process for desulphurizing the oil obtained from the Norfolk shales. Still other processes investigated were Tozer's system for producing oil by low temperature, vacuum process distillation, the S. O. S. system, the Maclaurin system and the Lamp-lough process. Oil shales from other parts of the country were also investigated, namely, at Anglesey, Skipton in Yorkshire and other places. Having failed to find any satisfactory process for eliminating the sulphur, attention was directed to the cannel coal and torbanehill which were known to exist in various parts of the country, and which were capable of producing a high percentage of oil.

General Observations

The English oil-shale deposits are essentially different from those investigated elsewhere and present specialized problems of desulphurization, retorting and refining. They are particularly characterized by

- a. A high specific gravity.
- b. A large amount of olefines and unsaturated hydrocarbons.
- c. A low content of the paraffin and naphthenic series.
- d. A high percentage of sulphur.

To those who foresee a high price for the ammonium sul-

phate produced from shale a note of warning should be sounded. The high price of ammonium sulphate obtainable in Scotland is the result of peculiar local and industrial conditions and should not be regarded as a criterion for the United States. Here the synthetic production of ammonium sulphate has progressed to such a point that its market price in the future will be lower than it has been in the past, so that a high price for ammonium sulphate, as a product from crude shale oil, should not be counted upon.

Good oil shales have low specific gravities. The specific gravity of ordinary clay shale varies from 2.4 to 2.5. The specific gravity of oil shale is seldom more than 2.2 and may go as low as 1.5. As a general rule the lower the specific gravity the richer the oil content.

The Use of Steam

ADVANTAGES:

1. Increase in the value of the oil (a practical observation in Scotland).
2. Dilution of the oil and gas vapors.
3. Increase in the velocity of the discharge.
4. Oil and gas vapors are swept away from the hot zone and secondary decomposition reduced.
5. Increase in the paraffin products (a practical observation in Scotland).
6. Equalizes the temperature.

In the opinion of the Scotch operators, exhaust steam should always be used. This is based upon years of practical experience rather than theoretical consideration.

DISADVANTAGES:

1. One hundred gallons of water, in the form of steam, are needed for each ton of shale retorted. This may be difficult to obtain in a semi-arid region.
2. Increased first cost of installation and subsequent cost of condensation.

After a two-months' study of the oil-shale industry in England and Scotland, I am led to the following conclusions:

- a. The present Scotch methods are well adapted to the shale treated; they are commercially successful and meet the local conditions.

- b. The Scotch plants are the result of 70 years of operation; they have been improved from time to time, but naturally are not now so arranged as to be highly efficient from an operative point of view; yet it would be folly to scrap them and re-build on more modern plans.
- c. Scotch methods should not be slavishly followed in other countries unless conditions are identical.
- d. The problem in Scotland is one of operating efficiency—the difference between cost of production and selling price.
- e. The problem in England is not yet a commercial one, but technical.
- f. The presence of an excess of sulphur in all oil-shale deposits of England demands that some effective and economical method for the elimination of the sulphur be devised.
- g. Where sulphur does not occur to an objectionable amount, as in the United States, the serious problem is the design of an efficient retort.
- h. Many retorts are in process of development. At the present writing, it is virtually impossible for anyone (except the inventor himself) to select the best.
- i. In my judgment, the successful retort will be one of three types:
 - 1. The present Scotch type, where local conditions are identical with those in Scotland.
 - 2. A vertical, modified Scotch type, adapted to shale rich in oil, but low in nitrogen content or,
 - 3. A horizontal type which will be based on correct scientific principles and be absolutely new.

It is not impossible that successful retorts will result of all three types. The keynote to the successful extraction of oil from shale is a retort adapted to the character of the shale to be treated.

WYOMING OIL-SHALES

By G. B. MORGAN, State Geologist, Cheyenne, Wyo.

The oil-shale beds of Wyoming, like those of Utah and Colorado, are found in the Green River Formation of Eocene Age. This formation underlies vast areas in all these States and in Southwestern Wyoming, particularly in Sweet Water, Lincoln and Uinta counties the formation underlies approximately 3500 square miles of territory. Outcrops of oil-shale seams have been examined by members of the United States Geological Survey along the Green River escarpment south of the Union Pacific Railroad almost to the State line. Beds sample along these outcrops average about five feet in thickness. The results of 40 samples taken by the Survey on weathered surfaces and analyzed show an average of 15 gallons of crude oil (and 6 pounds of ammonium sulphate) per ton of shale. There are many richer deposits in the shale area than those sampled by the Survey. Assays have been received in my office showing yields ranging from 23 to 60 gallons of oil per ton, and the samples were taken from beds 15 to 60 feet in thickness.

From data that have been sent in to my office I believe the typical section of the Green River shale deposits to be about as follows:

The surface is sandstone, averaging about 100 feet thick. Underlying the sandstone is a thin but very persistent band of black waxy shale, which contains from 60 to 110 gallons of oil to the ton. This bed runs from a few inches to about five feet in thickness. Below the black seam is a brown sandy shale about 12 feet thick, which will average 45 gallons of oil—the oil being very high in gasoline. Then there is a bed of massive paper shale 50 to 150 feet thick, which contains about 20 gallons of oil on an average. Underlying the paper shale is a sandstone member from 40 to 60 feet thick. This is, in turn, underlain by paper shale from 50 to 200 feet thick, which also contains about 20 gallons of oil to the ton. The whole is underlain by barren shale.

The above section is the result of work done for a distance of about 20 miles south of Green River. Lateral variation of the formations is very pronounced, and there are also a

number of faults in this area. It was noted that where the outcrops were abrupt the richest shales were found. As a general rule the paper shales contained a zone of enrichment from 40 to 50 feet thick where the oil content was a barrel or more to the ton of shale. Some of these zones were massive shales of some character and in others thin high-grade seams were found which brought the oil percentage up to considerably more than one barrel per ton.

Oil Reserves in Wyoming Shale

Owing to the lack of data, it is impossible to estimate the tonnage of available oil shales in Wyoming, and the probable yield in crude oil. It is estimated by the United States Geological Survey that the Green River shales of northwestern Colorado will produce 20,000,000,000 barrels of oil. We have reason to believe that similar shales in Wyoming are capable of producing about the same amount. As you know the total world's production of petroleum up to the present time is about 7,000,000,000 barrels and in the United States about 5,000,000,000 barrels. Probably not over 6,500,000,000 barrels of oil remain in the ground in the various oil fields throughout the United States. In the absence of more reliable information, I think it may be assumed that the oil shales of Colorado, Utah, Nevada and Wyoming are capable of producing 50,000,000,000 barrels of crude oil.

It is a well-known fact that the consumption of petroleum is increasing far more rapidly than domestic production. At the present rate of consumption, and this rate is increasing every year, our pools will be practically exhausted in about 20 years. Therefore, the future of the oil-shale industry is assured.

Oil distillation from shales is now passing through the experimental stage, and owing to the increasing demand for gasoline, lubricants and fuel oil, it will be matter of only a comparatively short time until shale-oil plants will be operating in Colorado, Utah and Wyoming. Shale-oil extraction is to a great extent a mining and metallurgical problem, and is a matter of figuring plant and operating costs against the market price of oil and by-products, including gas, which is used as a fuel in the retorts. There is not the element of risk in this industry as in prospecting for oil in unproven

fields, although the capital involved may be much larger. Given a practicable and workable plant for distillation one is able to calculate with a considerable degree of accuracy the cost of mining and treatment added to the original cost of the plant and also the amount of oil and by-products that can be extracted from a known deposit of shale, the contents of which have been carefully sampled and tested. It is also a simple matter to calculate the available tonnage of workable shale in a given area, especially if diamond core drills are used to sample the underlying beds. Thus, it seems possible to forecast unusually well just what to expect in such ventures, providing the method of distillation is suitable for the treatment of the shale and will return the greatest amount of the most desirable products.

Shale-Oil Will Partly Supplant Petroleum

Although we do not believe that shale-oil production will completely take the place of the dwindling petroleum supplies, yet it is not inconceivable that within 10 years our shale fields will contain many extraction plants, with millions of dollars invested and employing thousands of workmen. The price of crude oil will largely govern the development of the shale-oil industry. Just as soon as that figure is high enough to ensure profitable operation, the large oil interests will begin to get into that business, as they will be compelled to in order to protect their great refinery investments, and to perpetuate their organizations.

Practically speaking no real surveys have as yet been made of the Wyoming shale fields, but we hope to do something in that line during the next year. There is no question as to the great extent of our shale formations which cover an area almost equal to those of Utah and Colorado combined. There may be some doubt as to whether Wyoming shales are as high in oil content as Colorado shales. As to accessibility, our shale deposits lie along the main line of the Union Pacific Railroad, and workable beds are found near Rock Springs, Green River, Kenmerer and other points. Taking into consideration, therefore, the extent, richness and accessibility of Wyoming shales, there is no question in my mind but that Wyoming will run Colorado a close second in the great drive for shale-oil production which is ahead of us.

THE ASPECT OF THE PETRO-SHALES OF THE WESTERN SLOPE

By J. B. JENSON

Mining Engineer and Oil Shale Specialist, Salt Lake City, Utah

In a study of the petro-shales of the Western Slope I have in mind particularly those which are included in Colorado, Utah and Wyoming, and which comprised the original deposit of the Great Uinta Basin before its segregation, through upheaval and erosion, into the Green River Basin, the Uinta Basin, the De Beque and Soldier Summit fields.

Geology

These shales consist primarily of argillaceous clays, containing the remains of billions upon billions of small plants, such as diatoms and the algae which thrived in the Eocene period on the shores and bottoms of the warm quiescent inland lakes of that period. They resembled the green mossy plants that we see at this time at the bottom of stagnant pools during summer time. These evidently grew in great luxuriance, and together with numberless fishes and other animal and insect life were imbedded on the lake bottom within clays and mud sediments brought by freshets and streams from surrounding mountains. From the oscillating movements of the water and mud these were finely mascerated and ground into the sediments and finally became a part of them. Occasionally great mineral-bearing ledges extending through the mountains were eroded away and the sand and clay from these, together with such gold, silver and platinum as they contained, also found their way into the lake bottoms, thereby building up at times bedding which were metalliferous. As all plant and animal life contains nitrogen and potash, it is natural that these also should be preserved in the compressed muds and become constituents of the shale.

This building up of lake bottoms went on for ages, until great masses, consisting of thin layers or beddings, perhaps each representing a season, were built to an aggregate thickness of sometimes hundreds of feet. These great beddings

later on, through earth upheaval, have themselves become exposed to surface erosion, and in places have been entirely uncovered, while great gorges and river channels have been cut through the entire formation, leaving the surface exposed and showing hundreds of feet (in vertical thickness) of petro-shales, which are capable of yielding from a few gallons to as high as 100 gallons of high-grade petroleum to the ton.

These oil-yielding shales consist usually of at least two members, an upper and a lower. In the heart of the Uinta Basin, and where cut by the channel of the Green River, they show three distinct members, each separated by a bell rock. This bell rock is a brittle, hard sandstone, ranging in thickness from a few inches to two feet, and which breaks in long pieces, usually in an easterly or westerly direction, and at a width equal to the thickness of the bed, thereby taking on the appearance of sawed timber. It has a peculiar metallic ring when struck with a hammer, from which it derives its name. As we approach the rim of what was once the great basin, this bell rock merges into thicker and softer sandstone beddings. This is notably in evidence at De Beque, Green River and Soldier Summit. The members between the intervening bell rock consist of many measures ranging in thickness from a few inches to several feet, and in oil yield from a few gallons to as high as 90 or 100 gallons per ton.

Historical

My first work in connection with our American shales was undertaken early in 1902, when an old Scotch retort man came into my office with samples of shale from Tucker, Utah, with a wonderful story as to the possibilities of producing kerosene direct from shale in this country as was being done in Scotland. Gasoline was then somewhat of a drug on the market, and had little value. The enthusiasm of the old gentleman, together with actual demonstration in a laboratory retort of the production of oil from shale, had its effect upon me, and I entered into arrangements with him whereby I should build a Scotch-type retort of sufficient size to demonstrate the practicability of the undertaking. After a year's work we concluded that the Scotch-type retort was not fully adapted to the treatment of our high-grade American shales, and that while we had splendid success with certain grades,

particularly those ranging around 30 or 35 gallons per ton downward, we had a great deal of difficulty when treating shales running above a barrel to the ton. These would frequently flux in the retort and stop all operations until the solid mass could be removed. While we did not then understand the cause of fluxing, we have since discovered and overcome it.

We found certain fields, however, which contain non-fluxing shales, and which might be treated with entire success by the method we were adopting, but inasmuch as it was particularly the high-yielding shales that we were desirous of working, and which must necessarily be the ones selected in order to operate at a profit, it became necessary to work out other devices. After a good deal of experimental work, lasting between three and four years, this was accomplished in the development of what has become the 'stage eduction [recovery] process.' The matter was then allowed to lapse on account of inability to interest capital at that time in the industry, and it was not until about four years ago when the serious demand for petroleum products began to take on an acute aspect that a new retort was built in Salt Lake City. Since then I have confined myself to this work in oil-shale work.

Up until a few months ago, when the ruling appertaining to the patenting of shale lands was made by Assistant Secretary Vogelsang, and concurred in by Secretary Payne, the outlook for the shale industry was seriously doubtful, owing to the fact that no one could say whether or not titles could be secured to the lands. Owners and investors alike held aloof, and were unwilling to undertake any development or construction work, and it is only within the last few months that real activity has been noticeable. During that time more has been accomplished in this country looking to the early production of oils, perhaps, than through all the past ages. Large interests have secured extensive holdings under option, and while no great amount of actual cash has been paid over, perhaps, nevertheless, nominal first payments have been made, and as soon as the buyers can satisfy themselves as to the patentability of the various claims, payments will, no doubt, be completed.

Petro-Shales

Our Colorado-Utah shales, as generally spoken of, are misunderstood. They are not oil shales and contain no oil, but they are shales which contain the materials from which petroleum can be produced—not extracted, mind you—but produced. There are shales, however, which do contain petroleum and from which petroleum can be extracted, but they are not the Colorado-Utah shales which we are today considering.

I have here a number of pieces of apparently similar shale. Here are two pieces of true oil shale which come from California. These contain petroleum very much as our saturated sands do, and it may be extracted from them. When one today speaks of oil shales, his hearers naturally think of this kind of shale. Here is a piece of shale which contains no petroleum and from which petroleum, therefore, cannot be extracted, but from which it can be produced. It contains the basic elements of petroleum, hydrogen and carbon in their primary unretorted condition. This is a typical piece of Colorado shale of fairly high yield. On breaking open a piece of this character of shale, one detects a peculiar odor. This comes from a small amount of gas and a trace of petroleum, which has been produced from frictional or other internal heat at some time in the earth's history, and has been confined within the shale until the present time. An intense odor does not necessarily indicate a high-yielding shale as generally supposed, as some of our low-grade shales are much more odorous than some of our high-grade shales. The intensity of odor rather indicates the degree of temperature that the shale has undergone.

Terms Used in Shale Work

Some years ago, Prof. Crum Brown, possibly guided by the fact that kerosene was then the most important oil product from the Scotch shales, suggested the term "kerogen" to express this carbonaceous matter, and that term has been used quite generally in Europe ever since. It is not a definite one, however, and when applied to our American shales, where kerosene is of secondary importance, becomes as misleading as the term "oil shale."

In order to distinguish between these shales, and inasmuch also as the gasoline fraction from shale oil is materially different and contains some properties not contained in well gasoline, notably more complete and rapid combustion, and from the fact that as soon as our large shale plants begin operation, it will become necessary to have a distinguishing feature between the gasoline from wells and the gasoline from shales, and in order to obtain definite and concise terms for use in my geological reports, as well as in discussions of shale matters in general, I some years ago coined three words which I have since used continuously, and judging from the most satisfactory results therefrom it would be an opportune time to adopt some such words for use in our shale vocabulary in order that precise, accurate knowledge might better be disseminated. They are as follows:

From the fact that the hydrogen and carbon as contained in the shales is the source of petroleum, I have taken from the word petroleum the first syllable "petro" and have added the suffix "gen," or source, to form the word "petrogen," meaning, therefore, the source of petroleum or that material which through destructo-constructive distillation produces petroleum or tar.

To those shales which are still in their primary, unaltered condition, containing petrogen, but not petroleum, and, therefore, are yet only a source of petroleum, I prefer to apply the term "petro-shales." This applies in general to the shales of Colorado, Utah, Wyoming, New Brunswick, the Devonian shales of Kentucky, etc.

To those that were originally petro-shales, but which through later earth heat have given up their petrogen, and then through absorption have taken up the resultant petroleum, and are now saturated or true oil shales, and to those shales which were originally not petro-shales, but which through capillary attraction or otherwise have taken on migratory oils, and, therefore, also contain oil, I prefer the term "oil shales."

To distinguish the product from shales which corresponds to the gasoline fraction I add to the word "shale" the letters "ne" to form the word "shalene," and which gives me the following concise terms: Petrogen, petro-shales and shalene.

Massive Shale and Paper Shale

Petro-shales are commonly spoken of as of two kinds: Massive and paper shale. There is primarily no difference between the two except that the paper shale consists of much thinner beddings or measures than the massive. Between each bedding is a thin layer of argillaceous material containing no petrogen, and this, on weatherings, decomposes and permits the petroliferous beddings to separate, when the exposed edge resembles somewhat sheets of paper piled on each other, and which suggests the name—paper shale.

We may illustrate this by taking a number of sheets of tin and a number of sheets of blotting paper, and after pasting these firmly together to form a mass an inch or two in thickness, permit the edge to come in contact with water. The blotting paper will absorb the water and decompose the paste, permitting the sheets of tin, which are not affected by the water, to separate. The sheets of tin correspond to the non-permeable sheets of petroliferous material, while the blotting paper corresponds to the argillaceous sheets, and which are affected by the weatherings to a distance as far as the weathering can extend into the ledge. When a point beyond this is reached the shale face becomes solid and has the appearance of massive shale, but under the magnifying glass shows the intervening light and dark-colored laminations first described. Water and air have no effect on the petroliferous portions, whether thick or thin, and as the massive shale consists of thick beddings it retains its solid or massive appearance in the ledge. Hence these names—massive and paper shale.

As a rule, though not always, the massive variety is slightly higher grade than the paper shale, but when the ledge is penetrated beyond the weathering, the paper shale becomes solid and the oil yield usually increases.

Amount of Oil in Paper Shale

I have been endeavoring for many months to establish a factor which would enable one to make a fairly accurate estimate of the oil yield that might be expected in the average paper-shale ledge when development should reach a point where weathering has ceased and the ledge has taken on its primary condition. Thus far, I have found this impractical,

inasmuch as the different measures in the same shale member are not frequently different, but the paper shales of the different shale members in the same district are different. Also the corresponding shale member in the different localities are dissimilar and the changes in yield greatly variable. The only safe way, therefore, is to either prospect the ground with a diamond drill, which can be made to penetrate the entire series of shale measures at a point where no weathering has occurred, and when the log has been carefully kept and tests on the various measures have been made one will have a most accurate basis on which to calculate tonnage and yield. The next best mode of development is the driving of tunnels in the lower portion of the shale measure and sufficient distance into the ledge to reach a point where accurate determination may be made and then raise through the various measures before sampling. This should not be less than 100 feet, and preferably several hundred feet, especially if the ledge contains a gentle slope and thereby permits greater penetration of moisture downward through surface cracks than in case of a precipitous escarpment. The next best method is that of trenching the surface at a width of five or six feet and penetrating the ledge to such distance as weathering may extend. This is the cheapest method of the three and is fairly satisfactory. The trench may be "stepped" down on the various measures to prevent the necessity of carrying the lower portions of the trench further into the ledge than is necessary. In one or two such trenches, I have found the weathering of paper shale to extend all the way from a foot or two to 30 feet before the solid shale is encountered. Oil tests on the various measures show an increase ranging from a few gallons to several times the original yield. In one extreme case, the shale on the surface yielded $8\frac{1}{4}$ gallons. It was a loose, light-brown, papery shale. When the ledge was penetrated 30 feet a yield of $40\frac{1}{2}$ gallons was obtained. Another example is paper shale, medium weight, original assay 40 gallons in 10 feet, 52 gallons another example; paper shale $20\frac{1}{2}$ gallons, solid shale 30 gallons. It will be seen from this that while we may always expect an increase in yield, it is impossible to estimate what this may be, and in calculating yield, it becomes necessary before endeavoring to estimate,

to do enough work to determine with reasonable accuracy the change that will take place on that particular bedding.

In the massive shale a fairly good guide is that the lighter in weight the shale the greater the yield. It is practically impossible for the heavy, close-grained silicious type of shale to yield more than a small quantity of petroleum. That which is capable of a high yield leaves a light porous or honey-comb ash, which frequently will float on water. The ash from the lower grade shales will not do this.

The color of massive shale will vary from a light brown to coal black. The higher grades usually are of a dark brown color with a light brown, waxy streak and without grit. The fresh fracture has a smooth feel to the touch; the lower grade shales have a cat-tongue feel to the touch. The older the shales geologically the lower the oil yield and the higher the ammonium yield. Our American shales are, therefore, younger than those of Scotland.

Destructive Distillation

But what of destructive distillation that we have heard so much about and that seems to convey an unfavorable impression against shale retorting? Let us illustrate by analogy: On a mountain-side is a beautiful forest of giant pines, which nature has been carefully nurturing for 1000 years. We saw them into timber of many dimensions, pieces large and small, some thick and some thin, and from these we construct a machine, a bridge, a dwelling. We must first destroy the trees of the forest before we can obtain material with which to construct the dwelling. We employ destruction to obtain material to undertake construction. In the shale we have the vegetal growth of prehistoric ages in the form of petrogen. We decompose it and destroy its form much as we do the tree and the forest, and from it we construct a new material. We destroy the petrogen to construct the petroleum from which to produce the shalene, kerosene and the lubricating oils.

Destructive distillation, therefore, is not so utterly destructive as it sounds, and we might better use the term "destructo-constructive" distillation when speaking of the production of petroleum from petro-shales. In the case of extraction of petroleum from oil shales, no material chemical change is

affected and only straight or ordinary distillation is employed in contra-distinction to "destructo-constructive" distillation as in the treatment of the petro-shales.

In order then to convert the petrogen into petroleum it is necessary to effect a chemical change of the hydro-carbons. This may be done by the application of heat, but as the compounds derived from petrogen are highly combustible the shale must be treated within air-tight compartments. If air is permitted to enter the retorting chamber when the gases have reached a temperature of 650 degrees F. or over, the mixture becomes spontaneously combustible and an explosion results. In that case we have effected what takes place in the carburetor of your automobile, the right mixture of gas and oxygen for rapid combustion. This must be prevented.

The proportion of the permanent gases produced are governed by the method of retorting and the experience of the operator. Other things being equal, it is desirable to keep the proportion of fixed or permanent gases as low as possible.

There is another portion of our product, however, that we are not yet entirely able to control, although partly so. We might call it an unfinished product. Owing to the fact that petrogen contains a much larger proportion of carbon than of hydrogen, and that our petroleum products require possibly from two to three times as many hydrogen atoms as carbon atoms, it is evident that our resultant products and spent shale will contain a considerable amount of carbon, which has not been able to secure the required amount of hydrogen for the production of a staple petroleum product. These are our unsaturated hydro-carbons which should also be kept as low as possible. Their production, like that of the fixed gases, is largely governed by the process used and the knowledge of the operator.

It is obvious then that if our petro-shales are properly heated, the petrogen will be volatilized or converted into gas, and as this is conveyed into a suitable cooling system, the greater portion will condense and form crude petroleum. There are certain portions, however, which cannot be condensed. These constitute the fixed or permanent gases, and after having been "scrubbed" or passed through oil and water, to remove the remaining naphtha and nitrogen contained in them, are used for fuel under the retort and for

power purposes in the engine. Shales yielding 45 gallons or better to the ton are usually capable of producing sufficient fuel for their own retorting. The nitrogen is recovered and converted into ammonium sulphate, which is a valuable fertilizer. The potash and any metals that may be contained remain in the residue, or spent shales, and are easily recoverable by leaching or concentration.

The crude oil obtained ranges in color from a dark brown to olive green, and in specific gravity from .841 to .925. It consists largely of oils of the paraffin and olefine series, comparable with paraffin well oil of the highest grade. From this can be produced, by ordinary distillation, lubricating oils and paraffin, as well as all the products of the coal tar, including the finest of synthetic dyes.

Manufacturing Enterprise

Fortunately this premise is not one based on speculation. The risks incidental to well drilling are eliminated, and when the ledges have been carefully sampled and measured by a competent engineer and found commercially profitable, the enterprise becomes strictly one of quarrying and manufacturing, based on known quantities of raw material, with everything indicating good prices for the products for years to come. The petrogen will not migrate into a neighbor's ground if he works and you do not, such as is often the case in pumping of oil wells, and the shale ledges if properly selected are of such magnitude that they cannot be exhausted through the life of several generations.

Special Requirements

To be of value commercially a shale deposit must:

- (1) Be located advantageously as to railroad facilities.
- (2) Consist of beddings of sufficient thickness for cheap mining.
- (3) Contain a mill site to enable movements by gravity from the ledge to eduction plant at minimum cost.
- (4) Contain shale of sufficiently high grade to warrant profitable operation.
- (5) Be proved workable by a known economical and continuous process, capable of handling an unlimited tonnage daily.

(6) Have ample water for all mining, retorting and refining purposes.

To the individual or corporation that is buying shale land for the erection and operation of machinery there are a number of essentials which must not be overlooked.

Frequently little credence can be given to statements of yield made by the owner from the fact that the cost of analysis usually prevents his having more than one or two tests made, and these perhaps by no means dependable samples. More often his statements are a guess, based on what some one else claims for shale which looks like his, or he may have had a test run made by some stock company in a window display retort by an inexperienced operator. At any rate one must positively sample the property with precision and care before accepting it. It is not so much the purchase price that concerns us as the hundreds of thousands and perhaps millions of dollars to follow that must be invested, and that must not be spent on a worthless property. No more difficult or undesirable work comes to the mining engineer than the sampling of a shale ledge, and when the samples have been secured, to be reliable they must be run by a competent chemist; one who has had retorting experience; one who knows that it is necessary to insulate his retort, to replace the long "goose neck" with a closed nipple and ell; that fully appreciates the value of the "time element" in retorting and that understands the importance of separation of his product and does not report the emulsion as oil, etc. His results should be shown in a properly signed certificate.

It is necessary to inspect all monuments on the claims; the location monument to see that it contains a proper notice, and if a petroleum placer blank form has been used that the words "oil shale" have been written into the location notices, and that the claims are not held simply under a petroleum location; that the corner monuments either are all properly in place or that there is evidence that they were properly set when located and any fallen monuments re-set; to see that a valid shale discovery was made on each claim prior to the passing of the leasing bill on the 25th of February, 1920. It is not sufficient that the locator state that the bedding extends under the surface, even though he may be satisfied

of the fact, and it is not sufficient that discovery of petro-shale be made in doing this year's assessment work.

One must satisfy himself that the locators are all bona fide locators who are participating both in the expense attached to the locations and receipts of sale, and that this is neither a "horse back" or a "dummy location." If possible it is well to interview each locator, or as many of them as possible, and if the transaction is being conducted through an attorney-in-fact it is important to secure the signature of each locator to the option which you hold, even though you may accept a deed from the attorney-in-fact if you so desire. If deeds have been made to one or two of the locators the case requires more than ordinary investigation. In passing over the land you should also observe that there has been no subsequent entries, either desert or otherwise which will, of course, not appear on the abstract, and, therefore, be known by your attorney when he passes on this unless you inform him regarding these matters or a trip to the land office be made.

Mill-Site

When the property and titles have been found satisfactory, the next important matter is that of mill site, dumping ground and water, each of which is almost as important as the shale land itself, but which is seriously overlooked by probably 90 per cent. of our shale investors. It is necessary that it be so placed that the shale bed may be moved by gravity from the ledge to the plant without unnecessary hoisting or handling, for in this country the entire success of the industry will depend upon large operations. It is equally important that sufficient dump will accumulate in the years to come. When we consider that the shale on retorting expands in bulk, that it forms a light product that will be easily carried away by floods and freshets, that the neighbor below your property may perhaps seriously object to the storing of your tailings for you, it becomes important that the matter of ample dumping ground should not be overlooked. At least 30 per cent. of your holdings should consist of dumping ground, taking for example such deposits as we find in Colorado, where thick beddings and large tonnages will be treated.

The site selected for the retorting plant should be located upon the comb of a ridge at a point out of danger from falling

or rolling rock, and immediately below the measure of shale that is to be worked. In the De Beque district this will average approximately 400 feet below the top part of the shale member and possibly from 500 to 700 feet from the creek bottom.

Water

For the immediate present the water problem is not serious, and until a large number of extensive plants come into operation there will perhaps be no difficulty, but it is a lamentable fact that a great deal of land has been selected by purchasers which has not an ample water supply and which will have difficulty in securing one. It is true that in nearly all of our Western fields there are at present small live springs which upon development may be made to produce a sufficient quantity of water for 100 or 200-ton units. It is also true that in most all fields on the Western slope there are ravines which contain good shale bottoms and in the mouth of which dams can be constructed for impounding water from the melting snows, but when the great plants shall come into operation such as we may look for within the next two to five years and later, the water problem becomes a serious one, and the company that is amply financed and officered for large operation should not overlook the matter of immediately securing an ample water supply from ranchers or otherwise. It is true that crude petroleum may be produced from shale without water, but the profitable, successful big plant will consume from one to three gallons of water for every gallon of oil produced, and while a portion of this may be recovered and used over again, the water required will still be of material import.

Refinery

It should be noted that crude petroleum produced from our Western shales is of a heavy paraffin base and cannot be successfully transmitted through pipe lines to any great distance, particularly in the winter time in these mountain localities. It becomes important, therefore, that the refinery be placed reasonably near to the retorting plant. This may be done by putting it on the creek bottom at a point where it might serve one or a number of retorting plants in the same gorge or

ravine. The crude petroleum may then be conveyed while it is still warm and whether partly fractionated or not to the refinery, thereby reducing materially the refinery expense, or it might be placed at the junction of a number of ravines wherein various retorting plants may be operated, and thereby serve a number of plants or a number of companies. Eventually, fractionation will be so far developed that it will be possible to convey at least three different products directly from the retorting plant to the refinery many miles away, and when this is done the refinery may be placed directly upon the railroad where the various products may be conveyed into the tank car. For the time being, however, it is advisable to place the refinery and retorting plant near each other at a point where the various refined products may be loaded either into tank cars or into tank trucks. It should be perfectly feasible and profitable at the present time where good truck roads, such as those throughout the De Beque district particularly exist, to operate at a distance up to 25 or possibly 30 miles from the railroad, and to convey the refined products by truck to the railroad tank cars until such time as railroad transportation may come nearer. In that case the same truck should not be used for the light and heavy products. While a distance of 25 miles now seems excessive, it will within a few years become the center of an active shale district.

Mining

The matter of mining is not as difficult as has sometimes been intimated. Shale may be drilled satisfactorily by percussion drills, either wet or dry, although dry drilling is objectionable on account of the dust produced. In one case on average shale which I have in mind five feet per day was averaged in drilling 200 feet of tunnel, 5 by 6 feet in section, with a Waugh drill. The crew consisted of one engineer and mechanic, one driller and two shovelers; power furnished by a 30-horse-power gasoline engine.

Still better results are being obtained in a number of instances by the use of a boring machine, which is applicable to all commercial shales and which has the advantage of requiring only 10 to 15 per cent. of the amount of power used with the air drill. The shale after drilling breaks entirely satisfactorily when a low-grade powder is used.

Our present mining will be confined practically to underground work and not steam shovel, as is erroneously stated. My experience has been that not 10 per cent. of what is claimed to be steam-shovel deposits will be successfully worked that way for many years to come. A good power shovel, which can be operated by electricity, requiring a much smaller crew and has the advantage of being easily movable, is preferable. The cost under present conditions, on ledges from six feet upwards, for mining and delivering into the crusher bin should not reach \$1.25 per ton.

Equipment

For the time being we are only interested in the production of oils, and possibly potash, and the recovery of any metals that may exist in the various beddings and which range from traces to as much at times as \$4 or \$5. Our shales do not contain sufficient nitrogen to warrant the installation of an ammonia plant. Such a unit may be added at any time should development disclose sufficiently increased nitrogen. When the tonnage shall have reached, say, 1000 tons per day or better we shall in all probability find it profitable to produce ammonium sulphate. The initial plant, whether it be one of 10 tons per day or 100 tons per day, should be so constructed that enlargement may follow without increased cost or disruption of the portion already built. In no case should installation be made of more than 100 tons per day until the process has been fully adapted to the particular shales to be treated, the product to be made fully determined upon and the market at least reasonably well established.

The efficient retorting plant should permit only minimum cracking, giving a yield of only about 3½ per cent. of the crude-oil product as shalene. We will thus retain a higher yield of lubricating oil, and ultimately a higher yield of shalene, the two most important and valuable products. Should it be desirable to produce flotation oils, the same rule will hold good, it becoming a matter merely of dollars and cents as to which products will be put out when the plant becomes established. Provision should be made for the recovery of all water-soluble potash and such gold, silver or platinum as may exist and that may be recovered by amalgamation. About 80 per cent. of metals, as a rule, are thus recoverable, but

until extensive operations be reached it will not be advisable or profitable to add cyaniding equipment. A careful estimate for a 100-ton plant constructed on the average well-located Western property and designed to produce shalene, kerosene, lubricating oil, wax and recovery of metals is as follows:

Estimate for 100-ton equipment and camp:

Mining camp to accommodate employes, water-works, lighting, etc.....	\$10,000 00
Mine equipment, compressor, drills, haulage, etc.....	12,000 00
Crushing plant.....	8,000 00
Eduction plant.....	40,000 00
Refining plant.....	65,000 00
	\$135,000 00

The capacity may be doubled for from \$85,000 to \$100,000, making a 200-ton eduction plant with refinery cost \$235,000.

Production Cost Sheet:

Operating cost is shown below to cover mining, eduction and refining.

Operating 100-ton daily capacity plant:	
Mining and crushing (\$1.25 per ton).....	\$125 00
Eduction—3 shifts, 2 men (each \$4.50 per day).....	27 00
1 mechanic (\$5.00 per day).....	5 00
2 helpers (\$4.00 per day).....	8 00
Repair and upkeep.....	6 00
	\$171 00
Refining of crude oil and pressing wax (average \$1.12 per ton).....	112 00
Marketing, transportation, etc. (40 cents per ton)...	40 00
Management, superintendence, office help and rent..	37 00
Total operating cost, 320 working days per year (\$360 per day).....	115,200 00

Fixed Costs:

Insurance, 2.5% on basis \$135,000.....	\$3,375 00
Taxes, 2.0% on basis \$135,000.....	2,700 00
Interest 6.0% on basis \$135,000.....	8,100 00
Depreciation, 8.0% on basis \$135,000.....	10,800 00
	\$24,975 00

Grand total for treating 32,000 tons per year
(equals total cost of \$4.3804 per ton)..... \$140,175 00

A thousand pounds of shale from De Beque treated at Salt Lake City gave the following:

	Per cent. of crude oil.	Gal.	Sp. Gr. 15.50° C.	Be.	Price, c.	Value, c.
Crude oil.....	....	20.25	.901	25	...	...
Gasoline	4.5	1.08	.7550	55	.25	.27
Kerosene	12.0	2.82	.8175	41	.18	.40
Heavy illuminating..	10.5	2.10	.8438	36	.12	.25
Fuel oil.....	9.5	2.00	.8670	31	.05	.10
Light lubricating....	8.0	1.64	.8922	27	.30	.49
Medium lubricating..	14.5	2.85	.9250	26	.35	.99
Heavy lubricating...	11.0	1.5	.9693	15	.45	.92
Ammonium sulphate 1.4 pounds.....					.05	.07
Gasoline from gases 2.4 gallons.....					.25	.60
Wax, 6.6 per cent.....					.12	.79
Product, 1000 pounds.....						\$4.88
Product, 1 ton.....						\$9.76
Receipts on 100 tons per day, 320 working days, at						
\$9.76 per ton.....						\$312,320 00
Costs at \$4.3804 per ton, as per previous sheet.....						140,175 00
Profits						\$172,145 00
For absolute conservatism and unforeseen emergency						
deduct 33 per cent.....						56,807 85
Net profits one year.....						\$115,337 15

By-Products of Value

But what of the enormous values of our shales, the various products and the hundreds of by-products that we have heard so much about of late? Every derivative of coal tar that is named in the average textbook on chemistry has been heralded as a shale product, conveying the impression that these may be recovered by the shale operator. The writer of one article claims to have extracted between one and two hundred of these. It would, of course, be of interest to the shale operator in general and the chemist in particular to know the formula used and the percentage recovered of each. Aside from the fact that, in addition to hydrogen and carbon, our shales contain such quantities of nitrogen and potash as usually go to make up plant and animal life, they are not unlike ordinary carbonaceous shales and other sedimentary rocks for which no such claims have ever been made. Such

metals, of course, as were carried to the lake bottom by the muds and sediments which went to make up these shales are still contained therein, and if they happen to be petro-shales the metals will be found in the spent shale after treatment for oil. As a rule they are negligible, small quantities of gold and silver being present in almost all shales, just as in all rocks and soil. Only in exceptional cases do these become commercially of sufficient value to be of interest.

Utilization of Residue

It is true also that the shale residue in some cases has values for making cement, the body of paints, cardboard, roofing, for road material and various other products, but for the time being its proper place must be considered as on the tailings dump. If later on its owner finds a market for it, all well and good. It is also true after its production that certain fractions and the residue of the oil forms the basis from which are made a large number of products, among which are the most permanent of synthetic dyes of infinite varieties, drugs and anesthetics for human use, the sweetest-smelling perfumes, and even the explosives which we need in time of peace as well as war. The production of these, however, require immense factories, which can only come with time, and their presence, therefore, must only be credited to the shales in as far as they may make an added market for the shale plant's output.

While the elements for the production of all these are locked up in our great shale deposits in limitless quantities, and while they will some day do their part to make of America the greatest producing nation in the world, they cannot hold at this time be held out as an inducement for the investor to put his money into the shale industry, and they need not be. Nor is it necessary to claim for our shales fabulous values. It is sufficient to know that they are of high grade, can be easily mined and treated on a large scale, that they are capable of producing (at a good profit) a large yield of what have now come to be some of the very essentials of our existence—gasoline and oils. Just as there was perhaps no one element that played a greater part than gasoline in our successful outcome of the great World War, so will there be no product

perhaps that will contribute more to our progress and comfort for the next hundred years than will gasoline and oil. We now know for a fact that we must without delay turn to the shales for this product or witness in the very near future a shortage that will cause us serious and costly restriction in its use.

FLOTATION CONFERENCE

THE PROCESS OR ART OF FLOTATION

By **GEORGE E. COLLINS**, Mining Engineer, Denver, Col.

The subject of our conference is the process, or art, of flotation. I use the alternative word advisedly, because it seems to me to describe more correctly the actual development of the methods which are used under the general name of flotation, which really includes a great number of more or less distant methods, shading into each other. The one general link connecting all these different methods is the addition of some modifying agent to water in which ore is suspended, and the use of froth or bubbles to which the ore particles become attached, and which lift them away from the waste.

The modifying agent is usually oil, with or without acid, but an almost infinite variety of other substances, soluble or insoluble, have been suggested and actually tried.

So much of the history, and also of the technique, of this art has been obscured as a result of the unfortunate manner in which it has become a shuttlecock, driven from one side to another by contending parties in the courts, both sides endeavoring to assert their own claims rather than the abstract truth, that it seems to me desirable to state anew the origin of the art. And when I speak of origin, I propose going back to a time before the word flotation had been coined, and long before the inception of any of the patents which are now claimed to cover all its applications.

Brief History of Flotation

The early history of flotation is of special interest to us, because some of it took place within a short distance from our meeting place today.

I shall spare you any reference to Herodotus, or the various early discoverers of the fact that oil and grease tend to adhere to surfaces such as those of sulphide ores in preference to quartz or other gangue substances. Many experimenters,

myself among them, recognized that this attraction was not uniform, but selective, and attempted to base working methods of ore treatment on the fact. So far as I recollect, however, the only practical outcome of these investigations has been the grease tables used in South Africa for the extraction of diamonds from other minerals with which they are associated.

The true discoverer of what we call flotation was a Chicago physician, Dr. William K. Everson, who sank a considerable fortune in Colorado mines before 1880, and became interested in the treatment of ores. Everson seems to have been a true inventive genius, endowed with a considerable share of the scientific spirit. The first outcome of his investigations was a patent granted in 1886. (No. 348157) to his wife, Carrie J. Everson. This patent has been considered to include all the elements necessary to guide a metallurgist in the practical working of the process. To me, it indicates that Everson failed entirely to appreciate the kind of practical manipulation necessary to complete a satisfactory working method.

Dr. Everson came to Denver toward the end of 1886 or beginning of 1887 as an invalid with his family. At this time he appears to have been in straitened circumstances, and the possibility of their being taken by his creditors is said to have been the principal reason for taking out the flotation and other patents in the name of his wife.

While in Denver Dr. Everson made many unsuccessful attempts to interest local mining men in the development of his process on a working scale, and in the course of such efforts numerous demonstrations were made with apparatus very similar to that we might use for preliminary tests today. It seems clear that at this time, if not at the time of taking out the original patent, he appreciated the importance of using froth to lift up and carry off the mineral particles, for he made use of an egg-beater to produce agitation, and occasionally also air, which was introduced from an atomizer by means of a glass tube to the bottom of the flask used for the experiments.

At the beginning of 1889 Dr. Everson died, and his widow attempted, with the aid of an ex-blacksmith named Thomas J. Criley, who probably furnished some funds for the purpose, to get the process tried out on a working scale. To this end experiments were conducted in an old mill at Silver Cliff.

Tests in the Early Nineties

The description of the experiments suggests a decided falling off in practicability, as compared with Dr. Everson's own laboratory demonstrations, and they failed. Mrs. Everson later (in 1891) became associated with one Charles B. Hebron, and a patent (No. 471174) was taken out in their joint names, which incorporated Mr. Hebron's own ideas of ore treatment with Mrs. Everson's recollections—doubtless imperfect—of her husband's. To my mind, this patent shows a decided falling off as compared with the earlier one. It includes the idea of using a buoy-stock, somewhat along the lines of the original Elmore process, and also the germ of the future Murex process. Experiments, probably unsuccessful, were made with this method at Valverde, near Denver.

Mr. Ben Stanley Revett has described his personal recollection of experiments made by Criley at Baker City. I distinctly recollect some experiments, made by agitating powdered ore in a flask with oil, made at my father's office in London. Both of these experiments were clearly froth flotation.

I do not remember the year of this experiment, but it was made at my father's older office at Basinghall street, and not at his later office at Broad-Street Avenue, from which fact the date could be approximately ascertained. Unfortunately, I do not remember much of the detail, except that the flask used for the experiment, and the oil, black in color, were provided by the visitor. I plainly recollect grinding up the ore to be tested in a pestle and mortar, and the man's appearance. He was dark in complexion, of gross appearance, and very voluble. He may have been the Charles B. Hebron of the 1891 patent. My father was away at the time, and I was alone in the office, having come up from Cornwall. On his return I made an appointment for him to see the process man, but do not know what came of it. I recollect that the idea of making ore float appeared to me absurd, as I thought that it was infinitely easier and cheaper to allow it to sink, but my father did not seem equally skeptical. I wrote to him in 1915, shortly before his death; he remembered the incident, but could not add anything to my recollection. wrf.

On consideration I am convinced that Dr. Everson really invented the art of flotation just as it has since been developed, and I believe that had he lived a few years longer

the process would have been perfected and have come into general use 20 years earlier. Many persons, better able than myself to judge of the feasibility of the idea, certainly witnessed the demonstrations, and the fact that nobody realized what a great thing they were missing is rather a reflection on the lack of imagination of the ordinary man.

It may be apropos if I briefly refer to my experiments made in the use of grease in concentration about 1899 or 1900, when I used a grease table for catching escaped mineral from a gold stamp mill much as Haultain and Guess did more effectively a few years later. My contribution was the fact that the product so caught was far richer than the ordinary concentrate recoverable by re-concentration of the tailing. The latter would carry only, say, half an ounce to the ton, mine ran several hundred dollars. I showed that a sort of selective concentration was possible; the grease on the table became loaded with pyrite concentrate in a few hours, but this was of low assay. By leaving the table in the stream for several weeks a very high-grade product was obtained. Of course, it was small in quantity, and very messy to handle; it was shipped to the smelter, and to sample it was worth almost the value.

A short time after these experiments, Haultain and Guess made similar experiments on a much larger scale at the Silver Lake mill at Silverton, San Juan County. They there worked out the practical application of grease concentration in a very complete and able manner, but I think failed to realize as completely as I did the selective possibilities.

I have already indicated that, in my opinion, Dr. Everson was the first inventor of flotation, but the seed fell on stony ground and withered. For a number of years after, say, 1893, in this country nothing whatever was done to develop flotation.

Recent Improvements

Meantime Robson and Elmore had taken the matter up in England, and the latter, a metallurgist of great ability, had introduced bulk flotation, and worked out suitable apparatus to apply it practically. His subsequent introduction of a vacuum to release the air dissolved in the water of an ore pulp, together with the re-invention either by Messrs. Sulman and Higgins, or by metallurgists employed at the Central mill at

Broken Hill, Australia, according to the version we believe, of froth flotation induced by agitation, complete the early history of the process. Subsequent development has been determined on the one hand by the energy, determination and financial backing of the gentlemen who built up the organization of Minerals Separation in one direction, and on the other by a great number of independent investigators who have worked out almost every conceivable variation and modification.

Placing oneself in the position of an observer from the outside, and endeavoring to sum up the gradual unfolding of the art as it will be viewed by the historian of, say, 50 years hence, it is surprising how little of the practical result seems to depend on the original conception, and how much on the conditions under which it is applied and developed.

HAS THE ATTITUDE OF MINERALS SEPARATION RETARDED THE DEVELOPMENT OF FLOTATION CONCENTRATION?

By W. C. RUSSELL, Mining Engineer, Denver, Col.

When in 1915 I commenced to consider flotation as a commercial method of concentration, having previously been acquainted with it only as a laboratory experiment, I naturally sought the scientific literature on the subject. Much to my surprise I found but one book and a few scattered articles comprising the sum total of the contributions to the technology of this important branch of metallurgy.

Technology of the Process

I read Mr. Theodore Hoover's book and began a collection of everything available on the subject, but it was not until after some months of painstaking effort had failed to add much that was worth while to my store that I began to search earnestly for a reason to explain the paucity of technical data and illuminating experiment which engineers have grown so accustomed to find and enjoy in current contributions to scientific magazines, and discovered that apparently all information was being systematically suppressed.

This clearly indicated a *motive and an interest*, and soon after the decision of the Supreme Court in the Hyde case (I think in the spring of 1917), when first I read the iniquitous license contract offered those desirous of using flotation, the trail of carefully suppressed information led me to the door of Minerals Separation. Since then I have talked with many engineers, mining men and mill operators, and have yet to find one, whether licensee or non-user, who does not denounce the attitude of Minerals Separation, which in suppressing information and muzzling operatives has retarded the development of an art of great use to a great industry.

The attitude of a powerful corporation toward a single item, like a policy of Government or a particular thing or the custom of a country, is only to be gathered from many things, the sayings and expressions of many people, and so for the

most part this paper of mine is a mere compilation of many articles and editorial comments covering the past six years.

Abstracts From the Technical Press

In May, 1914, when the United States Court of Appeals had held Minerals Separation's patent claims *invalid*, the *Engineering and Mining Journal* said:

"Of course, no one will seek to minimize the credit that belong to Messrs. Sulman, Picard and Ballot and their well-organized and accomplished staff for their development of the froth-flotation process and their enterprise in contributing to its becoming the important commercial factor that it is today. But similarly is the technical staff of the Zinc Corporation, in whose works at Broken Hill the first great commercial success was achieved entitled to credit. We think that American mine operators will be disposed to recognize in a substantial way the engineering services of the Minerals Separation Co., even if they will not accept its claims to a monopoly.

"The Minerals Separation Co. possesses the 'know how' in the application of this process, and for that reason we have no doubt that the majority of American mine owners having difficult ores to treat will go to it and pay it for its knowledge and services, patent or no patent. The whole spirit of the American mining industry is one of freedom in the application of processes, the exchange of information for the benefit of everybody, an abhorrence of royalties and an objection to monopolies. On the other hand, the modern ideas of co-operation give the proper recognition, financial and otherwise, to those who contribute to improvements in the arts. We are disposed to think that Minerals Separation's loss of its American patent will prove a blessing to itself."

In January, 1915, the same journal said:

"Everybody has, of course, noticed the dearth of discussion about the flotation process in the current technical literature. The explanation of this is the still unsettled patent litigation and the attitude of Minerals Separation, Ltd., the claimant. That company will neither permit its own employes to talk or write about the process nor will it permit the employes of its licensees to do so. We do not recollect any metallurgical process of broad application and use respecting which such efforts toward secrecy have been exerted and so far have been successfully maintained. Toward that end no stone is left unturned. For example, a flotation apparatus is

introduced somewhere for experimental purposes. The experiments finished, the apparatus, which is essentially a construction of timber, is destroyed by axes. Naturally, those concerns which are employing the flotation process without license from Minerals Separation and are liable to be called into court keep their mouths shut as a matter of policy."

In March, 1916, in an article in *Canadian Mining Journal*, Mr. C. Terry Durell said:

"Seldom has litigation so retarded a science by smothering it in a cloud of secrecy. It is to be regretted that this condition has been brought about by some prominent engineers attempting to gain a world-wide control of all processes of flotation *after the basic patents expired.*"

At a meeting of the American Institute of Mining Engineers in 1916, Mr. H. W. DuBois, presenting some of his views as to the demands then being pressed by the claimants to flotation patents, took occasion to remark:

"Japan (I am informed) has passed a law by which no flotation patents will be allowed, solely in the interests of best conservation of their natural resources. This is interesting, if true. I also am informed (and this, I think, is reliable information) that applications, with the identical wording of the fundamental flotation patents which were granted to the Minerals Separation Co. in the United States, were submitted previous to the United States applications to the German Government. After an investigation, the German Patent Office decided that there was nothing new in these claims, and therefore patents were not allowed.

"It is a matter of undoubtedly a good deal more importance to us as mining men to know, if these flotation patents are going to be sustained by our highest courts, whether the practice in the past of demanding excessive royalties is to be maintained. In some countries, if a man has a patent and wants royalties which the industry considers unreasonable, those affected can go to the Government and get an adjudication as to some reasonable rate of royalties. That is not true in our country; but I think we should take, as mining men generally, a little more interest in the subject to prevent statements which *are not true* from being quoted as true before our highest courts, and apparently accepted by them with such confidence that decisions are being rendered along such lines as are going to burden greatly the mining industry on

account of the unreasonable royalties demanded by the parties having their patents sustained by the courts.”

After the decision (December, 1916) by the Supreme Court in the Hyde case, the *Metallurgical and Chemical Engineering* said editorially:

“ * * * The decision is of wide interest and has been awaited patiently by many metallurgists who were concerned in one way or another with the future of flotation in this country, and who viewed with apprehension the prospect of a monopoly in that new and promising branch of metallurgy. * * * It is equally true that it (Minerals Separation) will find ready adversaries along the way eager to break the monopoly which undoubtedly has deterred some big operators from openly adopting flotation. * * *”

A little later and after the broadcast distribution of the “stand and deliver” letter of Attorney Henry D. Williams, the *Mining and Scientific Press* (February, 1917) said:

“Steps are being taken by the Minerals Separation people to exact royalty from those not licensed by them to use froth flotation process. We published a copy of the letter sent by their lawyer to various mining companies, together with the list of questions the latter are ordered to answer. The tone is mandatory and peremptory. Some of the questions are inquisitorial and unwarranted. It is no business of Minerals Separation what ‘type of manufacture of apparatus’ is used by anybody. The Supreme Court has upheld the validity of patent No. 835,120, but defined it closely, and under that definition no embargo is placed on the use of any machine unless it involves the application of a process employing less than 1 per cent. of oil and the ‘beating in’ of air. Again, the demand for particulars concerning ‘any flotation tests’ made on the ore is quite outside reasonable curiosity—it is an impertinence. The object, evidently, is to obtain information for the use of Minerals Separation, and to discover the names of metallurgists engaged in experimental work in order to put them on a black list. Thus the company is continuing its maladroit methods of antagonizing those engaged in mining and of creating an intensified opposition to its alleged monopoly. * * *”

And still later, the same journal said, editorially, on March 10, 1917:

"In a recent issue we published a copy of the peremptory letter sent by the Minerals Separation people to the users of the flotation process. It appears that this letter was sent to some mining companies that are not using and never intend to use flotation; for example, the Kennedy Mining Co. at Jackson, Cal., in the Mother Lode region. The manager of the Kennedy mine received the peremptory demand of the Minerals Separation people for specific data concerning his mill operations, and this was followed by the threat of a suit for injunction. Certainly, Minerals Separation has acquired a fatal facility for irritating those engaged in mining. * * *

"Our contemporary at New York publishes a paragraph commenting on the mandatory circular issued by Minerals Separation and expressing the pious opinion that 'the company has no idea of instituting vindictive methods with anyone who has used flotation without paying royalties for it.' This statement is incorrect. The language used by Mr. John Ballot, the chairman of Minerals Separation, and by Dr. S. Gregory, its New York representative, indicates sentiments not to be reconciled with the ladylike policy thus outlined. On the contrary, the Minerals Separation people believe that they have a cinch and they intend to make the most of it; they expect to use the utmost power of the law in bringing infringers to their knees and compelling them to pay not only tribute, but ransom. The circular-letter contained questions—such as those asking whether any flotation tests had been made on the ore, and 'if so, by whom'—that have to be taken in connection with Minerals Separation's attempt to compel metallurgists to sign an agreement binding them not to disclose anything they learned in a mill or laboratory licensed by Minerals Separation to use froth flotation. That contract was submitted by us to a good lawyer and he pronounced it 'without valuable consideration and unconscionable.' There was no *quid pro quo*. It was a bluff which failed, but it was one more evidence of the real policy of Minerals Separation, namely, to prevent the spread of knowledge concerning the process; to hold to itself not only the right to impose a royalty, but the more objectionable power to place an embargo on technical information."

The *Metallurgical and Chemical Engineering* followed in July, 1917, with this:

"* * * Sulman, Picard and Ballot, who obtained tation process has been marred by unending litigation between the owners of a number of the basic patents and

various concentrating mills who have either wittingly or unwittingly committed infringements. It is notorious that a very large percentage of mill operators have assumed an openly hostile attitude toward the Minerals Separation Co., which is unfortunate in the extreme, but which they aver is entirely due to 'bulldozing' and other 'armstrong' methods of the holding company. It is a matter of universal regret that it seems impossible to suppress recrimination leading even to war during the development of this process which has such wonderful potentialities."

In September, 1917, the *Engineering and Mining Journal* published this editorial:

"* * * Sulman, Picard & Ballot, who obtained the the basic patents now owned by Minerals Separation, are entitled to the highest possible credit for carrying forward the early work of others in the field of flotation to a brilliant outcome in the laboratory. The management of Minerals Separation exhibited great skill and perception in collecting a far-reaching group of patents pertaining to the new art. With bulldog persistency they have fought their case through the courts of Australia, Great Britain and the United States. No fair-minded person ought to want to deny them the rights that the highest courts have given them. But when, in the same breath, Minerals Separation asserts that the use of more than 1 per cent. of oil gives woefully inferior results as compared with the use of less than 1 per cent., and yet claims the right to collect royalty on the use of any quantity of oil, in certain ways, there is created a feeling that hoggishness is being exhibited. While the mining public ought generously to admit the service that Minerals Separation has rendered to it, that company ought on its own part to recognize the service that mining and milling men, especially those of Broken Hill, rendered to it in making a commercial success of its process. In this, as in many other new steps in metallurgy, as, for example, in the cases of basic copper converting and in coal-dust firing, there was a big gap between the idea and the successful development of it in practice. The enormous success of the flotation process of ore concentration, which is admittedly one of the major improvements of all times in metallurgy, is the result of the work of many men. That being the case, one small group of men cannot be permitted to sit astride the mining industry of the world claiming and collecting royalties at its own sweet will.

So long as any such wish is expressed there will be litigation.

“Rightly or wrongly, the mining industry of the United States has obtained the idea that the management of Minerals Separation is arbitrary, dictatorial and grasping. In its own interest, that management ought to dispel that idea. Instead of antagonizing the mining industry, it ought to seek to win its friendliness and co-operation. If such a wish were exhibited, the mining industry would meet the company half way. It would be a good idea for the management of the American subsidiary of Minerals Separation to hold a conference with representative men of the mining industry and talk things over, giving the mining men a chance to say what, in fairness, they themselves think they ought to do and not telling them what they must do.

“After getting a decision from the United States Supreme Court for a process of concentration with a critical reaction when less than 1 per cent. of oil is used, the attorneys of Minerals Separation, Ltd., argued at the recent trial in Butte that the use of more than 1 per cent. is likewise an infringement. The Shade of Carrie Everson, after listening to some of these arguments, is reported to have prepared for a hasty and noiseless departure, saying: ‘I had better leave here *spurlos versenkt*, or those Minerals Separation attorneys will be coming after me for back royalty.’”

October 6, 1917, the same journal carried this as a news item from Toronto, Canada, under date of September 29, 1917:

“Cancellation of oil flotation patents controlled by Minerals Separation North American Corporation is being urged to prevent curtailment in production. The Minerals Separation North American Corporation has for some time threatened to bring actions for infringement against the Cobalt mining companies using the flotation process. * * * However, at a meeting of the Temiskaming Mine Managers’ Association, held at Cobalt on September 28, the following resolution was unanimously adopted:

“WHEREAS the attitude of the Minerals Separation North American Corporation, who claim to control all the basic patents for the treatment of ores by oil flotation, has restricted the output of war metals and retarded the economic development of the mineral resources of this country by claims for unreasonable royalties and by threatened lawsuits, it is hereby

“*Resolved*, That the Temiskaming Mine Managers' Association lend their sympathy and hearty co-operation to the *Northern Miner* of Cobalt in its endeavor to have the patents and personnel of the Minerals Separation North American Corporation thoroughly investigated by the Government, with a view to having the patents annulled.’”

In November, 1917, the *Canadian Mining Institute Bulletin* said, editorially:

“The Minerals Separation North American Corporation has succeeded very well in antagonizing the mining world of this continent by the avaricious course it has seen fit to pursue. Therefore, anyone who ‘eaves ‘arf a brick at it,’ can do so with the comfortable assurance that his performance will be hailed with a harmonious chorus of approval. A campaign was started vigorously, and has been prosecuted energetically by the *Northern Miner* at Cobalt, as a protest against the threat of the company to ‘hold up’ the mines that are employing the Callow process, and thereby, it is alleged, infringing the Minerals Separation patents. * * * It will not be in the least difficult to demonstrate that Minerals Separation, believing it has now a whiphand by having gained absolute control of the basic process, seeks to use that control to the utmost, regardless of the effect on the mining industry. That this effect will be detrimental, by tending, in particular, to check the development of resources and the production of essential metals at a time when it is vitally necessary in the national interests that such production should be maintained at a maximum level, is in itself a sufficiently strong argument to impel Government action, the aim of which would be not to deprive the proprietors of a valuable patent, of their just rights to collect a royalty from those deriving benefit from its use, but (as a war measure) to protect the user from being forced to submit to unreasonable demands and inhibitions, whereby industry would be adversely affected and production curtailed. Incidentally, and merely as an indication of the company’s rapacity, it may be noted that the amount it proposes to collect as royalty from the Cobalt mines is in excess of the total revenue derived by the Government from the mine taxation in the area. In ordinary times, of course, the company could be exacting as it pleased so long as it had the power and considered it good business to exercise it, and everyone would realize the futility of kicking against the pricks. The case now is different, and it is quite certain that if the Canadian Government

can once thoroughly be satisfied that Minerals Separation North American Corporation, even if it isn't German controlled, proposes to follow a program in dealing with the mines that will at all impede us in fighting Germany, prompt and effective measures will be taken to nullify its plans. Meanwhile, efforts in Canada to circumscribe the activities of the Minerals Separation octopus will undoubtedly be regarded sympathetically by many of our neighbors to the South, to whom it is, not without cause, anathema."

The "perpetual bondage" clause of Minerals Separations' license contracts received Canadian attention in an editorial in the *Canadian Mining Journal*, under date of November 15, 1917, from which I quote:

" * * * The claims of the Minerals Separation corporations with regard to discoveries by users of the process seem ridiculous to Canada, and it is unlikely that support for them could be found under our laws. It would be foolish for anyone to subscribe to such a contract as this until it has been proved legal. If it has not been proved legal in Canada, and if the Minerals Separation North American Corporation insists on such a contract being signed before granting a license, then the Corporation is, in fact, refusing to grant licenses. The obvious penalty for such action should be demanded. * * *

"It is an undeniable fact that not only a few, but a great number of metallurgists have contributed fundamentally toward the successful development of the flotation process. What seems so unreasonable in the whole affair is that Minerals Separation endeavors to claim the right of any further discoveries or improvements made whether by themselves or anyone else. This is, in part, what they request a licensee to subscribe to:

"The licensee shall, during his license, promptly communicate and explain to the licensors every invention or discovery made or used by them which may be an improvement, modification or addition to any of the inventions specified in the Letters Patent within this license, or may be useful in carrying out any of the processes thereby protected or any addition thereto or modification thereof, whether patentable or not, which the said licensees may use or be or become possessed of. All such inventions and discoveries shall be so available for use by the licensees as if they were contained in the Letters Patent within this license, and subject thereto the licensors shall be entitled to have the full benefit of and, if obtainable, to have Letters Patent for any such im-

*provements or discoveries communicated to them by the licensees, which said Letters Patent shall be and become the property of the licensors, and the licensees shall render all assistance in their power for that purpose * * ** (see Section 3 of license).'

"If this is not a deliberate attempt to monopolize one entire branch of science, for what purpose, then, was the word 'monopoly' coined? Other individuals own somewhat similar patents. All have contributed fundamentally toward making the flotation process the success that it is. None have contributed wholly toward doing so. None should be permitted to monopolize a chain of discoveries evolved through years of toil and study by independent workers. In a measure, local enterprises solve the problem of the economic treatment of Cobalt ores. The problem was solved by an adherence to certain principles laid down by Frank Elmore, Minerals Separation, and presumably many other metallurgists, coupled together with not a few separate and distinct, new, practical and scientific ideas developed by local ingenuity.

"If the Minerals Separation or their subsidiary in America is British or American, it would be nothing short of a crime to annul a solitary right contained in their patents. But if they elect to interpret liberty as 'license' for profiteering, then just as surely as rights exist they should be called to task and a curb applied. This curb would consist of the fixing of royalty terms by the Canadian Government. * * *

"Our quarrel is against an apparently burdensome monopoly. Anything that tends to impede progress in the mining profession we will oppose. We *directly charge* Minerals Separation North American Corporation with an apparently *deliberate attempt to mortgage* the brains of the men who become their licensees. We *directly charge* that concern with *retarding the progress* of metallurgy.

"Read the following Prussianized sections 5 and 6 of the license a licensee or prospective licensee must subscribe to:

"(5) The licensees shall not, directly or indirectly, during the continuance of this license, *nor at any time after the termination thereof*, dispute or object to the validity of the Letters Patent within this license or the novelty or utility of the inventions specified therein.

"(6) The licensees shall not, either directly or indirectly, during the continuance of the Letters Patent within this license or any of them, use the said inventions or processes or any improvement or modification thereof or addition thereto otherwise than in accordance with

these presents, and the licensees hereby undertake and agree that they, their officials and agents, will not in any way, directly or indirectly, support or assist third or hostile parties in any litigation either against the licensors or any licensees of the licensors, or against Minerals Separation, Ltd., of London, England, or subsidiary or associated companies or successors owning patents in the British Empire or in any foreign country for the inventions protected by the Letters Patent within this license, or its or their licensees, or by the licensors or said Minerals Separation, Ltd., or said other companies, against others.'

"In other words, the fruits of a licensee's intellect are not his own—they are Minerals Separation's—if that concern can enforce the lettering of their license. Surely such a pledge cannot be British. It would be difficult here to measure the embarrassment to which a licensee would be subjected during the future practice of his profession. He would always labor under the possibility of Minerals Separation, contending that any stand relating to the subject-matter of the agreement and brought forward by the licensee in his subsequent career, was a breach of his pledges. He would be honor bound to not even any time after the termination of the contract be permitted to utter adverse opinions regarding the validity, novelty or utility of the Letters Patent.

"Has any set of individuals the Prussianized right to seal the future or muzzle the expanding or changing views of the budding intellect of Canada? Can Minerals Separation get support of the legality of such an attempt in this Dominion? Self-respect of mining men of this country forms a barrier to their becoming a party to such a pledge. Self-respect of the Government will surely not permit the continuance of the attempt. The discoveries resultant upon the intellect which flows through this particular branch of the channels of science must not be taken into impoundage by one set of individuals who, at their own discretion, may permit them to become of use to the world or rule that they should stagnate in the pigeon-hole of an obscure desk of New York's Broadway."

In an article published in the *Engineering and Mining Journal*, under date of December 1, 1917, Mr. R. C. Canby said:

" * * * The mining world should not fail to give due credit to these gentlemen (Sulman, Picard and Ballot) for their marvelous perception as to the possibility of such processes, even though the evidence of such percep-

tion has been most largely shown in the development of a monopoly in patent ownership and by the expenditure of large sums in patent litigations, rather than in metallurgical developments. * * * ”

The patent laws of Canada contain a provision intended as a brake upon extortion under the guise of patent monopoly, which many of the mining fraternity who are obliged to deal with Minerals Separation devoutly wish were duplicated upon our statute books.

The *Canadian Mining Journal*, speaking of flotation patents in the Dominion of Canada, said in its issue of January 1, 1918:

“ * * * It is questionable whether the Minerals Separation patents are now of any great value in Canada. In our issue of October 15 we pointed out that Canadian laws allow only a reasonable royalty, and that the Minerals Separation corporations can hardly expect to be successful in Canadian courts as in United States courts. We stated that if the American corporation threatens Canadian users of the process with claims for excessive amounts it must be only bluffing. *It is provided under Section 44 of the Canadian Patent Act that in case a patentee refuses to grant licenses to others on reasonable terms, any one may apply to the Commissioner of Patents for a license to make, use or sell the patented invention.* As the claims of the Minerals Separation Corporation and the conditions under which it issues licenses are unreasonable, it is obvious that Canadian mining companies have good reason to assume that an application to the commissioner would be successful.”

And in the same issue published an article by Mr. W. E. Simpson as follows:

“ * * * Minerals Separation — In harmony with its attitude elsewhere, the Minerals Separation Co., through its subsidiary organization, the North American Corporation, has threatened proceedings against all users of flotation in the Cobalt district, so as to collect, if possible, the royalty of 2½ per cent. of the gross value of the whole concentrate recovered, according to the usual demands of this patent exploiting company. The success of flotation at Cobalt is due entirely to local enterprise; therefore, this demand is resented bitterly. The indications are that a legal fight is to follow, and a campaign has been started to enlist Government action ‘with

a view to having the patents annulled.' Amid the legal turmoil, metallurgical progress is being seriously handicapped, the free exchange of ideas has been completely stopped, and an embargo is being placed on valuable information. It is sincerely hoped that an equitable settlement may be obtained at the earliest possible moment. * * * * "

Article 3 of Minerals Separation license agreement, which the prospective user of flotation must swallow if he would avoid litigation, received attention in an article published by *Engineering and Mining Journal* in February, 1918, as follows:

" * * * Article 3 is one to which so much objection has been raised, it being contended by most people that this article of the agreement has practically stifled development by licensed users of the process. *The fact that all improvements made by licensees must be turned over to the patent holders has a decided tendency to destroy any incentive on the part of operators toward experimentation on improvement of the process.* Licensees may not, without the consent of the licensors, tell other operators about any modifications or improvements they may make, but this is in consonance with the attitude of Minerals Separation in inhibiting its technical staff from the customary participation in discussion of this process before scientific societies or in the current technical literature. A glance over the literature of the process shows the barrenness of the members of the Minerals Separation staff in this respect; except in the Patent Office and in the patent suits their names have for the most part been kept submerged. Whatever developments have been reported in the last five or more years, as to the nature of the process and its manifestations, has come from outside of the Minerals Separation Co., which has not only restricted the expansion of information through its own engineers, but has obligated users of the process to contribute their information only to Minerals Separation. The further restriction near the end of Article 3, prohibiting licensees from *using*, without the written consent of the licensors, *any improvement, modification or addition to any of the inventions not the property of Minerals Separation*, presumably has for its object the *protection of the royalties* of the Minerals Separation Co.'s patents. Licensees might have a different point of view in the event of some epoch-making development in the process—or might even view the mat-

ter differently now, did they not fear the all-pervading patent hand."

Mr. V. F. Stanley Low, member of the Institution of Mining and Metallurgy, member of the Australasian Institute of Mining Engineers, member of the American Institute of Mining Engineers, and a well-known Australian engineer, who was connected with mining at Broken Hill from 1902 to 1910, contributed an article to *Mining Magazine* in April, 1919, in which he said:

"Although the concentration of minerals by means of froth flotation, as distinct from the Elmore vacuum process, has been in successful commercial operation for over 14 years, very little has been written on the subject by British metallurgists in the British technical press. This is, in part, due to a national characteristic, by virtue of which our metallurgists and engineers are content to carry on the work in hand, seeking no notoriety, but satisfied if their efforts meet with success. There may also be in their minds a tinge of fear that, should they commit themselves to technical articles in the press, their co-workers may suspect them of an assumption of superior knowledge to which they in no way wish to lay claim. But, unfortunately, the greatest cause for silence would appear to be the refusal by directors of mining companies and of companies holding patent rights to allow their officers to communicate publicly the results of their researches in the laboratory or mill. * * * "

A composite of the comment of these prominent technical journals and the opinions of the eminent engineers which I have quoted, is undoubtedly an affirmative answer to the question, "Has the attitude of Minerals Separation retarded the development of flotation concentration?" which forms the title of this paper, but if any further answer be desired it may be found in the air of hostility and the profane emphasis of antagonism which meets the very mention of the name of Minerals Separation in the mining camps of the West.

PARTICULAR PRACTICES OF MINERALS SEPARATION WHICH MINING MEN HAVE CRITICIZED

By **GEORGE L. NYE**, Attorney, Denver, Col.

The day of the bonanza is gone; grass-roots deposits are no longer found; fortunes made over night no longer occur in metal mining; shipments of high-grade mineral direct to the smelter have given way to the concentrating mill; and metal mining has developed into an industry where economical treatment of large tonnages of low-grade material and the elimination of waste are the important features.

The evolution of the industry has naturally resulted in focusing the attention of experts upon the subject of "metallic waste." The evolution of mining has naturally produced a corresponding evolution in the manner of ore dressing and ore concentration.

Experimenters and investigators have been steadily in the field, and as far back as 1884 they were seeking to take advantage of the well-known affinity between metallic particles and oily substances, plus the buoyancy of oil in water, as a means of separating metal from gangue. Experiments and investigations were constant and widespread, but no satisfactory process, that is, none that was at the same time both efficient and economical, had developed until 15 or 16 years ago, when four processes came into commercial use at practically the same time in the Broken Hill district of Australia.

In 1907 and 1908 these four processes (R. 1460, Hoover) were in operation and were commercially successful. They were known as the Potter-Delprat, the De Bavay, the Minerals Separation and the Elmore vacuum processes.

The Potter-Delprat process, since acquired by Minerals Separation, consisted (in a general way) in the introduction of a fine ore pulp into a pointed box containing hot sulphuric acid or hot salt cake solution. There was a resulting reaction on the calcium carbonate in the material, producing a great quantity of bubbles which attached themselves to the sulphide particles and raised them to the surface in a thick coherent froth.

The De Bavay process made use of the "floating greased-

needle" idea, but instead of making a coherent froth there was a thin film of mineral particles floated off the top of the vessel.

In the Elmore vacuum process the material to be treated was thoroughly mixed with water, oil and acid, and the combination was then sucked up into the apparatus by a suction pump. The suction released the pressure of the pulp, with the result that nearly all the oil dissolved in the water escaped the solution in the form of bubbles which attached themselves to the sulphide particles and raised them to the surface in the form of a thick coherent froth. In some instances, calcium carbonate was added to the material.

In 1905 the Sulman, Picard and Ballot patent, which formed the basis of the process being operated by Minerals Separation, was taken out in England. The same process was patented in the United States in 1906, and is known as No. 835,120, being the patent litigated in the now celebrated Hyde case.

In 1905, 1906 and 1907, although the processes mentioned were commercially operating in Australia, but little was known about them in the United States, and it was not until after the patent application of Sulman, Picard and Ballot, which later became patent 835,120, was applied for that the use of oil flotation as a commercial method of ore concentration was introduced into the United States. The interest aroused was immediate and widespread, but the development of the art and its application to commercial uses was not at all in accord with either its possibilities or its opportunities.

Mining men the country over have been free to criticise the policy and practices of those controlling the fundamental patents, who apparently have been desirous of commercializing their ownership, while preserving their knowledge and information as trade secrets.

In taking this attitude the patent owners have entirely lost sight of the fundamental basis for the patent laws of the United States, found in the constitutional grant of legislative power to Congress in the following language:

"To promote the progress of science and the useful arts by securing for limited terms to authors and inventors the exclusive right to their respective writings and discoveries."

Referring to this constitutional provision, the Circuit Court of Appeals of the Third Circuit in *National Harrow Co. vs. Hench*, 83 Fed. 36, said:

“It is no part of the constitutional scheme or of the scheme of the patent laws to secure to inventors a profit from the suppression of their creations.”

In proceeding contrary to the spirit and intent of the constitutional and statutory provisions as interpreted by our courts, Minerals Separation has resorted to many practices criticised and condemned by the mining fraternity.

These practices may be summed up as follows:

It has suppressed technical information, thus retarding the development of the art.

It has made indiscriminate charges of infringement and has failed at the same time in many instances to point out any infringement.

It has required independent inventors and manufacturers to pay commissions on sales of their own apparatus.

It has discriminated unfairly in royalty charges, has charged and is charging excessive royalties and seeking to fasten such royalties upon the operator beyond the life of its patents.

It has made excessive claims to flotation rights, falsely disparaged independent apparatus and threatens lawsuits to coerce operators to sign a license contract.

It compels engineers in its employ to sign illegal and iniquitous contracts, and requires licensees and their employes to assign their inventions to it.

It has injected spies and hirelings into the plants of operators refusing to take out a license, and it has violated the criminal laws by breaking and entering the premises of another, and threatens to continue such practices, justifying its actions by its alleged necessities.

Suppression of Technical Information and Retarding the Art

In 1909 and 1910 there was a great scarcity of information concerning flotation, even in London, where the process was supposed to have been invented some four or five years earlier (R. 1624-40).

At the office of Minerals Separation it was stated that they

did not care to give out information. There were no books on the subject, and the practice of the art was shrouded in secrecy.

When Mr. Theodore J. Hoover sought to publish his book, he was violently opposed by Minerals Separation, which, however, later gave a reluctant consent and the book finally came out, minus certain excisions insisted on by Minerals Separation (R. 1642-3). The excisions, according to Mr. Ballot, were considered necessary in the company's commercial interests (R. 563). Private profit had even then begun to outweigh public interest in the prosecution of science and the useful arts.

Dr. Gregory sugar-coats the pill by calling it "self-protection." He says (R. 621-2-3):

"I am looking at it purely from a moral standpoint. I would say it was an absolute dereliction of duty on my part if I allowed any employe of ours to go and ruin the prospect of a company just because he wanted to air his views."

He adds, however, that in some instances:

"Where we have been able to satisfy ourselves that it would be innocuous we have allowed it (the publication of information), but it has done us harm, nevertheless."

Mr. John Ballot, president of Minerals Separation (R. 561-565), says:

"Our policy is thus: With a company developing and exploiting patented processes, we have licensees using these processes, and we are obligated to pass improvements and inventions on to licensees for use. We are not satisfied with the finality of our process as an invention; apart from exploiting the processes commercially we also try to improve them to make them still more useful. Our business, therefore, is of a secret nature. If we permitted our staff members to write papers and discuss things publicly, what possible chance would there be for us to develop our patents?"

In other words, for the sole purpose of facilitating private commercial exploitation of a patent right, Minerals Separation suppresses all information which might be used as a starting point for further development of the art by any one of a thousand brains outside its employ.

All this in the face of the fact that it has been the settled law of this country ever since the decision of the Supreme Court of the United States in *Pennock vs. Dialogue* (2 Peters 1):

“That the primary purpose of our patent laws is *not* the creation of private fortunes for the owners of patents, but is to promote the progress of science and the useful arts.”

Dr. Gregory admits (R. 624-5) that:

“There is no authoritative work on flotation, either in America, England or Australia; no book on flotation that I would consider an authority.”

If any further proof of the desire and effort of Minerals Separation to suppress information be required, it is found in the fact that some years ago when an editor [T. A. Rickard] was about to print an interview with a prominent metallurgist [Charles Butters], formerly a licensee of Minerals Separation, the latter's chief engineer threatened “to raise a red flag” if such publication was not suppressed. When crowded for a reason for his attitude, his only answer was that the author said something about the treatment of concentrates by chloridizing, roasting and leaching, and he was thinking of taking out a combination patent for that himself.

Of course, everyone at all familiar with the industry knows that such methods of treatment had been almost in common use for more than a quarter of a century.

That this attitude of Minerals Separation has unquestionably retarded the advancement of the art is affirmed and asserted by practically every mining man and mill man who has come at all in contact with the situation.

A well-known San Francisco editor, himself an engineer of wide experience, says (R. 1650-51) referring to the advancement of the art in this country:

“It has been extremely slow considering the importance of it. The progress of the art in this country has been retarded by the attempt to impose secrecy upon the experiments and the operations of those using the process by means, of course, of these license agreements and other methods, but more particularly by the effort to tie individual metallurgists to the chariot wheels of this patent-exploiting agency. * * * ”

Government officials connected with the Bureau of Mines express it as their opinion (R. 2067 and R. 2395-6) after years of experience and careful observation that the attitude of Minerals Separation has been to retard the development of the flotation art.

One Bureau of Mines man (R. 2053-65) has observed and noted a number of instances where mining companies have refused to consider an additional saving by the installation of flotation because of the repressive tactics practiced and the license agreement tendered by Minerals Separation.

Infringement

In one thing at least Minerals Separation has at all times dealt with lavish hand, that is, in its indiscriminate, wholesale charges of infringement. The company's own records show that it has carried in its "infringement file" hundreds of operators, individual and company, who have never used flotation at all, and in some instances concerns that have not even had a mill on their property.

Their chief engineer admits that they get most of their information concerning infringement from the technical press and casual information. (R. 1240, 647). This information is passed on to patent attorneys who send out notices of infringement and threats of suit without further proof of the fact (R. 1248). This same engineer admits that not nearly all of those listed as infringers are actually operating flotation (R. 1268-9, 1275-1278).

Apparently the plan was not only to reach the actual operator, but to throw a fear into the prospective operator at the same time.

The "holier than thou" attitude of Minerals Separation is well disclosed by the statement of its engineer (R. 1212-13-14) in referring to the actions of the manager of a certain company who, he says:

"Came and said that they wanted to take a license with us and settle up for their sins."

And adds:

"He was sinning against the law of using flotation illegally. His statement was the result of a letter which Mr. Henry D. Williams sent around generally to those on the list. They were our list of infringers."

These threatening letters from Henry D. Williams were sent to experimenters (Westcott, R. 1860), to those using the Callow process (R. 1894, Lambourne) and to those operating outside the limits of patent right awarded in the Hyde case (Hollister, R. 2330-31). Similar threats were made by representatives in personal interviews (R. 1894-2395), yet so far as we have been able to ascertain the threats were all based upon the broad and all-inclusive proposition that Minerals Separation *controls flotation*.

The chief engineer says (R. 1152) :

“The scope of our patent has been discussed by me with infringers in a general way, in that I told them that our patents covered the commercial use of flotation, and that we proposed to enforce our patents. * * * Advice to field men has been in a general way that people using flotation are probably infringers.”

He also says (R. 1247) :

“Our investigators went to the operators and obtained information. They did not report what patent was being infringed. They haven't any idea of patents. We have these operators down on our infringing list. * * * The elements entering into flotation process which, in general, infringe our patents are agitation and aeration, and the use of oil and other reagents with the formation and operation of froth, all in an ore pulp containing mineral values.”

One of Minerals Separation's field representatives admits that in many instances (R. 1828-35) neither the apparatus nor the reagents used were disclosed, and yet the operators were classed as infringers.

The former manager of the Midvale Minerals Co. in Utah reports (R. 1877) that the representative of Minerals Separation who called on him “got into the subject of infringement immediately.”

“He did not state or point out in any way whatever the manner in which we were infringing, but claimed infringement merely by use of flotation. He (R. 1885) talked about suits that Minerals Separation had brought against other parties, and was careful to state that all of them had been decided in favor of Minerals Separation.”

Another mine manager was informed (R. 1897) that the company was going to give the smaller operators *their due* later on.

Still a third (R. 1954) was told that suits were being brought on other points than the amount of oil used, and that after the decision of the Supreme Court Minerals Separation was "going after the protection of their rights."

Another manager, using more than 1 per cent. of oil on the ore (R. 2326) was told that he was infringing. The representative did not say how, but insisted that flotation could not be used without infringing Minerals Separation patents.

I have given a few of the instances where wholesale charges of infringement without specification, and threats of litigation without actual suits, have been used apparently to intimidate and frighten the small operator.

Independent Inventors and Manufacturers

Another branch of the "exploiting" business upon which Minerals Separation embarked originally with great eclat was that of requiring independent inventors and manufacturers to pay commissions on sales of their own apparatus. True it is that this practice has now, in the main, been abandoned, but the facts concerning its pursuit while it lasted are interesting and extremely illuminating in a consideration of the acts and doings criticised by the mining industry upon which this patent-exploiting agency is thriving.

In December, 1916 (R. 1358-78, Exhibits 249-259, inc.), the Stimpson Equipment Co., handling the Janney machine, designed to be operated in flotation concentration, was advised by a prospective purchaser that Minerals Separation was threatening trouble if the purchaser put Janney machines into operation. This naturally caused the Stimpson Equipment Co. to investigate the matter and to request that the attitude of Minerals Separation be disclosed.

Later Minerals Separation was advised that the prospective purchaser was one of their licensees, so that the sale could in no manner contribute to infringement. Stimpson was informed, however, that the chief engineer would see him on his way West, and later was requested to meet the engineer at Ogden, Utah. The meeting occurred, and the engineer then tendered to Mr. Stimpson a memorandum of a proposed

contract that might be entered into between Stimpson Equipment Co. and Minerals Separation regarding the sale of Janney machines. The memorandum was handed to Mr. Stimpson (Ex. 250).

This memorandum is one of the most astounding documents that has ever found its way into print. It provides that Stimpson shall have the right to sell the Janney machine to Minerals Separation's licensees, but requires that he agree not to sell, rent or lease any flotation machine except to such licensees. It stipulates that Minerals Separation must have a contract enforceable by injunction, and that it (Minerals Separation) shall become sole licensee to sell the Janney machines, but that it will, in turn, appoint the Stimpson Company selling agent. It stipulates that orders for Janney machines must be certified by Minerals Separation before machines are shipped, and requires that it receive 25 per cent. of the gross profit made between net manufacturing cost and selling price.

Naturally such a contract was not acceptable to the Stimpson Equipment Co., and after objection and considerable correspondence a new form of contract was submitted, which Minerals Separation's chief engineer declared would not violate the anti-trust laws, but this contract contained a provision for a heavy penalty in the event that any machines manufactured by the Stimpson Company were used in infringement of Minerals Separation's process patents.

In other words, the effect of the penalty was to close the door to any customers for the Stimpson Equipment Co., except licensees of Minerals Separation. The proposed contract was not signed.

Jackson Pierce, another machine manufacturer, was told by the engineer, E. H. Nutter, that anyone who used one of his machines and infringed would make him (Pierce) liable (R. 2296). Pierce refused to sign the contract submitted, objecting to the clause requiring payment of 10 per cent. of the selling price to Minerals Separation and fixing a liability of \$10,000 in the event that any Pierce machine was used in infringing operations.

A similar contract was offered to Mr. Ruth, another manufacturer. It was stated at the time by the chief engineer that the contract was the standard form (R. 2410), and that

he, Ruth (R. 2414), was not only an infringer, but worse than an infringer, for he was "furnishing the brains for other men to infringe with." Ruth was also told that he was making a living illegitimately (R. 2417).

Royalty Charges

In February, 1915, the assignor of Minerals Separation North American Corporation, entered into a special contract with the Anaconda-Inspiration interests, and in June, 1916, special royalty terms were given to the Colusa Parrot Mining & Smelting Co., because the quality of its dumps, the low recovery and the narrow margin of profit to the company made such terms equitable in the opinion of the assignor (R. 501).

A special agreement was also made with the St. Joseph Lead Co., the Doe Run Lead Co. and the Desloge Consolidated Lead Co. (R. 905).

Dr. Gregory explains (R. 908) that the licenses issued to these particular companies were special, because containing a condition that they would pay a certain sum whether they treated ores or not.

President John Ballot (R. 513) explains that in the instance of the Colusa Parrot Company the contract provided for a royalty of 6 cents for 20 pounds of copper recovered and that his company rebated 3 cents. He says (R. 515) :

"We merely agreed to leave the license as it was, the license taken up at a certain rate of royalty. As the royalty was paid and payable we refunded half of it to the owner. The agreement was probably oral, at most an exchange of letters."

It is stated (R. 537) that Minerals Separation, in settling with infringers, has adopted the policy of charging the infringer who comes to the office and confesses infringement double the amount he would have paid if he had taken out a license; then after he had paid for past infringements he is treated and put on the same basis as everybody else who has a standard form of license—he cannot, however, get the Anaconda agreement.

This was the attitude and stand upon which Minerals Separation in August, 1915, tried to avoid a previous agreement with Utah Leasing Co., saying (Ex. 303, Ex. p. 2242) :

“The London Board refuse to agree to the 6-cent minimum royalty * * * and insist that this material pays a flat royalty of 12 cents per ton. This on account of the fact that to grant you this 6-cent minimum would jeopardize our contract with the Anaconda Company.”

And yet in November, 1915, a special contract was granted the St. Joseph Lead Co., the Doe Run Lead Co. and the Desloge Consolidated Lead Co., “with the consent of London,” which was “the identical terms accorded Anaconda in their license and private agreement.”

It also appears that for several years Minerals Separation was charging one company 50 cents per ounce of gold recovered by flotation concentration and another company using substantially the same methods and treating substantially the same character of material during the same interval was charged 25 cents per ounce.

It must have been punishment or special privilege, one or the other.

Excessive Royalties

There can be no question but that the royalties charged by Minerals Separation are excessive. They are in practically every instance based upon metallic recovery. In other words, upon gross recovery upon ores treated.

In one instance a company during its operations in 1917 made a handsome profit, about \$550,000, and paid Minerals Separation a royalty of \$18,652. The following year the same company made a profit of \$50,000 and paid Minerals Separation \$30,000 in royalties. The third year the same company suffered a loss of \$70,000, but nevertheless paid Minerals Separation \$32,800.

If the fees paid for the use of a process bore some relation to the net amount of profit made by the operator, they might show some elements of fairness, but when charges are made upon a basis such that Minerals Separation gets its profit when the use of its process contributes to a loss upon the part of the operator, as well as when he makes a profit, there is something unfair and inequitable, if not illegal and illegitimate, in the royalty charges.

Field engineers for Minerals Separation have repeatedly

reported (R. 1766-1832-3) that operators protested royalties as excessive.

Mining operators all over the West (R. 1917-1952-2062-2063 and Ex. 352-2064-2290-2293-2312-2455-2471) protest the excessive royalty charges, characterizing them as prohibitive, and in many instances refrain from using the process because of such charges.

In one instance, after holding out the prospect, if not actually promising, a royalty of 4 cents per ton of tailings treated, Minerals Separation demanded 6 cents per ton, and after tendering a contract upon that basis and selling to the prospective licensee Minerals Separation flotation machines, which the licensee fully paid for, later demanded a flat royalty of 12 cents per ton upon the statement that a minimum of 6 cents would jeopardize their contract with the Anaconda Company.

The licensee refusing to be boosted a second time, Minerals Separation took the high-handed procedure of refusing to deliver to the licensee the machines which it had bought and paid for as a coercive measure to produce an acquiescence in an extortionate royalty. In this they were entirely unsuccessful (R. 2097 et seq. Witness Strange and Ex. 275 to 345).

The matter finally wound up with the most astounding suggestion from the representative of Minerals Separation, namely, that the licensee should sign both the 6-cent and the 12-cent agreement, submit them both to Minerals Separation for a decision, and entrust themselves and their contract to a concern which was then, in violation of decency and fair dealing, withholding the machinery which the prospective licensee had bought and paid for.

Is it any wonder that the licensee brought a replevin proceeding to obtain possession of its own, and that Minerals Separation ultimately failed in its attempted holdup?

Under the terms of the license contract put out by Minerals Separation, every licensee is bound not only to give every invention or discovery made during operations under the license to Minerals Separation, but to bind its employes to assign and transfer any such discovery or invention. The licensee also agrees that he will not without the written consent of Minerals Separation during the continuance of the

license use or employ any improvement, modification or addition to any of the inventions specified in the letters patent within the license which is not the property of Minerals Separation.

Dr. Gregory, referring to the contract of the licensees, says (R. 580) :

“Now, coming back to the contract, as I said before, one had difficulty in that direction, because it was considered that this contract never terminated, but when I explained to them that this was merely an option, and if you used the process you paid, and if you did not use the process you were as good as not having a contract at all—there was no objection of any kind. We simply made the contract and said. ‘Now, go ahead; if you find it convenient to use the process, you pay us a royalty.’ The agreement terminates upon their ceasing to use flotation, and it commences again when they start to use it.”

In other words, when once signed, the contract is perpetual, and extends the payment of royalties beyond the life of the patent right.

The charge of exacting excessive royalties was confessed by Chief Engineer Nutter when he wrote to Minerals Separation in March, 1917:

“I am becoming more and more convinced that our royalties are too high, and am getting together data which, I think, will show that we are losing out financially through charging a royalty which is considered too high. The only argument that I can see is that by maintaining our present position we can hold the Butte and Superior Company up for more than we otherwise might.”

Excessive Claims of Flotation Rights

The chief engineer of Minerals Separation thinks (R. 1156) that “any use of oil infringes Minerals Separation patents.” “All users of flotation (R. 1160) are infringers,” or (R. 1144) “probable infringers.”

He told Manager Martin of the Ozark Company (R. 1178) that Minerals Separation patents covered “flotation process,” that is, all manner of flotation concentration. He keeps all those using flotation on the infringers’ list (R. 1129) upon the general theory that they could not be using flotation in a commercial way without infringing, and says (R. 1267) that

it is practically impossible to use oil in flotation concentration without infringement. Furthermore (R. 1230) he regards all manufacturers of machines as contributory infringers.

In talking with Jackson Pierce, who was himself the manufacturer of a machine for use of flotation, Chief Engineer Nutter said:

“You are furnishing the brains for other men to infringe with. If they hadn't the flotation machine they couldn't infringe, and that would eliminate them. I suppose you are aware of the fact that our patents control any number of them. Our patents carry us up into the year 1935, and for fellows like you who are making flotation machines, we have a contract whereby you can manufacture without infringing.”

He then offered Mr. Pierce a contract similar to that proposed to the Stimpson Equipment Co., requiring that he only sell his machines to Minerals Separation licensees and pay them 10 or 20 per cent of the selling price for the privilege of being thus restricted in his market.

Falsely Disparaging Independent Apparatus

One of the methods formerly in use by Minerals Separation to coerce the manufacturer of independent flotation machines and compel them to come in and transfer all their rights to Minerals Separation and take in return a mere selling agent's contract was, to use an ordinary expression, to “knock” such apparatus and in every way to disparage the same in the minds of prospective purchasers.

When the Engels Copper Co. late in 1916 and early in 1917 (R. 1416) was thinking of installing Janney machines, the representative of Minerals Separation advised the president of the Engels Copper Co. that before he installed Janney machines he must procure the consent of Minerals Separation, frankly stating, however, that he did not think that the operator could get such consent. When asked what would happen if the operator went ahead without the consent, the reply was that very possibly his license *would be revoked*.

In another instance, one of Minerals Separation's own representatives in the field, in calling upon an operator engaged in installing independent apparatus, had “instilled doubt in

his mind that the Hyde machine which he is installing in one of his mills would do the work" (Ex. 157, Ex. p. 1476).

In yet another instance, the Ohio Copper Co. in Utah was using flotation. They had installed a Janney machine, and had had the same in operation about 60 days before a Minerals Separation machine was installed. The mill was treating copper ores, which in solution naturally corroded any metallic iron with which they came in contact. The Janney machine was of metallic construction, and at the end of 60 days was naturally less efficient in operation than when new. After the Minerals Separation machine was installed, the two machines were operated concurrently, and, of course, a record of the results was kept. Alfred Frank, the manager of the Ohio Copper Co. (R. 2557), states: "I did not consider there was any definite period during which there was a test." Notwithstanding this situation Minerals Separation attempted to make capital and to disparage the work of the Janney machine by circulating unfair comparative results in operation (R. 1691-4), and this in the face of the fact that the manager of the Ohio Copper Co. states: "The Janney machines did slightly better metallurgical work."

Minerals Separation representatives have repeatedly proclaimed the desire to be of assistance to operators, and always use that as an introductory statement in approaching anyone thought to be infringing, but their ardor to be of assistance cools rapidly after a license is taken out, and actual help is often entirely missing.

One notable instance was the experience of the Chicagoff Company where, after repeated efforts (R. 1399-1402) to get help from Minerals Separation, they gave up in despair and went to independent experimenters, who quickly gave them a solution which raised their savings 16 per cent.

Threatening Lawsuits to Coerce Operators

Dr. Gregory says very plainly (R. 601) that a licensee is insured against lawsuits. The inference is perfectly obvious. Anyone using flotation who is not a licensee is manifestly in danger of litigation. This is particularly emphasized in a letter sent out by Minerals Separation's patent attorney, in which he stated:

"You are hereby notified of infringement of my client's patents. * * * You are hereby directed to send me a full statement of your infringing operations. * * * In default whereof I am instructed to bring suit against you for an injunction, profits and damages, including a preliminary injunction at the commencement of the suit to immediately stop your operations."

According to the statement of Minerals Separation's chief engineer, such a letter was sent out to 250 or 300 operators when, confessedly, not more than one-third of them were actually infringing.

One of the field representatives on one occasion called upon the Idaho Mining, Reduction & Transportation Co. at Idaho Springs, Colo. (R. 1740). This enterprising and energetic young man stated to the superintendent:

"We are checking up the infringers, trying to keep them out of metallurgical difficulties and endeavoring to get them to come in and take out a license to avoid any disagreeable business that might follow."

This representative thereafter very naively stated: "He understood that meant litigation."

Another instance, that of the East Butte Copper Mining Co., after receiving the threat of litigation from patent counsel already referred to, took the matter up (R. 2371-3) with their own counsel, and reached the conclusion that they could not afford to get into a fight with Minerals Separation, "not because we felt they were in the right, but simply as a matter of expediency."

Then there was the case of the Evergreen Mines Co. (R. 2332), absolutely deterred from operation by threats of litigation by Minerals Separation. Their property today is lying idle under a resolution by the stockholders of the company to the effect that they will not reopen the property and commence active operations until they can receive fair and decent treatment from the patent-exploiting agency.

Compelling Engineers in Its Employ to Sign Illegal and Iniquitous Contracts

Mr. Theodore J. Hoover, one time general manager for Minerals Separation, who signed one of their engineer employes' contracts, by the terms of which Minerals Separation

seek to bind the engineers to them not only during the period of their employment, but for all time, characterized the perpetual obligation contract (R. 1585) as unjust, immoral and illegal.

The clause of the contract in question reads (R. 1589 Hoover, Respondent's Ex. 9) :

“He shall also pledge himself to keep in absolute confidence all information acquired regarding the company's business and processes during the time of his engagement, and also afterwards.”

The words “and also afterwards” constitute the particularly objectionable features of the contract.

Hoover says (R. 1584) that his career has been hampered and rendered difficult for years by those words and by the attempts of Minerals Separation to enforce them.

Mr. Hoover finally sought and obtained the opinion of eminent legal counsel to the effect that such a contract was unjust, immoral and illegal (R. 1582).

Minerals Separation also seek to stop the mouths and hamper the efforts of every metallurgist who enters the employ of a licensee by forcing upon them a contract similar to that which they enforce upon their immediate employes (R. 1652 et seq.).

Compelling Licensees to Assign Their Own Inventions to Minerals Separation

Clause 3 of the license contract is the clause requiring licensees to assign their own inventions and improvements, and the inventions and improvements of their employes to Minerals Separation.

Dr. Gregory very lucidly (?) explains (R. 616 to 19) the intention of this clause of the contract. He says, in effect, that it is intended merely to procure for all their licensees the benefit of new inventions without extra charge. He fails, however, to make mention of the fact that each time a new invention is made by a licensee and turned over to Minerals Separation for inclusion within the list of patents under its control that the claims of the licensees are forged anew, and the period of their slavery extended for the life of such patent.

Many licensees and prospective licensees complain bitterly of this clause of the contract. One of them characterizes it as "giving a warranty deed (R. 1917) on the brains of our organization," and all object to being obliged to release the results of their own investigations and efforts to Minerals Separation for its sole benefit.

In 1917, after writing to the company suggesting that royalty charges were too high, Chief Engineer Nutter said:

"Another matter which is in my mind now and which I will mention here—although it does not properly belong in this letter—is this: That it would be better policy for us to delete from our license those clauses which always cause irritation to our licensees and in practice are not observed. I refer more particularly to the embargo on information and to the binding of employes to turn over inventions to us."

This statement of Mr. Nutter is important for two reasons: first, as a confession that the company has an embargo on information and requires its employes to turn over inventions; and, second, because he recognizes and asserts that as a matter of business policy the company is making a mistake.

Using Spies and Detectives in Plants of Operators

Dr. Gregory tells (R. 653) how Chief Engineer Nutter went right into the plant of the Butte and Superior Company. He says they had the doors locked, but Nutter broke in. It was "absolute robbery," and took some of the stuff (concentrates) and put it into a bottle. "If you get some of the froth you know what they are doing," and then added with the utmost *sangfroid*: "You have to set a thief to catch a thief."

This characterization of their chief engineer may or may not be entirely acceptable to him, but up to date he has been sufficiently mindful of his complete ownership by Minerals Separation, so that he has made no complaint.

President John Ballot says that they have had occasion, and unless they are ordered to the contrary they may have occasion in the future to employ men who will use their ingenuity and skill to get into places and find out what people are doing. "We have to use all the modern methods that everybody uses—detectives. We employ a man to get into the works—anyone that we can get hold of to do the business.

We employ a man to go into the works and pay him. Detectives were sort of workmen."

In other words, they employ men outright in the first instance as spies, put them under salary, induce them to go to various operating companies and misrepresent themselves as honest men seeking employment, and thereby worm themselves into the work of an operator, taking their money from such operator as regularly as they get their pay from Minerals Separation for the sole purpose of spying out and reporting the operations in that particular mill.

It is brazenly admitted (R. 779) that they had a chief spy located in Salt Lake City, who recommended other spies (R. 769) who were employed in at least two instances, and who were characterized as the "Northern observer" and the "Southern observer." He says, however (R. 773), that they were employed to ferret out instances of stealing, and adds:

"By stealing, we mean that they were suspected of illegally using our process patents."

These observers were employed at a total cost of a little less than \$10,000.

The arch-conspirator, reporting to President Ballot (Ex. 83, Ex. R, p. 1161), says:

"I just want to inform you that I have secured, by devious and most unethical means, a sample of X cake, which I am sending by registered mail to Mr. Higgins today."

When we consider the suppression of information, the indiscriminate charges of infringement, the demands upon independent inventors and manufacturers, the excessive claims to flotation rights, the disparagement of independent apparatus, the threats of coercion, the strangle-hold contracts imposed upon licensees and employes, and the excessive and discriminatory royalties which are being charged, to say nothing of the outrageous methods employed by this patent-exploiting monopoly to obtain the evidence with which to club non-licensees into submission, is it any wonder that practically the whole mining fraternity has been aroused to that spirit of self-defense which years ago found expression in the words, "Millions for defense, but not one cent for tribute"?

MINERALS SEPARATION'S POSITION UNDER THE PATENT LAWS AND THE ANTI-TRUST LAWS

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Minerals Separation owns, controls and is interested in 68 United States patents. Of these, three only have been litigated: No. 835,120 ("fraction of 1 per cent." oil), No. 962,678 (soluble frothing agents) and No. 1,099,699 (phenol or cresol, cold, without acid). None of the remaining process patents, most of which cover merely some variant or alleged improvement of one of the above processes, and none of the apparatus patents, all of which together admittedly cover only a few of the many types of machines capable of use in flotation, have ever been litigated or invoked by Minerals Separation in any court against any alleged infringer.

Taking up these three patents, which alone have been litigated by Minerals Separation:

No. 835,120 ("fraction of 1 per cent." oil) was patented in the United States on November 6, 1906, by three British subjects, Messrs. Sulman, Picard and Ballot. No. 962,678 (soluble frothing agents) was patented in the United States on June 26, 1910, by the same Mr. Sulman and two other British subjects, Messrs. Greenway and Higgins. No. 1,099,699 (phenol or cresol, cold, without acid) was patented in the United States on June 9, 1914, by the same Mr. Greenway. Considerable mystery has been thrown by Minerals Separation around the present ownership of these patents, but so far as can be ascertained (see testimony in *Federal Trade Commission v. Minerals Separation, Ltd., et al.*, pp. 40-41, 324-325, 1015-1016) such ownership is somehow suspended between the parent company, Minerals Separation, Ltd., a British corporation, and its subsidiary, Minerals Separation North American Corporation, which the British parent company caused to be organized under the Maryland law in the midst of the Great World War.

"To Promote the Progress of Science"

The Constitution of the United States (Art. I, Sec. 8, clause 8) provides that Congress shall have power "To pro-

mote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writing and discoveries." That Congress was empowered simply "To promote the progress of science and useful arts," and was authorized to secure "for limited times" to "inventors the exclusive right" to their "discoveries" only in so far as this would "promote the progress of science and useful arts," and that the patent owner's rights under the Constitution are thus conditioned by the constitutional purpose "To promote the progress of science and useful arts" must always be remembered, and if my reference to this almost forgotten constitutional provision, and to some often overlooked duties and obligations of patentees arising thereunder, seems sometimes too frequent, it is only because the arrogance of patentees in general, and Minerals Separation in particular, makes it constantly necessary to recall that by the very words of the Constitution Congress had no power to secure "for limited times" to "inventors the exclusive right" to their "discoveries" excepting in so far as such "securing" should "promote the progress of science and useful arts."

With this single constitutional purpose in view, Congress has enacted that after filing in the Patent Office a "written description" of his "invention or discovery," and "of the manner and process of making, constructing, compounding and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound and use the same," and "particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery" (U. S. Revised Statutes, Sec. 4888, as amended, Act March 3, 1915, c. 94, Sec. 1), and after establishing, to the satisfaction of the Patent Office, the fact of his "invention or discovery," the inventor shall then receive "a grant to the patentee, his heirs or assigns, for the term of 17 years, of the exclusive right to make, use and vend the invention or discovery throughout the United States, and the Territories thereof, referring to the specifications for the particulars thereof" (U. S. Revised Statutes, Sec. 4884). This grant, be it always remembered, is conditioned by the Constitutional purpose "To promote the progress of science and useful arts." Many times the courts

have held that only in so far as the patentee has fulfilled this constitutional purpose, and through his specifications and claims on file in the Patent Office disclosed his "invention or discovery in such full, clear, concise and exact terms as to enable any person skilled in the art * * * to make, construct, compound and use the same," is the patentee entitled to a patent; and that for conduct tending to frustrate this constitutional purpose, such as fraud, or intent to deceive, or excessive claims, the patentee must forfeit his patent.

Litigated Patents Soon Expire

Returning to the three patents which alone have been litigated by Minerals Separation:

No. 835,120 ("fraction of 1 per cent." oil) by assignment grants to the British parent company and to its controlled American subsidiary, Minerals Separation North American Corporation (or to the latter alone, according as may appear when the mystery of ownership is cleared up), "for the term of 17 years," i. e., until November 6, 1923, "the exclusive right to make, use, and vend * * * throughout the United States, and the territories thereof" such "invention or discovery" as the patentees "particularly point out and distinctly claim" in respect of their so-called "fraction of 1 per cent." oil process. Similarly, No. 962,678 (soluble frothing agents) grants to the same companies, until June 26, 1927, similar rights in respect of the so-called "soluble frothing agents" process, and No. 1,099,699 (phenol or cresol, cold, without acid) grants to the same companies, until June 9, 1931, similar rights in respect of the so-called "phenol or cresol, cold, without acid" process. By their own terms, therefore, and by the express language of the statute, these companies must cease exercising these rights on November 6, 1923, June 26, 1927 and June 9, 1931 respectively, and by the precise words of the Constitution these rights are conditioned by the constitutional purpose "To promote the progress of science and useful arts."

What are these rights, which, by the Constitution, the statute, and the patents themselves, must expire anyway in a few years, and by the language of the Constitution are conditioned "To promote the progress of science and useful arts," which

now are so aggressively asserted against the entire mining industry by Minerals Separation?

Precise Limits of Patent No. 835,120

No. 835,120 ("fraction of 1 per cent." oil) has been litigated in the so-called Hyde case (Minerals Separation, Ltd. vs. Hyde, 207 Fed. 956, D. C. Montana, July 28, 1913; Hyde vs. Minerals Separation, Ltd., 214 Fed. 100, C. C. A. Ninth C., May 4, 1914; Minerals Separation, Ltd. vs. Hyde, 242 U. S. 261, U. S. Supreme Court, December 11, 1916), and in the so-called Miami case (Minerals Separation, Ltd. vs. Miami Copper Co., 237 Fed. 609, D. C. Delaware, September 29, 1916; Miami Copper Co. vs. Minerals Separation, 244 Fed. 752, C. C. A. Third C., May 24, 1917), and in the so-called Butte and Superior Case (Minerals Separation, Ltd. vs. Butte and Superior Mining Co., 245 Fed. 577, D. C. Montana, August 25, 1917; Butte and Superior Mining Co. vs. Minerals Separation, 250 Fed. 241, C. C. A. Ninth C., May 13, 1918; Minerals Separation, Ltd. vs. Butte and Superior Mining Co., 250 U. S. 336, U. S. Supreme Court, June 2, 1919).

In the Hyde case, after varying fortunes in the United States District Court for Montana and in the United States Circuit Court of Appeals for the Ninth Circuit, No. 835,120 ("fraction of 1 per cent." oil) was sustained by the United States Supreme Court as regards the claims specifying "*the use of an amount of oil which is 'critical,' and minute as compared with the amount used in prior processes 'amounting to a fraction of 1 per cent. on the ore,' and in so impregnating with air the mass of ore and water used by agitation—'by beating the air into the mass'*—as to cause to rise to the surface of the mass, or pulp, a froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subjected to treatment" (Minerals Separation, Ltd. vs. Hyde, 242 U. S., 261, 265), and was rejected as indefinite as regards the claims specifying a "small quantity of oil" (p. 271).

In the Miami case, the United States Circuit Court of Appeals for the third circuit started from the point settled by

the United States Supreme Court decision in the Hyde case, i. e., "that invention resides not alone in critical proportion of oil but also in air and agitation" (Miami Copper Co. vs. United States, 244 Fed. 752, 758). "It is to be noted," said the Circuit Court of Appeals, by Judge Woolley writing for the Court, "that the Supreme Court did not construe the patent or determine its scope, for it had no occasion to do so" (p. 758). Accordingly, the Circuit Court of Appeals proceeded "to construe the patent in the light of that finding and determine whether the defendant's practices of aeration and agitation in connection with its admitted use of the critical proportion of oil, are within or beyond the scope of the patent" (p. 758). The Circuit Court of Appeals then considered the contention of Minerals Separation, Ltd., that "whenever the modifying agent of the patent (oil) is used, a person infringes who gets air into the pulp *in any fashion* and agitates the mixture *by any means* to a sufficient extent to cause the mineral particles to attach themselves to air bubbles and to rise therewith above the top of the mixture in a collection of bubbles and metal particles, to wit, froth" (p. 758). This obviously was an attempt by Minerals Separation to shift from the narrow ground which it previously had assumed, and which the Supreme Court, in the Hyde case, had adopted, and to place the patent upon another and quite different ground which would be free from the inconvenient limitations implied in the position which Minerals Separation had assumed, and which the Supreme Court had sustained in the Hyde case. The Circuit Court of Appeals rejected this contention and said: "The contention of the plaintiff at least omits the very definite limitation of the patent to the results obtained by the use of oil within the described proportions, and also the equally definite disclosure of an agitation in violence and duration greater than before employed" (p. 758). Construing No. 835,120 ("fraction of 1 per cent." oil), the Circuit Court of Appeals declared that the patentees "first told the art that a maximum metal recovery could be had from a minimum oil content," which "disclosure alone, interesting as it was, would have been valueless to the art, and would not have entitled the discoverers to a patent until they told how and by what medium that phenomenon could be brought into practical use," and that accordingly the patentees "proceeded

by further disclosures to tell the art that the way to produce the desired fomentation is by * * * agitation 'greater than and different from that which had been resorted to before.' * * * Agitation was thus made the practical element of their patented process, and by their patent disclosures they told the art that agitation was the secret by which the principle of their discovery could be unlocked and used" (p. 765). The Circuit Court of Appeals held that the first, second and third flotation processes installed by the Miami Company included agitation equivalent to that described in No. 835,120 ("fraction of 1 per cent." oil), and therefore infringed the patent, but refused to pass upon the so-called "fourth process" then being used by the Miami Company. Discussing the Miami Company's second process, the Circuit Court of Appeals said: "If the only agitation to which the pulp was subjected * * * was the agitation of the Callow cells, we would not say that that agitation * * * constituted an infringement" (p. 768). One of the Circuit Court of Appeals judges, it should be noted, dissented, and held that neither the second nor the third process of the Miami Company included the agitation of the patent (pp. 775-792). That the Circuit Court of Appeals has no intention of hastily declaring the so-called "fourth process" used by Miami Company, or the different variants of this process, used since 1917, to be infringements of No. 835,120 ("fraction of 1 per cent." oil), appears from the Court's refusal, in June, 1920, to hold at this time that the Miami Company is violating the Court's decree in using any of these variants or substitutes.

In the Butte & Superior case, after varying rulings by the United States District Court for Montana, and the United States Circuit Court of Appeals for the Ninth Circuit, the United States Supreme Court on June 2, 1919, held that the "essence of the discovery" covered by No. 835,120 ("fraction of 1 per cent." oil) was the *reduction* of the total amount of "oily substance" used in the process to any "fraction of 1 per cent. on the ore," plus "*vigorous agitation*," resulting in "flotation mainly from the inclusion of air bubbles introduced into the mass by agitation. (Minerals Separation vs. Butte & Superior Mining Co., 250 U. S. 336, 346-347, see also 341-2, 334-7).

Minerals Separation, Ltd., the British parent company, and

its controlled American subsidiary, Minerals Separation North American Corporation, began suit upon No. 835,120 ("fraction of 1 per cent." oil) against Nevada Consolidated Copper Co. in September, 1919, and against Magma Copper Co. in January, 1920, both in the United States District Court for Maine. Both mining companies have filed elaborate answers, which foreshadow their defense that the processes which they are using are wholly different processes which lie outside No. 835,120 ("fraction of 1 per cent." oil), because they depend upon air bubbles introduced or generated not by "agitation," but solely by Callow or pneumatic cells, and do not depend upon, nor in any way involve the "vigorous agitation" which the Supreme Court, in the Hyde case, and in the Butte & Superior case, and the Circuit Court of Appeals for the Third Circuit, in the Miami case, held to be essentially characteristic of No. 835,120 ("fraction of 1 per cent." oil).

Precise Limits of Patent No. 962,678

No. 962,678 (soluble frothing agents) has been litigated only in the so-called Miami case (Minerals Separation vs. Miami Copper Co., 237 Fed. 609, D. C. Delaware, September 29, 1916; Miami Copper Co. vs. United States, 244 Fed. 752, C. C. A. Third C., May 24, 1917), where the Circuit Court of Appeals for the Third circuit sustained the patent, as to four of its claims, in which the frothing agent is "*a small percentage*" of one or more specified soluble "*organic substances*" (instead of oil as in No. 835,120, "fraction of 1 per cent." oil), and the "*mixture is thoroughly agitated*" or "*vigorously agitated*" by "*beating air into it*" (Miami Copper Co. vs. Minerals Separation, 244 Fed. 752, 771-774). "Here (i. e., in No. 962,678) as well as there (i. e., No. 835,120)," said the Circuit Court of Appeals, by Judge Woolley, writing for the Court, "the decision turns upon the kind and degree of *agitation* employed by the defendants * * * what has been said about the infringing agitation in the oil process (i. e., No. 835,120) must also apply to the same agitation when considered in reference to the second process (i. e., No. 962,678)" (p. 774).

Minerals Separation, Ltd., the British parent company, and its controlled American subsidiary, Minerals Separation North American Corporation, began suit upon No. 962,678 (soluble

frothing agents) against Nevada Consolidated Copper Co. in February, 1920, and against Magma Copper Co. in January, 1920, both in the United States District Court for Maine. Both mining companies have filed elaborate answers which foreshadow their defense that the processes which they are using are wholly different processes which lie outside No. 962,678 (soluble frothing agents) because they depend upon air bubbles introduced or generated, not by "agitation," but solely by Callow or pneumatic cells, and do not depend upon, or in any way involve the "vigorous agitation" which the Circuit Court of Appeals for the Third Circuit in the Miami case held to be essentially characteristic of No. 962,678 (soluble frothing agents).

Precise Limits of Patent No. 1,099,699

No. 1,099,699 (phenol or cresol, cold, without acid) has been litigated only in the so-called Miami case (Minerals Separation, Ltd. vs. Miami Copper Co., 237 Fed. 609, D. C. Delaware, September 29, 1916; Miami Copper Co. vs. Minerals Separation, Ltd., 244 Fed. 752, C. C. A. Third C., May 24, 1917), where the District Court held the patent invalid, but the Circuit Court of Appeals for the Third Circuit sustained it. The process covered by this patent consists "in mixing a powdered ore * * * with neutral matter containing in solution *a minute quantity*" of hydroxy compounds and "*agitating* the mixture in the cold to form a froth and separating the froth" (Miami Copper Co. vs. Minerals Separation, 244 Fed. 752, 774). The Circuit of Appeals held that by dispensing with heat and acid, and by using "*a minute quantity*" of hydroxy compounds (i. e., phenol, cresol, etc.) the patentee disclosed an original and novel plan which has broadened and made more simple the *agitation* process of air flotation" (p. 775). Neither Minerals Separation, Ltd., the British parent company, nor any of its subsidiaries, has ever sued anyone else upon this patent.

"Occupied Zone" of Minerals Separation

Summarizing the rights which Minerals Separation, Ltd., the British parent company, and its controlled American subsidiary, Minerals Separation North American Corporation have under the only patents which it has litigated:

Under No. 835,120 ("fraction of 1 per cent." oil), conditioned always upon the constitutional purpose "To promote the progress of science and useful art," the patentees have the "exclusive right," expiring in any event November 6, 1923, merely to the process of *reducing* the total amount of "oily substances" to any "fraction of 1 per cent. on the ore" and adding "*vigorous agitation*," greater than and different from that which had been resorted to before—"by beating the air into the mass"—so as to produce "flotation mainly from the inclusion of air bubbles introduced into the mass by agitation," which right the Court has expressly held does not cover *any process in which the total amount of "oily substances" exceeds "1 per cent. on the ore," nor any process in which air gets "into the pulp in any fashion," or "by any means" (such as "the agitation of the Callow cells"), different from the "vigorous agitation" mentioned in the patent.*

Under No. 962,678 (soluble frothing agents), conditioned always upon the constitutional purpose "To promote the progress of science and useful arts," the patentees have the "exclusive right," expiring in any event June 26, 1927, merely to the process of *using* "a small percentage" of one or more specified soluble "organic substances" and *agitating* the mixture "thoroughly," or "vigorously," "beating the air into it," which right, by well-settled law, *does not cover any process in which the total amount of such "organic substances" exceeds the "small percentage" referred to in No. 962,678 (soluble frothing agents), nor any process in which air gets "into the pulp in any fashion," or "by any means," different from agitating "thoroughly," or "vigorously," or "beating the air into it."*

Under No. 1,099,699 (phenol or cresol, cold, without acid) conditioned always upon the constitutional purpose "To promote the progress of science and useful arts," the patentees have the "exclusive right," expiring in any event June 9, 1931, merely to the process of *using* "a minute quantity of hydroxy compounds" without acid and "*agitating* the mixture in the cold to form a froth," which right, by well-settled law, *does not cover any process in which the total amount of hydroxy compounds exceeds the "small percentage" referred to in No. 1,099,699 (phenol or cresol, cold, without acid), nor any process in which air gets "into the pulp in any fashion," or "by*

any means," different from the agitation described in the patent.

These precise limits of Minerals Separation's three litigated patents define the entire zone which, so far as the courts have decided, Minerals Separation today has any legal right to occupy in the field of flotation.

Occupied Zone Soon to Be Vacated, Free Zone Always to Be Unmolested

By the express conditions of this occupation, prescribed by the Constitution, the statute and the patents themselves, Minerals Separation on November 6, 1923, must evacuate the first sector of this occupied zone which it now holds under No. 835,120 ("fraction of 1 per cent." oil), and on June 26, 1927, must evacuate the second sector which it now holds under No. 962,678 (soluble frothing agents), and on June 9, 1931, must evacuate the third and last sector which it now holds under No. 1,099,699 (phenol or cresol, cold, without acid).

The plain emphatic intention of the Constitution, the statute and the patents themselves is that on November 9, 1931, Minerals Separation's evacuation from this occupied zone shall be complete, and that Minerals Separation's present servitude over this occupied zone shall then cease, and that this entire occupied zone shall then be wholly free to everyone.

The "exclusive right" for which the patentees bargained when they "disclosed" their processes and obtained their patents was, as they then well knew, by the Constitution, the statute and the patents themselves, absolutely and strictly limited to this. After the 17-year period for each patent has expired, freedom to everyone to use these processes, without paying royalty or incurring any obligation of any kind to Minerals Separation was, as the patentees then well knew, one of the absolute essentials of this bargain, because if this essential should fail, then the sole constitutional justification for this "exclusive right," namely, "To promote the progress of science and useful arts," would also fail, and the entire constitutional purpose would be utterly frustrated. I say, advisedly, "one of the absolute essentials of this bargain" because there is another essential equally necessary to the constitutional purpose "To promote the progress of science

and useful arts." Inventors, engineers, manufacturers and others, independent of and competitive with the patentees, must be permitted and encouraged, at every moment throughout these 17-year patent periods, to utilize every suggestion which the patents themselves afford to make every independent and competing "invention or discovery" possible in the area outside the occupied zone of the patents. Suppression, intimidation, molestation or harassment by the patentees of such investigations of such independent and competing inventors, engineers, manufacturers and others thwarts the constitutional purpose "To promote the progress of science and useful arts," and destroys the sole constitutional justification for the patentees "exclusive right." To abstain from these practices is just as much the patentees' duty, under the Constitution and the patents themselves, as is their duty to cease to exercise their "exclusive right" at the expiration of the 17-year patent periods.

How defiantly Minerals Separation, throughout its career in the United States, has evaded these two duties, appears in the standard license agreements which Minerals Separation has executed with dozens of American mine operators who have never contested Minerals Separation's patents, who at great cost to themselves have paid quarterly to Minerals Separation the exorbitant royalties exacted under these agreements, and who are now discovering from the Federal Trade Commission's evidence that the royalties which Minerals Separation is exacting from them, in some cases, several times exceed the royalties paid by their more favored rivals and competitors, and that having executed these agreements they must continue to forever pay these royalties, always handicapped by the lower royalties enjoyed by their more favored rivals and competitors, and after November 6, 1923, June 26, 1927 and June 9, 1931, still further handicapped by competition from rivals and competitors who, not having executed any agreements with Minerals Separation, will, after these dates, be free to use the respective processes covered by Minerals Separation's three litigated patents without paying any royalty or incurring any obligation of any kind to Minerals Separation.

Stretching Seventeen Years Into Eternity

Minerals Separation's first duty, under the Constitution, the statute and its patents themselves, is to evacuate, sector by sector, on November 6, 1923, June 26, 1927 and June 9, 1931, the occupied zone of Minerals Separation's three litigated patents.

To evade this duty, Minerals Separation annexes to its standard license agreement a "schedule" setting forth these three litigated patents, and also all its other United States patents, 65 in number, none of which have been litigated, and most of which cover merely some variant or alleged improvement of processes or apparatus described in earlier patents, and all of which Minerals Separation has succeeded in obtaining from the United States Patent Office at the rate of from one to ten new patents each year. The American mine operator, as a rule, desires to use only one, or at most two or three of the processes and apparatus described in these 68 Minerals Separation patents. Minerals Separation invariably refuses, however, to give him this permission unless he executes a license agreement, in the standard form of which Minerals Separation recites that "the licensors (i. e., Minerals Separation), hereby grant unto the licensees (i. e., the American mine operator), full license, power and authority to make, use and exercise any or all of the inventions described and claimed in the Letters Patent within this license" at such mine as the license agreement specifies, "during the terms of the Letters Patent within this license or any of them and any extension thereof." Elsewhere in the license agreement, Minerals Separation recites that the "Letters Patent within this license" mean "all or any of the inventions, processes or apparatus described and claimed in the said Letters Patent *and any Letters Patent for the concentration of ores that are or may become the property of the licensors* (i. e., Minerals Separation)." This effectively brings within the phrase "Letters Patent within this license" all patents which Minerals Separation may thereafter succeed in getting patented, which, judging from past experience, will aggregate from one to ten new patents each year until the end of time. The life of the license agreement, therefore, which runs until 17 years after the date of the latest patent among the "Letters Patent

within this license" will be, until the end of time, extended each year by the addition of new patents, and the license agreement will thus become perpetual, unless Minerals Separation's plans are upset by the Federal Trade Commission.

Royalties: Discriminatory and Eternal

Several Minerals Separation licensees, as I have stated, pay royalties which are only a fraction of those charged by Minerals Separation to other licensees similarly situated, whom Minerals Separation has required to execute standard license agreements. Such discrimination handicaps each such standard licensee in competing with his more favored rivals, and its correction is one of the objectives of the Federal Trade Commission's proceeding against Minerals Separation.

The eternal duration of Minerals Separation's licensee agreements presents a situation which insistently calls for relief from the Federal Trade Commission. How it operates upon Minerals Separation's licensees may be illustrated by their plight upon the expiration of the patents covering the only Minerals Separation processes which they may happen to be using.

Assume that a Minerals Separation licensee is using only No. 835,120 ("fraction of 1 per cent." oil): On November 6, 1923, this patent expires. The plain, emphatic intention of the Constitution, the statute and the patent itself is that on that date Minerals Separation shall completely forfeit its present "exclusive right" to the process covered by this patent, that Minerals Separation's present servitude on the art through its ownership of this patent shall then cease, and that this process shall then be wholly free to everyone. Mindful of this, the licensee, let us assume, who several years before, in order to obtain permission to use merely this "fraction of 1 per cent." oil process, executed with Minerals Separation a standard license agreement, and who has never contested with Minerals Separation this or any other patent, and who at great cost to himself, has paid quarterly to Minerals Separation the exorbitant royalty exacted by this license agreement, and who has never used any process or apparatus belonging to Minerals Separation excepting only the process covered by this patent now expired, takes out this license agreement and reads it over in the expectation of finding that all his obliga-

tions to Minerals Separation have now been fully discharged, and that now he may freely use this process without paying any royalty or incurring any obligations to Minerals Separation or anyone else. His license agreement, and thus his obligation to pay royalties, he now discovers, do not end when the patent expires, but continue as long as he uses the process, continue even while his rivals who executed no agreements with Minerals Separation are absolutely free to use the process without paying any royalty to Minerals Separation, continue even while his competitors who defied Minerals Separation and contested its patent are using the process without incurring any obligation of any kind to Minerals Separation or anyone else, and will so continue until the end of time, with the requirement that he account quarterly and settle promptly with Minerals Separation in the same exorbitant figures, so long as he continues to use the process of this now expired patent.

Other Conditions of Minerals Separation's Eternal Servitude

Article 3 of Minerals Separation's standard license agreements provides that throughout the eternal life of these agreements, all licensees must disclose and turn over to Minerals Separation the ownership of "every invention or discovery made or used by them which may be an improvement, modification or addition to any of the inventions specified in the Letters Patent within this license, or may be useful in carrying out any of the processes" above mentioned, and that all licensees must, so far as practicable, "bind their employees" to turn over to Minerals Separation all such inventions made by such employees, and that no licensee may use "any improvement, modification or addition to any of the inventions specified in the Letters Patent within this license" except upon request to, and consent by, Minerals Separation. Articles 6 and 9 provide that throughout the eternal life of these license agreements the licensee "shall not in any way, directly or indirectly, support or assist third or hostile parties" such, for instance, as the Federal Trade Commission, "in any litigation against licensors," and "shall not, without the written consent of the licensors, communicate any detail connected with the working of any of said inventions, modifications, additions or improvements to any third party."

If, as Minerals Separation claims (erroneously, as I believe), these license agreements ought to be executed by every mine operator practicing the art of flotation, it would follow that every mine operator who, by any possibility, could interest himself in inventing any improvement in the art, now or at any time in the future, would be perpetually subject to the bondage of Minerals Separation.

Nothing approaching the duration, extent and burdensomeness of the servitude imposed by Minerals Separation has ever been presented in any reported decision in the State or Federal courts. This intolerable and perpetual servitude Minerals Separation seeks to impose upon the entire mining industry of the United States, and upon all present and future inventive genius which, in this or any future generation, can, by any possibility, advance the art of flotation. Compared with Minerals Separation, every other trust which the Government has dissolved under the anti-trust laws pales into insignificance, for Minerals Separation seeks to bring within its combination and monopoly not only all processes and apparatus which its own employes may develop, but also all processes and apparatus which any mine operator anywhere, who now or at any future time uses flotation, may now or at any future time by any possibility invent or discover. To curb this extravagance of monopoly, and to place limits upon these eternal license agreements, are among the objectives of the Federal Trade Commission's proceeding against Minerals Separation.

Obstructing "the Progress of Science"

Minerals Separation's second duty, under the Constitution, the statute and its patents themselves by which Minerals Separation's "exclusive right" under these patents is conditioned, is not to thwart the constitutional purpose "To promote the progress of science and useful arts." This constitutional purpose requires that independent and competing inventors, engineers, manufacturers and others should be permitted and encouraged to utilize every suggestion which Minerals Separation's patents afford to develop, and exploit every independent and competing "invention or discovery" possible in the area outside the occupied zone of Minerals

Separation's patents, and that Minerals Separation should abstain from suppressing, intimidating, molesting or harassing independent and competent inventors, engineers, manufacturers and others engaged in such development and exploitation.

In defiance of this duty, the Federal Trade Commission charges, Minerals Separation has tried to prevent independent and competing inventors, engineers, manufacturers and others from exploiting independent and competing processes and apparatus, has tried to prevent American mine operators from using such independent and competing processes and apparatus, has falsely and maliciously disparaged such independent and competing processes and apparatus, has falsely and maliciously claimed patent rights in excess of those actually possessed by Minerals Separation, has maliciously threatened to prosecute American mine operators who were using such independent and competing processes and apparatus, has seduced, corrupted and bribed employes of American mine operators to give Minerals Separation confidential information regarding their employers' operations, and in various ways has tended to suppress, intimidate, molest and harass the development and exploitation of independent and competing "inventions or discoveries" in the area outside the occupied zone of Minerals Separation's patents, and has thus tended to frustrate the constitutional purpose "To promote the progress of science and useful arts" by which Minerals Separation's "exclusive right" under its patents is wholly conditioned. These practices attributed to Minerals Separation, the Federal Trade Commission proposes to stop.

All these practices, according to the Commission's complaint, Minerals Separation has been committing for many years, with such success that by means of them Minerals Separation has stifled and suppressed the development and exploitation of independent and competing processes and apparatus, and has prevented actual and potential competition from independent and competing inventors, engineers, manufacturers and others, and has thus obtained that position of power and dominance which now enables Minerals Separation to charge exorbitant and discriminatory royalties.

What the Commission Can Accomplish

The Commission's purpose is not to dislodge Minerals Separation from the occupied zone which Minerals Separation succeeded in capturing in its first legal onset upon the American mining industry. That task is being attempted only by the American mine operators who are now defending themselves against Minerals Separation suits above described. The Commission's object is to ensure that Minerals Separation shall fulfill its plain emphatic duty under the Constitution, the statute, and its patents themselves, to evacuate, sector by sector, on November 6, 1923, June 26, 1927 and June 9, 1931, the occupied zone of Minerals Separation's three litigated patents, and meanwhile not to suppress, intimidate, molest or harass independent and competing inventors, engineers, manufacturers and others now working outside this occupied zone, and that Minerals Separation shall not utilize its ingenious entrenchments, its skilfully planned attacks, its enormous exactions of tribute from the occupied zone under its servitude, its awe-inspiring preparations for extorting colossal indemnities from the outside realm of flotation, and its campaign of commercial *schrecklichkeit* generally, for the purpose of evading this plain emphatic duty.

The Federal Trade Commission, in most of the proceedings which it has heretofore brought, has found, like the Supreme Court in the Standard Oil case (Standard Oil Co. vs. United States, 221 U. S. 1, 77) "that ordinarily where it was found that acts had been done in violation of the statute adequate measure of relief would result from restraining the doing of such acts in the future." But in the present proceeding, the Federal Trade Commission will find as the Supreme Court of the United States found in the Standard Oil case, that "in a case like this, where the condition which has been brought about in violation of the statute, in and of itself, is not only a continued attempt to monopolize, but also a monopolization, the duty to enforce the statute requires the application of broader and more controlling remedies" (p. 77).

The Federal Trade Commission's authority for devising and applying these remedies is ample under the Federal Trade Commission Act and the Clayton Anti-trust Act. Adequate remedy in the present situation will never be obtained until

the Commission, by explicit directions in respect of the amount of royalties to be charged by Minerals Separation ensures that such royalties are not in excess of what they would have been had not actual and potential competition from rival processes and rival apparatus, and from rival inventors, engineers, manufacturers and others, been stifled and suppressed by Minerals Separation over a period of years. Merely to enjoin at this late day the continued practice by Minerals Separation of the particular methods of unfair competition set forth in the Commission's complaint will not immediately revive the actual and potential competition which Minerals Separation has for years been stifling and suppressing. Not for several years, perhaps not for many years, can this competition be revived, nor the mining industry be made safe for rival processes and rival apparatus and rival inventors, engineers, manufacturers and others to compete with Minerals Separation. Until that time arrives, therefore, the Federal Trade Commission, "recreating, out of the elements now composing it, a new condition which shall be honestly in harmony with and not repugnant to the law" (United States vs. American Tobacco Co., 221 U. S. 106, 187), should make explicit directions as to the amount of royalties to be charged, to the end that the exorbitant and discriminatory royalties, which are the purpose and crowning accomplishment of years of unfair methods of competition on the part of Minerals Separation, may not be perpetuated after the mere practice of such methods has been discontinued.

RECENT DEVELOPMENT IN FLOTATION

By PHILIP ARGALL, Consulting Engineer, Denver, Col.

Substantial progress is being made along chemical and mechanical lines and in a more careful preparation of ores for flotation, tending towards somewhat coarser crushing followed by one or more flotation cleanings of the concentrate and re-grinding the middlings from the cleaner cells previous to re-floating. Selective flotation, through which two or more minerals can be floated separately, producing marketable concentrates of both ore minerals, has made considerable progress. It is, however, extremely difficult to obtain details or data of recent developments, as so many inventors are reticent until patent protection is secured, and others are not yet ready to discuss their methods. Under these circumstances I can only indicate the direction of improvements that come within my knowledge.

Oil Not Wholly Essential

Under chemical improvements, I might say at once that oil is not essential for good flotation results, as demonstrated by Henry E. Wood of Denver about 14 years ago, and by Potter and Delprat in Australia some four years earlier. The two latter, however, used water and sulphuric acid, or acid sulphate of sodium and successfully treated several million tons by their process. There is a strong tendency today to get away from the use of oil in flotation, hence the earlier oil-less processes are subject to close study.

It is well known that various chemicals added to water facilitate flotation by either the film or the bubble method, and such reagents are in common use in oil flotation methods; apart from these there are some new compounds or reagents now available, or soon to be available, which are expected to produce a froth highly effective in separating minerals from their gangue without the use of a trace of oil. In this connection colloids, or colloid solutions have been used on an experimental scale, and I believe in some instances, on a practical scale also, producing commercial results without the use of oil.

I believe I am safe in saying that there are several people

actively at work today in the elaboration, perfection and manufacture of reagents that will satisfy all requirements of good flotation without the use of oleaginous compounds.

Selective Flotation

In the field of selective flotation much good work has been accomplished by first deadening the zinc ores by gases or other chemicals so the lead can be floated, and following the removal of the deadening film the zinc can next be floated, thus producing two marketable concentrates from mixed zinc and lead ores. The Bradford process is a notable example that marks the beginning of large commercial results in this line of work. Here, again, there are several methods of selective flotation the full details of which are not yet available to the public, while some of the schemes are very probably not thoroughly worked out. In selective flotation there is a vast field open for proved methods, and I believe there is a bright future along this line of operation.

In mechanical improvements the greatest efforts appear to have been concentrated in developing agitating machines of many and varied designs. These may be divided into two general types—vertical agitators and horizontal agitators—the latter apparently in the lead. The vertical agitator, with the hollow shaft through which air is drawn down into the pulp, takes a prominent place but is scarcely novel. Machines of this type have been used over 30 years ago for amalgamation and for oxidizing the impurities in mercury. The horizontal agitator, drawing in its air around a central shaft, appears to me both novel and efficient. I refer to the type having agitating drums of a length of 3 to 6 diameters, which, fan like, draw in air around the horizontal shaft from both ends. The drums operate at the bottom of the flotation cell providing a quick passage for the ascending bubbles, mineral-laden, to reach the surface in a short and direct route and discharge their burden into the overflow launders on either side of the cell. No filter or canvas bottom is used, and for acid processes this type of agitator offers very great advantages.

Some Principles of Gravity Concentration and Flotation Alike

More attention is given to the preparation of the ore for flotation where a granular product with minimum slime is

sought. Some principles governing gravity concentration apply equally to flotation; the minerals must be fully liberated from the gangue when high-grade concentrate and low-tailing is desired. In gravity concentration it is invariably admitted that the middling product remains middling until re-ground to liberate the minerals. This important principle was not recognized in flotation, or I should say was not put into use as early as it might have been; yet when properly applied it will decrease operating expense by permitting coarser crushing in the initial stage, and will also increase the recovery in a higher grade concentrate.

Returning unground middlings from concentrate cleaning cells to the mill stream usually result in building up a product that in time escapes in the tails or contaminates the concentrate. Very fine initial grinding, it is true, lessens these losses but increases the percentage of slime, a product that seldom gives the best recovery even in bubble flotation.

Good practice, for the production of a high-grade concentrate and high recovery, in my opinion, favors coarse initial crushing; a bulky roughing concentrate, followed by one or more flotation cleanings of this concentrate, with the re-grinding of all middlings from the cleaning cells that are worth re-treating.

THE INFLUENCE OF FLOTATION ON METALLURGICAL PRACTICE

By FRANCIS A. THOMSON, Dean, School of Mines, University of Idaho

In ten years flotation has revolutionized the entire art of ore dressing. At its inception, the writer—and he had plenty of distinguished company—greeted the new process with skepticism, and felt inclined to classify it as simply one more of that great array of abortive ore-treatment schemes. In this he was mistaken.

Flotation has become one of the leading metallurgical processes, and with the single exception of the smelting of iron ore in blast-furnaces, no other method approaches it in magnitude of tonnage handled.

In a paper published three years ago, I presented some estimates on this subject, and after revising these for 1919 and 1920, I would give the following figures:

Process.	Tons per annum.
Iron blast-furnace smelting.....	75,000,000
Flotation plants.....	25,000,000
Gravity concentration plants.....	18,000,000
Copper smelting plants.....	5,000,000
Gold and silver milling plants.....	5,000,000
Copper leaching plants.....	2,500,000
Lead smelting plants.....	2,000,000
Zinc smelting plants.....	750,000
Zinc leaching plants.....	150,000

These are frankly estimates, as the exact figures are subject to considerable variation and are difficult to procure.

So much for the place of flotation on the quantitative side now as to the changes wrought in metallurgical practice.

Ore Dressing

First, in the field of ore dressing itself, flotation has primarily increased recovery to a point never previously dreamed of. For instance, Mr. Frederick Laist, in response to an inquiry, writes as follows: "The average recovery by concentration at Anaconda, prior to the installation of any slim treatment, was about 78 per cent. The 20-deck round table

increased the recovery to about 85 per cent. This recovery was raised by flotation process to about 96 per cent." Incredible as it may sound to those expert in the older practice of gravity concentration, there are authentic instances where upwards of 99 per cent. recovery was maintained for several days at a time in moderate-sized plants, treating particularly easy ores.

Almost as striking as the remarkable increases in recovery is the great simplification of flow-sheets and of plant construction brought about by flotation, thus decreasing both first cost of plant and labor expense for operation. On the other hand, the finely divided and frothy character of the concentrate produced has necessitated the addition of filters and dryers in concentrating plants; and the need for careful control of pulp dilution has increased the number of pulp-thickening devices.

Slime, once the "bugaboo" of all millmen, is no longer feared. There are some metallurgists who claim that in their particular plants, slime is an indispensable factor in the successful flotation of their ore. A secondary result of this aspect has been the rapid development and application of various types of ball-mills.

Each ore is a problem in itself, and in no process are skill and technique—both in preliminary testing and in plant operation—so necessary as in flotation. This is one of its disadvantages. It is undoubtedly true, however, that many millions of tons of ore are being concentrated today which would be left on dumps or in mines had it not been for flotation.

Ferrous Metallurgy

So far as I am aware, the field of ferrous metallurgy is as yet uninfluenced by flotation unless we care to place under this head the recovery of molybdenum, tungsten and other ferro-alloy constituents by flotation.

Treatment of Gold and Silver Ores

In the treatment of these ores, flotation has not filled as important a place as its advocates predicted for it. Cyanidation, supplemented to a constantly decreasing extent by

amalgamation, still holds the field. It is possible, experimentally, to show a high recovery of gold by floating certain ores. Generally, the gold, in part at least, is so finely divided, that crushing ore through approximately 200-mesh is necessary for its liberation; and there is still some difficulty in large-scale flotation of ores crushed to that fineness.

It is also true that many profitable gold mines are situated in remote places from which the transportation cost prohibits the shipment of anything but bullion, compelling the process to be one of ultimate extraction rather than of concentration.

In the treatment of complex gold and silver ores which render the cyanide consumption prohibitively high, or from which no satisfactory extraction can be made, flotation has a field.

In the case of oxidized ores of silver, where the primary sulphide ore is not amenable to cyanidation, it may be more profitable to sulphidize and then float the silver and other sulphides thus produced, than to erect a cyanide plant for the oxide ore and a flotation plant for the sulphide.

Treatment of Copper Ores

It is probably in the metallurgy of copper that the flotation process has exerted its most powerful influence. The changes at Anaconda are the best illustration of this fact, as this company had a well-established large-scale works before the advent of flotation, and a comparison of the older practice with the new makes this clear.

Coincident with and in a large measure due to the introduction of flotation, the blast-furnace has gradually been superseded by the reverberatory. Most new plants are designed for these furnaces. The reason is, of course, obvious: No one is going to pour a stream of fine concentrates into a furnace with a gale of wind (the blast) blowing through it.

The great increase in volume of finely-divided concentrates has led to additional roasting capacity, and to the necessity, therefore, of more apparatus for catching and treating the dust therefrom.

Flotation has also checked the development of treatment of sulphide copper ores and tailings by leaching. Reverting to Anaconda, we find the conclusion there is that while equally

good results at approximately the same cost can be secured on sulphide tailings by flotation and by leaching, nevertheless flotation recovers the silver while leaching does not. This applies only to sulphide ores of copper; oxidized and semi-oxidized ores will probably continue to be treated by leaching.

Treatment of Lead Ores

In the treatment of lead ores flotation so far has wrought no striking changes. If the Dwight-Lloyd sintering machines had not been developed almost coincidentally with the development of flotation, then something of the kind would have been so indispensable as to demand and ensure its development. However, the lead smelter finds himself seriously embarrassed by the nature of the material that he is receiving. Much of the flotation concentrate shipped to him is in the form of gummy, sticky slime, which will neither leave shovels, dump from wheelbarrows, run in bins, nor permit itself to be handled by any of the means commonly used for the storage and transportation of concentrates.

Treatment of Zinc Ores

Similar difficulties are encountered at zinc smelters. It is stated that at times, additional troubles have been met with by reason of retort explosions, due to the fine state of division in which the flotation concentrate comes to the plant. In response to an inquiry on the subject, Dr. Charles H. Fulton writes: "The zinc smelter seriously objects to flotation concentrate and, unless covered by special contract, assesses a penalty at the present time of \$10 per ton for concentrate when it originates from flotation. The reason for this is the losses caused during roasting and the difficulty of roasting such fine material in the present-day furnace. There is also an objection to the fineness of the material in the retorting itself, as impurities are mechanically carried over into the spelter."

So far as the new and rapidly developing art of zinc leaching, followed by electrolytic precipitation is concerned, I cannot do better than quote from a recent letter from Mr. J. O. Elton, to whom is due in a large measure the successful development of this process:

Flotation concentrates are the only zinc concentrates that can be treated to advantage in the electrolytic zinc plant without special fine grinding. Even table concentrates are too coarse. While the fineness of the roaster feed increases the dusting, the time of the roasting period is cut down and the temperature necessary for the elimination of the sulphur from the fine particles is much lower, thus decreasing the percentage of ferrate formed. With adequate dust-catching equipment the objection to a fine feed largely disappears. The finer the particles the quicker the chemical reactions take place; that is, the solution of the zinc oxide and the precipitation of the iron, arsenic, alumina and silica, with a relatively small excess of calcine. It is nearly impossible to wash zinc sulphate solution from the residue resulting from coarse calcine when all the washing is done on Oliver filters. A vacuum-filter will not pick up the coarse particles which, therefore, collect causing frequent and expensive delays to filter, pump and settler equipment. I will say that the finer the concentrates the better they are for the electrolytic zinc process.

Finally, and in conclusion, I think it safe to say that while flotation has increased the recovery in ore dressing on an average of from 10 to 20 per cent., it may be said also to have increased the difficulties of the metallurgist who is treating his ores by smelting. It, however, gives to the field of hydro-metallurgy an initial advantage in that the material received is already finely ground and in good condition for leaching after roasting. I am willing to venture the prophecy that in the next 25 years flotation and hydro-metallurgy, advancing hand in hand, will in large measure have displaced the present methods of pyro-metallurgy for the treatment of the ores of copper, lead and zinc.

GOLD CONFERENCE

THE INDUSTRIAL GOLD CONSUMERS' SUBSIDY

By H. N. LAWRIE

Chief, Precious Metals Division of The American Mining Congress

Price of Gold Fixed By Government

There are 480 grains in an ounce of gold. By United States statute there are 23.22 grains of fine gold in the standard dollar. Dividing the number of grains in an ounce by the number of grains in a dollar, the quotient obtained is 20.6718 dollars, the price of the fine gold ounce. That the Government has arbitrarily fixed the price of gold has been questioned, but this fact alone determines the solution of the gold problem. Because the price of gold is fixed, the premium specified in the McFadden Bill cannot be construed as a subsidy to the gold producer, as it constitutes a compensation of the loss in the purchase power of the gold ounce, and for the same reason the consumer of industrial gold who buys the metal at the pre-war price is receiving a subsidy. Fixed in price, gold cannot respond to the law of supply and demand, and market conditions differ altogether from all other products.

Purchase Power of Gold Ounce

As compared to 1914, the average purchase power of the dollar in terms of the wholesale prices of all commodities during the last five years (1915-1919) was 67 cents. The gold ounce, the only source of income to the gold producer, with a purchase power of \$20.67 in 1914, had an average purchase power during the last five years (1915-1919) of \$20.67 multiplied by 0.67, or \$13.85. Had the \$10 premium been in effect during this five-year period the purchase power of the gold ounce would have been \$30.67 multiplied by 0.67 equals \$20.54, or 13 cents below the fixed price of \$20.67. Opinions have already been expressed by our leading financiers and econo-

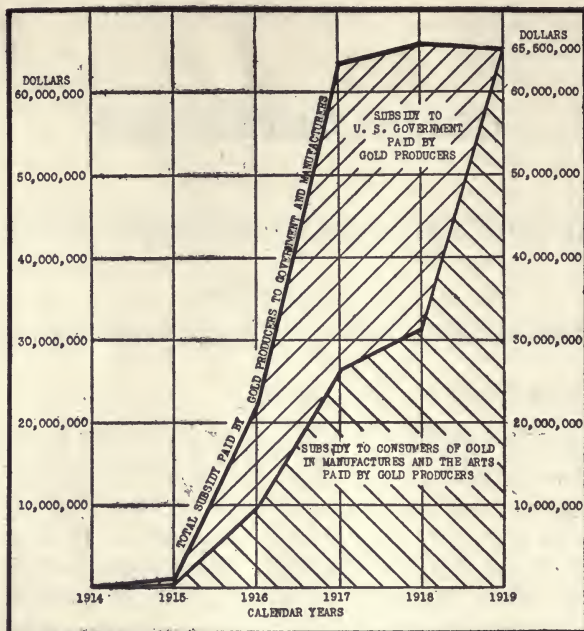


Chart 1.—Subsidy paid by gold producers to U. S. Government and consumers of gold in manufactures and the arts, based on production and decline in purchase power of dollar, 1914-1919.

mists that it will be a matter of ten years before the 1914 dollar will have regained even a large part of its purchase power, and many question that it will ever return to its purchase power of 1914. It would be most liberal to assume, therefore, that the 1914 dollar will regain its purchase power during the five-year period (1920-1924), in which event the average purchase power of the dollar during this five-year period would be less than 67 cents, the average during the period of uprising prices (1915-1919). The purchase power of the gold ounce, including the \$10 premium, based on 67 cents as the purchasing power of the dollar, would be \$20.54 during the period (1920-1924), the same as if the premium had been in effect during the period (1915-1919). It is fundamental to the maintenance of a normal gold production during this abnormal period that the purchase power of the ounce be restored to normal as compared to 1914. The McFadden Bill providing a premium of \$10 an ounce for the newly produced gold will accomplish this result.

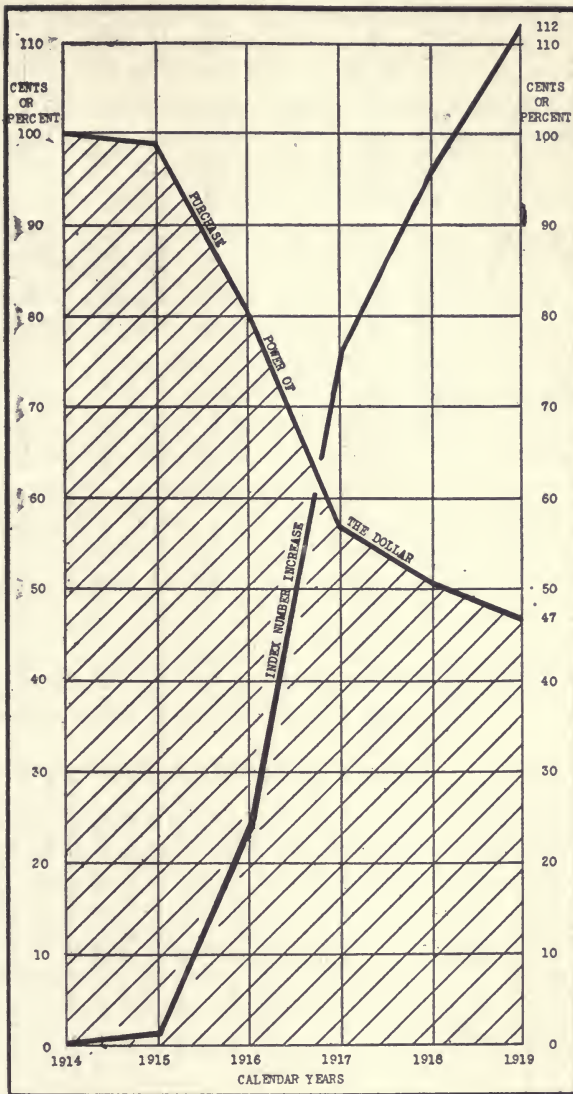


Chart 2.—Decline in purchase power of dollar based upon the wholesale price index numbers, 1914-1919.

DATA FOR CHARTS

	1915.	1916.	1917.	1918.	1919.	Total 1915-19.
1. Average percentage increase in whole-sale commodity prices over 1914, %...	1	24	76	96	112	AV. 62
2. Purchase power of dollar as compared to 1914, cents.....	99	81	57	51	47	AV. 67
3. Purchase power of the fine gold ounce. (In 1914 equaled \$20.67).....	\$20.46	\$16.74	\$11.78	\$10.54	\$9.72	AV. \$13.85
4. U. S. gold production.....	101,035,000	92,590,000	83,750,000	68,646,000	58,488,000	404,509,000
5. Net gold consumption in manufactures and arts.....	29,600,000	41,120,000	34,800,000	32,890,000	58,488,000 ^a	196,898,000
6. Percentage net gold consumption in manufactures and arts of total production, %.....	29	44	42	48	100	.....
7. Subsidy paid by gold producers to consumers of gold in manufactures and arts.....	296,000	9,868,000	26,448,000	31,574,000	65,500,000	133,686,000
8. Monetary surplus of gold over that consumed in manufactures and arts..	71,435,000	51,470,000	48,950,000	35,756,000	.....	207,611,000
9. Subsidy paid by gold producers to Government on monetary surplus.....	714,000	12,352,000	37,202,000	34,326,000	.....	84,594,000
10. Total subsidy paid by gold producers on account of decrease in purchase power of dollar.....	1,010,000	22,220,000	63,650,000	65,900,000	65,500,000	218,280,000

1. U. S. Bureau of Labor statistics (index numbers). 2. Computed from (1). 3. Computed from (2). 4. U. S. G. S. and U. S. Mint. 5. U. S. Mint. 5a. Sales reported by U. S. Mint Service Stations are in excess of production. 6. (5) divided by (4). 7. (5) multiplied by (1). 8. (4) minus (5). 9. (8) multiplied by (1). 10. (4) multiplied by (1).

Subsidy Paid by Gold Producers

Had the price of gold ascended to the average wholesale price of all other commodities during the five-year period (1915-1919), the gold producers would have received for the amount of gold they actually produced \$218,280,000 more than the amount which they did receive of \$404,509,000. Of the \$218,280,000, the amount which would have been paid by the industrial consumers of gold would have been \$133,686,000 for the gold actually consumed, while the Government would have paid \$84,594,000 upon the monetary gold surplus. Inasmuch as the price of gold has been fixed, these respective amounts may be construed as subsidies paid by the gold producers to the industrial consumers of gold and also to the Government, which received the monetary surplus. Since there was no monetary surplus in 1919 the industrial consumers of gold benefited by the entire subsidy of \$65,500,000. It is reasonable to assume that if the premium had been in effect during the entire period (1915-1919), which would have insured a normal (1914) purchase power of the ounce, the gold production of 1915, \$100,000,000, would have been maintained throughout the period, in which event the gold producers would have received \$500,000,000, the monetary price, plus \$250,000,000, the premium, a total of \$750,000,000, or \$345,491,000 more than actually received.

Excise Compensates for Industrial Subsidy

In imposing the excise of 50 cents a pennyweight, which is equivalent to \$10 an ounce, for the gold contained in manufactured articles, the McFadden Bill enables the industrial consumer to pay more nearly the anticipated cost of production during the forthcoming five-year period, an amount which when paid to the producer of new gold will re-establish the purchase power of the ounce to its status of 1914, and will therefore insure the normal production of gold in the United States.

Monetary Necessity for Immediate Remedy

Gold production of the United States this year (1920) will be between \$40,000,000 and \$50,000,000, less than 50 per cent. of the 1915 production; and unless some remedy as is provided

for in the McFadden Bill is expedited, the production for the ensuing years will rapidly approach the vanishing point, as the gold mines of the country continue to shut down. By reason of the monetary necessity for maintaining the normal gold production of the United States, especially during this period of credit and currency contraction, of protecting the monetary gold reserve from further industrial depletion and of safeguarding the gold standard itself, Congress should provide a remedy without delay in the interest of national security.

PRESENT CONDITION OF THE GOLD-MINING INDUSTRY IN CALIFORNIA

By FLETCHER HAMILTON, State Mineralogist, San Francisco, Cal.

In California we produce over 50 different varieties of minerals, the total production in 1919 being close to \$200,000,000.

I will confine myself to the gold situation in California, as well as a few remarks upon the McFadden Bill.

I spent the last six weeks (Oct.-Nov., 1920) in making an auto trip through the various counties of California, covering 4000 miles, and in that time I did not cover one-half of the State, but merely the points where I thought some good could be done, and some education started along the lines which would bring the business people, the bankers as well as the miners of California, to the point where they would realize that the gold situation, not only of the State of California, but of the United States was at a critical point. We all know the conditions confronting the gold mining industry, the high cost under which they are operating, but the industry is laboring under a condition which no industry has: they have a fixed price for their product.

The Status of Gold

The premise upon which gold is being studied is this: that the gold miner himself is not looking for relief for the gold industry because of the fact that he is in difficulties, but we are looking for relief for the gold mining industry because of the fact that the gold reserve of the nation is being depleted by the use of gold in the arts and trades to a greater

extent than it is being produced in the United States. Last year there was consumed \$20,000,000 over production, and this year there will be consumed in the United States some thirty or forty million dollars over production, and that is being taken from the gold reserve.

In California, in making this trip, I wanted to familiarize myself personally with the conditions, and all I can say is, coming from a gold State—the primary gold State of the nation—that it is a shame to see the mining camps and the mines themselves forced to close down because of the unnatural conditions which prevail at this time. In Trinity county there were three stamps operating, when in the past there had been perhaps a hundred stamps dropping. In Amador county, where in the years past there were five to six hundred stamps at work, we have today the equivalent of sixty stamps. In Calaveras county, in 1914, there were 494 stamps dropping, and today there are 50 stamps. In Tuolumne county, where there were 300 stamps crushing, today there is not a stamp operating in the county. In Kern county, the Yellow Aster, which had 100 stamps, is not operating today. So the history goes throughout the State, and it does not mean only that stamps are not dropping, but it means that the population of the mining counties of California is dropping off—for example, in Calaveras county the decrease shown by the census of 1920 was 40 per cent.—and I take it that this as well pertains to the other gold producing States—that the gold mining counties are losing population; and it is not only at the expense of the mining counties that the population which developed the natural resources of the State is being depleted, but at the expense also of the valleys and the big towns, because if we are going to progress we must maintain our population in the development of our natural resources. You can not point out any industry in the United States that is not dependent in some way or other upon the mineral resources of the country, and I must say that it is absolutely necessary that education extend to all the people of the United States in order that they may realize that the mineral industry must be supported both by the nation and by the States. If we are going to have any relief for the situation which confronts us, it must be quickly applied, and the only application that will be satisfactory, or will be successful, is the application of public opinion.

The mining people themselves in their industry do not constitute a great percentage of the population of the United States, and it must be that we should go and educate and tell our story to the balance of the nation if we are going to have any successful legislation; and it was with that idea in view that I made the trip through the State of California, and I should like to see it done in other States.

The McFadden Bill

The relief which we are working for is embodied in the McFadden Bill. I will not go into the history of it, but I should like to point out some of the salient features in order that you may—those who are familiar with it—carry the voice to those people who should be advised.

The McFadden Bill provides for the maintenance of the production of gold in order that it may satisfy the wants of the arts and trades, that our gold reserve may not be depleted. To do that, it is proposed to place an excise tax upon the manufactured article in which gold is used. That in no way affects the monetary value of the gold. The excise tax so collected is placed in a premium fund, and from that fund the miner of the new gold is paid a premium of \$10 per ounce. In other words, there is an open market for gold at the established standard value of \$20.67, and the tax is collected only upon the manufactured article.

It seems to me that every business organization in this country should take action on a measure which so vitally affects the business of the country, and I would like to see a campaign started which would get in touch with these organizations and get results from them. We have had some opposition to the McFadden Bill by the jewelers, who based this attitude on the grounds that paying the gold producer a premium of \$10 an ounce would be granting a subsidy to that industry at the expense of the jewelry trade. If you will just look upon the other side, you will realize today that the gold consumer is being subsidized by the United States because of the very fact that he is being supplied with his raw product at a fixed price. There is no economic formula which will allow the life of any industry in a time of rising costs when it must sell its product at a fixed price.

Views of the Bankers not Consistent

There has also been opposition by bankers stating that there is too much gold in the country, and in the same breath they say that this gold problem is an international question, but they do not say in the same breath that there is too much gold in the world. It is merely that there is too much in the United States. So the problem is the distribution of the gold, and not the fact that no new gold is necessary. Five years ago there was not any bank that would have stated that there was too much gold in the country. If we are going to maintain the ordinary process of business, we must get the added increment to our gold reserve. A commission appointed some years ago figured that the normal gold reserve of the United States should be \$2,000,000,000, and the required added increment to that should be about 10 per cent. annually. Instead of that, we have been registering a decrease in production. You may not realize it, but the State of California alone has produced practically the normal gold reserve of the United States in the last 70 years. California has produced today \$1,723,000,000 in gold bullion.

Now, that seems to me to define to the Government a policy not involving a period of two or three or four years, but they should look ahead for the next 50 or 60 years and see to it that the industry—the gold mining industry—which gives to it the standard product on which its monetary system is based, and on which all international financial principles are based, is maintained and put in such position that it can get its gold production as it is needed.

A Tax Levied in France

We have had some opposition also by people who would say that this is not the proper policy to pursue, that the principle is wrong. I state to you that the Government of France has had for many years past a sumptuary tax upon the use of gold as a commodity, or the use of gold in the arts and trades, and in June of this year they passed a further sumptuary tax, or an excise tax upon the use of gold as a commodity, and you did not find, when they passed that, that there was any change in the monetary value or the exchange rate on the franc, and

it was proved that such a tax did not affect in any way the monetary value of the gold.

It is also stated sometimes that other Governments are not giving relief, and that it is due purely to the matter of exchange that exists that the British Government is able to get a higher price or a premium for its gold.

I possess a report of Sir Evelyn A. Wallace, president of the Transvaal Chamber of Mines, and I should like to read a few sentences of that report, which places on record the fact that although there is not an open market for gold in England today, the gold mines of South Africa and Australia are enabled through an express agreement with the Bank of England to sell their product and thereby obtain a premium. This address was made before the Transvaal Chamber of Commerce on March 22, 1920. It goes on to state:

“Since the 24th of July, 1919, we have been able, under the new agreement with the Bank of England, to market our gold not, indeed, to the best advantage, since the Government of India is reserving the best for its own operations, but to considerably increased advantage. The result of this has been that during the last five months of 1919 we obtained about £3,000,000 more than we should have obtained had we been restricted to the standard price. Beginning at approximately 16 per cent. the premium has varied up to 44 per cent., the average up to the latest date of which we have advice being $26\frac{1}{4}$ per cent., and the last cable states that the premium is approximately $33\frac{1}{2}$ per cent.”

So it shows that although there was a closed market for gold in England, the Government has realized the necessity for maintaining their gold-mining operations intact, and they have made a special agreement whereby their mining operations, or their mining properties, may obtain for their product a higher price or a premium for their gold.

Now it seems to me that the United States, in the financial position which it is, should see to it that the confidence of the world is maintained in the financial integrity of the United States, to the extent that its gold production is maintained and the gold reserve of the nation maintained.

I should like to see the American Mining Congress give a great deal stronger support in the efforts to bring about this relief to the industry, and I believe that the gold-mining inter-

ests, as well as the nation itself, should give to Mr. H. N. Lawrie, who has spent so much time and who has sacrificed his own personal affairs in order to study this question, the support which would enable this legislation to be carried through to a successful conclusion. It is right and it is just, and I believe it is absolutely in order that we maintain the financial position of which we boast.

THE CONDITION OF THE GOLD PRODUCER IN COLORADO

By GEORGE E. COLLINS, Consulting Mining Engineer, Denver, Col.

The condition of the gold mines in this State may be best illustrated by a simple recital of ascertained fact. In the five years from 1915 to 1919, the production steadily declined from \$22,500,000 to \$9,750,000. In 1920, the production, assuming that November and December continue at the same rate as the rest of the year, will be less than \$7,250,000.

The first year's drop was 15 per cent., the second nearly 17 per cent., the third 20 per cent., the fourth over 23 per cent. and this year (1920) nearly 26 per cent. In other words, the decrease has been steady and continuous at an advancing ratio. There is every reason to expect that if present conditions continue, the production in 1921 will decline to \$5,000,000.

De-population of Mining Towns

What does this involve? In the first place it involves the de-population of thriving communities, homes broken up, the savings of a life time sacrificed, families parted. Typical gold-mining towns such as Cripple Creek and Central City are almost deserted. Houses are being torn down, and the lumber shipped away. Mining railroads, such as the Cripple Creek Short Line, the Boulder & Northwestern and the Gilpin Tramway, have gone out of business, and in some cases have already been scrapped. Mines are being abandoned, and their workings are caving or filling with water. Most of the men who used to work in the mines have left and gone into other lines of employment.

Comparing the condition of the gold industry with that of other States, it would seem that our decrease has been greater. California in particular, which in 1915 produced almost exactly the same amount as Colorado, by 1919 had dropped only to \$17,330,000, although there is reason to fear that 1920 will show a much larger decrease.

What is the reason for these differences? Why has Colorado, as a gold-producing State, suffered so much more than California?

The reason is, I think, largely because California produces gold mainly in the form of bullion, whereas our own production consisted to a greater extent of gold contained in ores and concentrates, which were shipped to the custom smelters and treatment plants. The figures* supplied to me by individual producers show that the falling off in the case of the mines and districts which produce gold as bullion was not as serious as in those which shipped to smelters. This is confirmed by the fact that from 1915 to 1919 the gold from Colorado mines deposited in the Denver Mint fell from \$14,304,980 to \$7,648,044, or 46½ per cent., whereas the gold from Colorado purchased by the smelting plants dropped from approximately \$6,846,320 to \$2,175,745, or over 68 per cent. In 1920 the smelter gold will apparently increase slightly, but I think this was due entirely to the fact that the new mill at the Tomboy produces gold entirely in the form of concentrates, whereas heretofore a great part of the gold from this mine went to the Mint in the form of retorted gold.

It seems evident that the difference arises from the fact that when a mine reduces its own gold the treatment costs are under its own control. To some degree employes—and especially the skilled and permanent employes—of treatment plants are influenced in their demands and in the character of the work which they produce in return for a given wage by what they know to be the surplus available from which to pay them. Such men, usually more intelligent than the mine employes and often possessing comfortable homes, are disinclined to destroy the enterprise by which they live.

Increase in Operating Costs

Actual figures show that in two of the largest and most representative treatment plants in the State, both producing

gold almost entirely as bullion by the cyanide process in districts widely separated and physically very different, the treatment costs from 1915 to 1919 increased, respectively, 8 per cent. and 60 per cent. In the same mines, during the same period, the mining costs increased, respectively 98.8 per cent. and 160 per cent.

According to my own experience and to the confidential figures with which I have been supplied, this tendency is universal. Costs of mining have advanced more than costs of treatment at the mine.

In the case of mines that ship ores and concentrates to the smelters, this is not true. I cannot give you the figures from all mines, and I do not suppose that the smelting plants are able to supply them as a whole, even if they were willing to do so. But I feel confident that the costs of smelting have advanced at a greater ratio than the costs of milling, and I am still more sure that the smelting charges, including deductions, show a still greater increase. In the case of one mine, which was among the principal gold producers of the State, and where the nature of the ore renders it entirely dependent on the smelters, the freight increase has been 57 per cent., and the smelting costs have been doubled.

Now freight and smelting are a first charge on the value of the ore shipped. The miner does not share the proceeds of the ore with the railroads and the smelting plant; he receives the balance after their charges have been deducted. They have not the same incentive to temper the wind to the shorn lamb which may be supposed to influence the men employed in a mine-treatment plant. To the worker in the smelter, his employer is a great and wealthy international corporation; he does not realize that his compensation really comes from mines which are struggling to make both ends meet, usually without success. The increased cost can be, and is, passed on to the miner.

Smelting and Freight Charges

Nor is this the entire story. As I have said, the freight and smelting rates, direct and indirect, are a first charge on the proceeds of the ore, and as they increase, so much more tonnage of ore becomes unpayable. You can easily realize that

if you increase the limit at which ore becomes workable from \$5 to \$10, you are certain to reduce the quantity of available ore by more than one-half. In the case of the mine just alluded to, the minimum aggregate freight and smelting charge is about \$11.50, so that ore loaded into railroad cars must run, say, \$12 to be worth billing out. Obviously, therefore, low-grade ore, which has to be shipped to the smelter, has ceased in Colorado to be ore at all, excepting as to lime, and iron ores from Leadville, Aspen and Kokomo, which usually do not contain gold. Without going further into detail, I may say that the minimum value of workable smelting ore, excepting in the districts named, is now \$20 to \$30. The minimum value of workable concentrating ore has similarly increased in about the same proportion. The result is that most of what was ore in Colorado in 1915 has ceased to be ore in 1920, and will continue worthless until all costs have come back to the 1915 level, which may not be in our time.

Meantime, even of the mines which are still producing or are in a condition to produce, the ores which were of higher grade or cheaper to handle have been mined out in the struggle for bare existence, and in almost every instance development work has been curtailed or suspended. It is very clear that, while the proposed bonus of \$10 per ounce on gold will prevent a further decline in the gold output, no increase in production will be possible unless in addition to the bonus a considerable reduction in working costs is effected.

Conditions at Cripple Creek

With regard to the Cripple Creek district—the greatest gold-producing area in the State—while it operates on the custom-treatment basis, the situation is more favorable than is the case with the districts which ship to the smelters. Practically all of the production goes to the Golden Cycle mill at Colorado Springs, which purchases the ore on a sliding-scale basis. The tonnage treated at this plant fell from 389,000 tons in 1915 (when part of the output of the district was still treated at the Portland mill) to 285,600 tons in 1919. The increased cost per ton in 1919, as compared with 1916, was about 35 per cent. The cost for 1915 was probably about 40 per cent. less than in 1919.

Nevertheless, thanks to the enlightened and liberal policy which has been adopted by the controlling interests, the treatment charge to the miner has not been increased. Similarly, on the Midland Railroad, which now transports all ore from the mines to the treatment plant at Colorado Springs, the latest increase in freight rates authorized last August by the Interstate Commerce Commission has not been put into effect. As a result, the output from this district has not been so completely arrested as from those districts which ship to the smelting plants, and, but for this fact, the present output from Colorado would be even less than it actually is.

The figures of reduced output do not tell the entire story. Many mines have managed to stave off the evil day by the use of various expedients, such as the following:

- (a) Concentration of production on the richest or most cheaply worked ore bodies.
- (b) Reduction or entire cessation of development work.
- (c) Reduction or entire cessation of maintenance expense.
- (d) Consumption of stores or material purchased at pre-war prices and failure to replace them at present prices.
- (e) Cessation of expenditure on investigation and experiment, and reduction of staff.

Most gold mines have been compelled to adopt some of these expedients in order to exist; many have had to adopt them all, and yet have succumbed after a greater or less period of struggle. In fact, it can easily be seen that they all amount, in the long run, to meeting expenses out of capital, and that actual figures of cost per ton, taken from the books of operating mines, understate the facts. It is clear that the increase of mining costs average nearly 100 per cent. Now, as very few mines before the war had any such profit margin, it seems evident that many of the gold mines which have survived have been enabled to do so only because some change in condition has offset the increase in costs. In other words, most of the gold mines which are still working are those in which the figures of cost, for one reason or another, are not typical.

A Limit to Present Conditions

The process above outlined cannot go on forever. The acute danger of the situation is that mines are getting down to where they can no longer resort to such temporary expedients. A large proportion of the gold mines in the States which are still in operation are reduced to a situation where they must spend more on development and maintenance; must have new stocks of supplies; must purchase new plants of machinery, etc., or go out of business altogether.

The urgency of the problem, in so far as it affects the Rocky Mountain States; of which Colorado is the principal one, has never been adequately realized. The Jennings Committee, in 1918, and the Strauss Committee, in 1919, did not include men qualified by personal experience to appreciate the special problems which confront this important part of the gold-mining industry, and consequently misread the outlook to a degree which todays seem hard to realize. I quote from the last-mentioned report to the Secretary of the Treasury, under date February 11, 1919: "Under these circumstances there is, in our opinion, no need for artificial stimulation of gold production. Not only has any need therefor passed, but there have come into operation causes that will in due time restore all industry, including the mining of gold, to a normal basis. Gold mining will then become again normally profitable, and respond automatically to normal stimuli."

It is, of course, easy to prophesy, and easier still to show, a couple of years later, how bad a guess the prophets made. The result should, however, warn us to avoid this spirit of undue optimism for the future. In fact, it is not too much to say that the warnings of decreased gold production, made at various times on behalf of the producers, have been fulfilled to the letter, and that the optimistic predictions of those who have belittled the gravity of the situation have correspondingly falsified. It would seem, therefore, that so far as our own business is concerned our judgment has proved to be sound, and it would apparently follow that in any future inquiry as to gold production the considered judgment of the industry itself should be held to outweigh the opinions of those who speak without first-hand knowledge of the facts. I refer especially to the representations made before the Ways

and Means Committee of the House of Representatives on behalf of the Jewelers' Vigilance Committee, to the effect that the gold-mining industry could very well stand a few years of low profits because before 1916-1917 "they had had a long series of very profitable years," during which "they were producing gold at a very low cost and amassing large profits." I think, that taking the gold-mining industry as a whole, that was never true.

A Bonus or Premium Necessary

In view of the exhaustion of our resources, forced by the attempt to pilot the industry through this stormy period; in view of the unfavorable condition of our mines and plants caused by sheer necessity; in view of the destruction of capital, the loss of trained labor and organization, I will venture to say that without a bonus or premium on gold in some form, or such a reduction in costs as will amount to a catastrophe for all other forms of industry, the production of gold in Colorado will continue to decline. If the world needs gold, as I believe, and as most of the bankers and economists declare, then the world must pay for it, and the longer common justice to the gold-mine industry is delayed, the higher will be the price to be paid ultimately.

You may recall the legend of the sibylline books. The sibyl offered Tarquin nine books at a price which he thought too dear. She then destroyed three, and offered the remaining six at the same price, which he again refused. She again destroyed three, and offered the remaining three books at the price of the original nine, and this time the king was forced to pay the price.

Gold Is Needed

So will it be with the gold-mining industry. The world will need gold, and will have to pay whatever price is necessary to reopen such mines as can produce it. Every plant scrapped, every mine which caves or fills with water will merely reduce the value of the asset which the world will have eventually to redeem. In the long run this wasted capital will have to be replaced; true national economy would lead us to maintain the industry at its maximum productivity, even if the product

can for the moment be dispensed with. It is indestructible, and is essential under modern conditions as insurance, even if it does not constitute intrinsic wealth.

At the time when the Jennings Committee made its investigation, perhaps even when the Strauss Committee reported, the output of gold might have been restored to a maximum in much less time, and at one-half the ultimate expense to the community that will be necessary now.

It is incontestably true that so long as the flow of South African gold continues at its present rate, and so long as it is available for export to the United States, the effect of stimulation of home production would be relatively unimportant. But neither of these conditions can be depended on to continue indefinitely.

The gold production of the Rand is rapidly falling off, and is only maintained at all by the premium which arises out of the difference in exchange.

Moreover, it is probable that, directly the continental European nations begin to do business on any large scale, they will require all the gold available outside the United States with which to settle their balances. Had the war ended, as most of us hoped, in the millennium, this might not have been true, but having resulted in something approaching pandemonium, nations will trust each others' papers less than ever, and will give less credit, so that balances will have to be adjusted more frequently and more promptly than heretofore, which involves the use of gold or silver in greater quantities.

GOLD-MINING CONDITIONS IN ALASKA

By MILNOR ROBERTS, Dean of The College of Mines. University of Washington, Seattle, Wash.

Alaska offers an excellent example of decreased production of gold due to increased cost of mine operation. The conditions under which gold mining thrived in past years in our rich northern Territory and those that prevail there today can be discerned, making clear the causes that have brought about the present situation. Perhaps in no other region of equal size has the low value of gold, in comparison with the cost of

mining it, had such a disastrous effect on the industry and on the region in general.

Mining the Essential Industry

Alaska is principally a mining country. The development of its settlements and routes of transportation took place under the pressure of mining needs. The upbuilding of nearly all its towns, except the fishery centers, accompanied the opening of its mines. Although some of the coast towns existed as fishing and trading ports prior to the finding of gold in the Klondike on August 17, 1896, their real growth took place after that date, along with the opening of the territory as a whole. Juneau, the capital of the Territory since 1906, attained early importance through the Treadwell mines, which were in regular operation in the early 80's. Seward, another part, was founded and developed as the coast terminus of a railway (now owned and being completed by the Government) to be built to reach nearby mining districts and the gold fields of the interior. Cordova also is a railway terminus and ore-shipping point. All the cities, towns and camps of interior Alaska, without exception, grew up either as mining centers or as stopping places on routes to the mines.

If gold had not been discovered in Alaska, other industries would independently have made more or less growth there following the rapid settling of the Pacific Northwest and British Columbia. Sealing, whaling and fishing would have brought settlements along the Alaskan coast, but one need only consider the numerous canneries and fishing stations located in scattered harbors to see how disconnected such a development would have been dependent upon an industry that is active only a few months in the year and that employs largely foreign laborers on contract. The tourist business alone would have added little. The fur trade would have been important and might have served to keep open certain trails, river camps and trading posts, but the hunter and trapper rarely burden themselves with many belongings or seek the opening of a country. Agriculture and stock raising even with the present incentive of nearby markets at the mines have made only a little headway, although they have a good future. It seems clear that no cause has yet arisen in Alaska

that would have served to develop the country in any degree as mining has done.

The current life and activities of the Territory, as distinguished from the causes of its settlement, are likewise mainly dependent on mining. The exceptions to this statement are easily noted and can be segregated for the purpose of considering the condition of the mining industry. The only prominent exception consists of the fishery interests, and these are confined to the coast. The fur trade involves a comparatively small number of persons, and the same may be said of farming. Indeed, most of the farming depends upon the mines for disposal of its products, or upon other lines of industry which, in turn, serve mining.

From whatever standpoint the situation is viewed it will be found that the basic industry of the Territory as a whole is mining. The one metal that far outranks all others, except copper, which prevails along the coast and on the Copper River, is gold. Therefore, it may be said that whatever influences affect gold mining have a bearing also on most other industries in Alaska.

Decline in Production

Gold mining has suffered a great decline in the North during the past few years—a period in which it has been dwindling elsewhere in the United States. In 1905 the gold production for Alaska reached a value of \$15,630,000, and in the following year rose to its record figure of \$22,036,794. These two totals served as limiting figures for the output during the next 10 years. At the close of that period, in 1916, the production was \$17,241,713. Since this latter figure corresponds closely to the average for the 12-year period of which it marks the end, evidently no falling off in production had taken place up to 1916, but thereafter the gold output decreased rapidly. In 1919 it was about \$9,000,000, while for the present year (1920) the estimated total is far less. Let us consider the several causes that may have had a part in bringing about the present situation in Alaska.

The first probable cause that comes to mind is the war. At the outbreak of the war in 1914 many British miners in Alaska, together with those from the adjacent Yukon terri-

tory of Canada, hastened to their country's aid. As the need for men became more imperative they were followed by others. America's entry into the war caused most of our young men to enlist, but even then there remained a good proportion of the older and more experienced miners, including some of the most solid members of the industry. When the demand for men to carry on war industries in the States became pressing another outpouring took place. On hearing from "the outside" of the ever-increasing wages in the copper mines, and the fabulous earnings (so called) being made in ship-building and other industries in the Pacific Northwest, the miners, being accustomed to adapt themselves to various kinds of work, were quick to take advantage of the opportunities open to them. Thus the war drew upon the man-power of Alaska both directly and indirectly.

Possibilities of Alaskan Mines

The statement is occasionally made that the mines of Alaska are exhausted, and that the decreased production of gold is due to this cause alone. Such a theory would postulate the simultaneous failures of practically all mines distributed over an area one-fifth the size of the United States proper. If all the mines had been discovered in the same year, and if all were more or less of a type, it is conceivable that they all might have failed within two or three years of one another, but the very fact that Alaska was a wilderness with no roads but its rivers caused at least two decades to elapse between the first discovery and some of the recent ones. Some of the mines that contributed to the former steady output of gold were quartz lodes, while others were placer. Certain of the known gravels are deep, with gold on bedrock at 100 feet, while others are shoveling-in propositions requiring frequent shifting of the sluice boxes. Sometimes the pay is found to be concentrated in rich runs; other ground is uniform over large areas and can be worked only by some large scale, cheap method, such as hydraulicking or dredging. To believe that under all these varying conditions nature's numerous stores of gold are all coming to an end at once requires a great stretch of the imagination.

The flooding of three of the four Treadwell mines in 1917 is also pointed out as a prominent factor in the lessening of

production. Yet in place of the Treadwell are two other low-grade properties in the Juneau gold belt, the Alaska Gastineau and the Alaska Juneau, which have been yielding gold steadily, although not profitably, and the Chichagoff, a remarkable mine of high-grade ore, situated near Sitka.

The Rise in Wages

Elimination of the factors that have had only a minor part in diminishing the output of gold from Alaska brings us to the most direct cause, namely, high wages and the high cost of materials and supplies used in mining. The increased wages in the States reached during the war not only drew men away from the North, as already stated, but since then have held them here, the high scale having in general remained in effect on the Pacific Coast. Why should men pay the high rates of fare to distant points in the North only to receive less wages there than they can obtain here? In order to attract miners to Alaska, rates of pay higher than those prevailing in the Coast States must be offered them. In the Puget Sound region today common labor receives \$5 to \$6 per day, the higher rate being paid for heavy work comparable to mining. Carpenters, machinists and blacksmiths are paid \$7 and up. At the same time the Alaska Gastineau near Juneau is offering millmen, laborers and oilers \$3.50, cranemen, carpenters and blacksmiths \$4 to \$5.50, mine laborers \$3 to \$3.75, and machinemen \$4, although contract miners are enabled to earn \$5 to \$10 per day. This is the highest wage scale this gold mine can pay and still make both ends meet, regardless of a profit. Meanwhile the copper mines to the westward can offer shovelers \$5.25 to \$5.75, miners \$5.75 to \$6.25, or, including contractors, an average of \$6.75, and millmen \$5.60 to \$7.10.

Let us look at the situation from the viewpoint of an average operator in Alaska. Formerly such employers could engage men for the summer's duration at rates varying from \$3 (with board) on the Coast to \$5 at the most distant points in the interior. Supplies were dear enough even then, but with the increasing traffic and improvement in roads and trails as the territory developed, charges for transportation were diminishing. To quote a former case, the writer spent the season of 1912 in Southwestern Alaska, testing placer

ground with a crew of men who received \$3 and board for the arduous work required. Most of the men stayed through the six-month season. Today in the same region the wages are \$6 and board for eight hours instead of ten, as formerly in the placer camps. Inasmuch as the cost of boarding men has fully doubled and the wages are exactly double it will be seen that the whole item of labor has doubled.

On Seward Peninsula summer wages are now \$6 to \$8 with board, the latter being estimated as costing the operator \$2.25 in Nome and \$3 or more on the creeks. For work on the breakwater at Nome during the past summer the Government has been paying \$10 without board for eight hours of ordinary labor and \$12 to piledriver men and semi-skilled mechanics. An engineer who has just ended a full year's operations on the Arctic side reports the winter pay, which formerly was \$3 to \$4.50 with board, as now \$5 for surface laborers, \$6 for miners and \$7 to \$10 for carpenters and blacksmiths. In the interior of Alaska gold mining is about at a standstill, but at McGrath, at the head of the Kuskokwim River, where the Treadwell is developing a new high-grade quartz property, the minimum pay is \$6 with board.

Supplies Rose More Than Wages

Materials and supplies have increased in cost even more than wages. Ordinary lists showing former and present prices of numerous commodities are not wholly applicable when considering the particular needs of the Alaska miner, who cannot afford to ship goods of doubtful quality to his distant camp. On this point there should be no confusion. Prices in the Coast States for the good grades of materials needed for the mining trade in the North are far above those prevailing before the war, approximately double, to speak in round numbers. To mention a few items, dynamite, for example, has advanced 70 per cent. over pre-war prices; caps and fuse, 100 per cent; drill steel, 110 per cent; tool steel, 125 per cent. California crude oil for use as fuel at a low price was once a strong factor in keeping down costs in many parts of the Territory. Its present price is several times the former one and the supply is being cut off. Gasoline, which is indispensable for certain duties, has more than doubled in price.

Quality is especially necessary in foodstuffs, for it is useless to ship in articles that are likely to spoil or prove unpalatable. It is common knowledge that to purchase supplies on the Pacific Coast of grades corresponding to the best that were formerly available, one has to pay a high price. Some observers hold that prices of commodities were about to fall sharply, after which event wages will be lowered. Press dispatches since the Presidential election, however, state the probabilities to be quite the contrary. If smoked meats put up to withstand long storage, carefully dried fruits, tea, coffee, sugar and condensed milk reach pre-war prices in the immediate future, the miners at least will be pleasantly surprised.

Many Small Operators in Alaska

While the large operations in Alaska are carried on with the aid of engineers and office forces, many small mines are worked by the individual owners with small crews. Such operators do not need a complicated system of accounting to show them whether they are making money or losing it. A pocket notebook and a pencil have often sufficed for working out an estimate of cost for the proposed season's work and for summing up the results, while many a million in fat pokes has come out of the North unchaperoned by even that much bookkeeping. Yet the owners knew how they stood on the season's operations and the miners had their pay from bed-rock. Today the consensus of opinion is that gold mining, except in rich ground, does not pay. In a recent letter the Alaska Bureau of Publicity at Juneau states that in pre-war days the average cost of mine operation was \$6 per man-day, including wages, materials, supplies and overhead expenses, while the average today is \$11.

Ordinarily in the fall our Alaskan friends call at the Mines Building, Seattle, to compare notes on the past season and to discuss plans for the coming year. Some of them attend the winter session given for mining men at the College of Mines, and make use of the laboratories for experimenting on their ores. Many such men are letting their gold claims lie while they turn their attention to other metals. The high cost of operation has not only lessened the actual mining, but has also discouraged prospecting for new ground and the

development of finds already made. A grubstake nowadays represents a small fortune in money. A man is not justified in giving up his time for a season of prospecting when he knows in advance that he could not work on ordinary strike if he made it. The absence of large numbers of gold miners from Alaska has reacted against those who remain and against the country in general. Steamer and river-boat service is less frequent than in the active days, some of the important road-stations are closed and the merchants maintain smaller stocks of goods. These conditions, in turn, increase the difficulties and costs of mining.

WHAT FAILURE MEANS TO SOUTH DAKOTA

By B. C. YATES, Superintendent, Homestake Mining Co., Lead, S. D.

Perhaps the best way to show what failure to obtain an increased price for newly produced gold means to South Dakota is to present the true condition of the gold industry of the State, with the more apparent causes which have brought about this condition. Briefly stated, the gold industry of the Black Hills of South Dakota is in a state of disintegration, not because the mines are becoming exhausted, but because the gold taken from the mines does not have sufficient value to pay the cost of production.

The Gold Region of South Dakota

The Black Hills do not comprise a very large area—about 100 miles square—and the gold producing section is only a small part of the whole. In this limited area, four years ago, there were from 10 to 12 regular producers of the precious metal, and there were other mines being developed, some of which were producing a considerable amount. Only two, the Trojan and the Homestake, have survived the war period. These properties have been operated during this period to keep the mines and treatment plants in working condition and their organization intact, with the hope that in the near future, conditions will be such that some profit may be had from their operations. Prospecting is at a standstill and only

two or three mines in the development stage show any signs of activity.

Population Decrease

The population of the two largest mining towns of the Hills, Lead and Deadwood, has decreased from 12,045 in 1910, to 7416 in 1920, and the population of Lawrence county, which is the principal mining section of the Hills, has 6665 less people now than ten years ago. Practically all of this decrease has occurred during the past three years. In every mining community of the Hills are to be found idle mills, empty houses and deserted prospectors' cabins.

Gold Statistics

The joint reports of the U. S. Geological Survey and the Bureau of the Mint give the average yearly production of gold in the Black Hills, from 1912 to 1917 inclusive, as having a value of \$7,436,000; in 1918, \$6,699,400; in 1919, \$5,289,700; and from the report of the State Mine Inspector for the first six months of 1920, it is estimated that the total for this year will not be much over \$4,000,000. This is a reduction of approximately 45 per cent. in three years.

Men Employed

The annual reports of the State Mine Inspector give the average number of men employed in the gold mines of the district from 1912 to 1917 inclusive, as 3063; for 1918 and 1919, as 1933; and for the first six months of 1920 as 1681, with very little if any increase to date.

These figures do not indicate a very healthy condition of the gold-mining industry in this district. They do tell us, in language which cannot be misunderstood, that something must be done to improve the situation.

Increase in Price of Supplies

The prices of supplies and labor that have prevailed during the past few years and which still prevail, make the cost of production almost prohibitive at the fixed price for which the gold miner is forced to sell his product. Wages have increased from 40 to 50 per cent., cyanide 52 per cent., dynamite 92 per cent., drill steel 138 per cent., and all other sup-

plies used in mining operations show similar increases. No figures are available which will accurately give the increased cost of producing an ounce of gold in the Black Hill mines. The producing mines of the Hills are fortunate enough to have had a large amount of ore broken down and remaining in the stopes, as well as ore that could be mined at a low cost, which has thus far tided them over the high price period. It is needless to say that these favorable conditions will not last. Calculations based on normal operations show an increase of approximately 30 per cent. in the cost of producing an ounce of gold, and these calculations do not take into account interest on investment or depreciation of mine and plant due to deferred development and repairs. It is difficult to estimate how much should be added to operating costs to cover these last two items, but they will certainly be reflected in future balance sheets. Should cost of labor and supplies be reduced to pre-war normal in the near future, we will still have to pay more for our gold because of the depreciated physical condition of our mines, and this is true whether they have been kept running or were closed down.

This will probably be considered an extremely pessimistic report; doubtless it is. The gold industry is face to face with a grave crisis—a crisis brought about by a world war and the short-sighted policy adopted by the Government, of bleeding without feeding the one industry absolutely essential to the life of any civilized nation at all times, and doubly so when the nation is at war and is using a large part of the products of its mines and factories. If these products are paid for with a medium that depreciates in purchasing value to such an extent that the price paid is less than the cost of production, the nation's industries become bankrupt, and a bankrupt nation follows. The Government must pay for what it uses for the common welfare—Russian sovietism to the contrary notwithstanding—and until a substitute is found the payment should be made with gold.

The Case of the Homestake Mine

When our Government decided to take an active part in the great European conflict, the producers of metal, gold included, were urged to speed up production. Gold producers, trying to respond to this patriotic call, found themselves confronted

with indifferent governmental executives, loss of labor, high prices of supplies, an ever-increasing difficulty in getting supplies at any price and a fixed price for their product based on pre-war conditions. For the gold mines to keep up production during this period of rising cost, it was necessary to reduce expenses, and this could be done only by cutting off development and prospecting and plant repair, as the price of labor and supplies was continually rising. Increased costs for the future is only a natural consequence. As a concrete example, the Homestake mine, under normal conditions, excavates yearly 17,500 feet of tunnels for the purpose of developing known ore bodies and prospecting virgin ground. During 1918 and 1919 this was reduced to 8600 feet. From this it may be readily seen that this company will have to spend many thousands of dollars, in the very near future, to bring the mine up to its normal working condition. What is true at the Homestake is undoubtedly true at other producing gold mines and the situation is far worse in those mines that were forced to close down.

So it may be known that the gold-mining community of South Dakota measured up to its full duty during the war, permit me to digress somewhat from the subject: Lawrence county, the home of the Trojan, the Golden Reward, the Homestake and other gold-producing mines, contributed 1100 fighting men, purchased \$2,571,700 of bonds, \$227,455 of War Savings Stamps, gave \$75,000 to the Red Cross and \$11,000 to the Y. M. C. A. and other war work. These figures are not given in a spirit of boastfulness, but to show those of you who are not closely associated with the gold-mining industry that we are loyal citizens and are worthy to receive—not charity—but just compensation for our labors.

Thus briefly I have attempted to show you what it means to the gold industry of the State of South Dakota to fail to get an increased price for our gold by giving an outline of present conditions. Let me repeat, that we are facing a very grave crisis and something must be done if we, as a nation, wish to get back to normal gold production or even maintain present production.

GOLD-MINING CONDITIONS IN ARIZONA

By W. B. PHELPS, Superintendent, Tom Reed Gold Mines Co., Oatman, Ariz.

As you are no doubt aware, gold mining in Arizona in the proper sense of the word is almost entirely confined to the Oatman district. The balance of the gold produced in the State is gained as a by-product from the copper mines, and gold mining in our State, as elsewhere throughout the West, is languishing under the heavy burden of conditions over which we have no control, and which have grown worse instead of better, year after year. The producing mines are becoming depleted and there is no incentive or encouragement to find new gold mines. The prospector has forsaken the hills; the discovery of ore that could be mined at a fair profit a few years ago does not interest him today; neither can capital be interested to pursue the development of ore bodies where there is no hope of any return on the investment. Then where are our new gold mines to come from? Unless some measures of relief are afforded the gold mining industry, it is my belief that it will be only a question of time until gold mining, the great industry that has made famous our Western States and Alaska, will be a thing of the past.

Gold, heretofore recognized as the yard-stick by which all other commodities were measured, the zero on the thermometer of values, recognized as such, is not used for monetary purposes and has not been for five years. Gold today is a commodity just the same as wheat or cotton. Over \$20,000,000 in gold has been used for industrial purposes in 1919 in excess of what all the mines in the United States produced.

Those who use gold for industrial purposes object to paying even the cost of production. They buy their gold today the same as they did five years ago, for \$20.67 an ounce. Five years ago, before the dollar had lost its purchase power, the gold ounce could be produced at a profit and maintain the normal gold production of the country, but at this time the purchase power of the dollar, or the purchase power of the gold ounce, is less than half what it was then, and this accounts for the serious decline in the gold production of the nation. It will be necessary to restore the purchase power of

the gold ounce to the pre-war standard in order to rehabilitate the gold-mining industry and to maintain the normal gold production of 1915.

Profit and Loss—Operation or Suspension

Gentlemen, I have heard it stated time and time again that when any business does not pay to operate, that business should suspend operation until it does pay. That conclusion for ordinary business is correct, but gold mining is not an ordinary business. In fact, it is unlike any other business. For instance, take the Tom Reed Company with which I am connected. We have been in operation for over 12 years and have an investment of over \$3,000,000. It will not cost as much to close down, but what will it cost to stay closed down, and what will it cost to reopen? A shutdown for any length of time would spell destruction and ruin to that mine and its investment. It is not so much the visible loss as it is the invisible loss; our mill and surface equipment can be repaired or replaced, but there are miles and miles of underground work which would be flooded, caved in and destroyed. Work that was done and carefully guarded and watched at enormous expense would be in ruins. Would that mine ever be reopened, and would its possible ore output warrant the tremendous cost even if it was? It would be years before it could be brought back to its present condition, and the chances are that no body of sensible men would want to spend the time and money rehabilitating an old mining property with so many more attractive opportunities for investment offered in other lines of endeavor.

The Oatman District

Getting back to general conditions in gold mining, the case of the Oatman district, which I represent is typical. Powder that we paid \$13.25 for now costs us \$24; fuse which we bought for \$38.40 costs today \$81; caps that we used to get for \$11.50 now are \$21; steel rails that were \$65 now cost us \$115; timber we paid \$24 for now is \$71; oil and coal have more than doubled. Boarding-house supplies are about 90 per cent. higher, and the cost of labor has increased \$2 per shift for each man. Yet the gold-mining industry alone has been called

upon to bear this increased cost of production without any increase in the price of the metal that we produce.

It has been stated recently that we are now in a downward market and that prices are dropping in favor of gold mining. That may be the case in other parts of the country, but I can assure you that we have not been confronted with any such serious predicament in Oatman; if some small items have been reduced in price, that reduction means nothing in comparison with the increase in electric power and freight rates which only recently went into effect.

GOLD-MINING CONDITIONS IN OREGON

By HENRY M. PARKS

Director, Oregon Bureau of Mines and Geology, Portland, Ore.

Oregon's gold-mining industry has for a number of years been quite a healthy child. True, she has never grown up so large as her California or Colorado sisters, but until recent years she has enjoyed fairly good health. She is now dangerously ill. The first signs of indisposition appeared in 1916 and 1917. In 1918 she grew rapidly worse, and during that year her vitality speedily waned. Early in 1919 it became evident that she was in for a long sick spell. During 1920 the patient has been growing so much weaker that at times it has been difficult to determine whether there is any pulse left.

I have come to Denver for a consultation with you to see if something may not yet be done to save her life. Possibly oxygen—or maybe an operation—but one thing is certain: something must be done, and that quickly.

What Oregon Has Produced

For a few years prior to 1916 Oregon produced annually about \$2,000,000 in gold. This annual production has continually decreased since 1916 and with increasing rapidity. The greatest decrease has taken place during the year 1920. This is due to the fact that some of our most important quartz properties which have been holding on for the past year or two, hoping against hope, have at last exceeded the elastic limit of their holding-on power. Three of these important

producers have recently closed down and pulled the pumps. As a result Oregon's 1921 gold production will probably be not more than one-fourth of the output in 1916.

The conditions that have brought this blight upon the gold-mining industry of Oregon and of the United States, are due naturally to the unavoidable expedient of enormous inflation or expansion of the currency of the country. Necessarily it required more and more of this diluted currency to satisfy All the real money of the country (gold) vanished from circulation almost over night. The only gold in sight during the past four years has been that produced with great travail by the gold miner, and he had no alternative but to take diluted currency in exchange for his gold. Is there any wonder that the gold production of the country is rapidly diminishing?

The surprising thing to my mind is, not that these conditions with their natural results obtain, but that so little national concern is in evidence because of the existence of such unfortunate conditions.

I am surprised that \$50,000,000 can be lopped off our country's annual gold production, which thus deprives the nation of a substantial addition to or broadening of the very foundation of the currency and credit of the country, without commanding more interest and concern on the part of our statesmen and financiers.

A very logical plan is proposed in the McFadden Bill which is intended only as a temporary relief measure to tide us over this crisis and to save, if possible, the life of a fundamental industry. It seems incredible that there should be any opposition to the reasonable plan of throwing out a life line to the gold-mining industry.

Manufacturers Object to Gold Premium

The opposition to the measure that has arisen in certain of the industrial arts and trades seems short-sighted. By such opposition there is grave danger of "killing the goose that lay the golden egg." I wonder what would happen if the Government should decide not to sell more gold from the Mint. One result would be that the industrial arts would certainly have to go into the open market for gold. I dare say that before many months gold, as a commodity, would be selling at

price that would act as a lively stimulant to production. Indeed, this very condition may be brought about much sooner than anyone of us expects. Both the rapidly increasing gold production on the one hand, and the growing exportation of the metal because of the balance of trade with foreign countries which is now going against us on the other, are operating in this very direction.

I would like to take this opportunity to read some resolutions recently adopted by the State Bureau of Mines of Oregon:

The Commission of the Oregon Bureau of Mines and Geology, at its regular meeting in Portland on October 22, 1920, discussed at considerable length H. R. 13201, usually referred to as the McFadden Bill. The measure was introduced in the House of Representatives on March 22, 1920, by Congressman Louis T. McFadden, chairman of the Committee on Banking and Currency, and is designed to stimulate the production of gold in the United States for use directly as money, or indirectly as a base for the issuance of currency. The McFadden Bill provides that an excise tax of \$10 per ounce be placed upon manufactured gold in order that the gold producer may receive, from a fund derived from the excise tax, a premium of \$10 an ounce for newly produced gold. The interesting fact was brought out in a prolonged discussion of its provisions that, for example, during the year 1919 gold was purchased from the United States Mint for uses other than coinage to a value of over \$20,000,000 in excess of the entire gold production of the country for that year.

Oregon Endorses the McFadden Bill

The conclusion of the Commission, by unanimous vote, was as follows:

- (1) That the bill is carefully drawn and can be successfully administered without difficulty.
- (2) That if enacted it will greatly stimulate the production of new gold, the annual output of which is now less than one-half that of 1915.
- (3) That the excise tax on manufactured gold will produce revenue sufficient to meet the requirements of the act.

(4) That the benefit accruing to the gold producers is justly due them and is in no sense a bonus.

(5) That the act, when in operation, will not in the slightest degree alter or affect the monetary system, except that the increased production of gold will, by adding to the supply of gold currency, permit a reduction of paper currency already issued in excessive amounts, thus tending away from unsound money in the direction of sound money.

(6) That after a careful study of the bill and the need therefor, the Commission unqualifiedly endorses the same and is confident that no one, after seriously reading the provisions of the measure, will do otherwise than endorse it; and that such opposition as has arisen is due to failure to read and study the bill, and not the result of mature judgment as to the effects of the proposed act.

(7) That other agencies interested in sound currency and the maintenance of the gold production be advised of our action and urged to work to the end that the bill may become a law.

TAXATION CONFERENCE

DEPLETION OF MINES IN RELATION TO INVESTED CAPITAL

By WM. B. GOWER,

Member American Institute of Accountants, New York

In the system of Federal taxation adopted in 1917, and continued since for the purpose of raising the immense sums required by the war emergency, the concept of invested capital plays a most important part. The definition of invested capital, in both the Revenue Acts of 1917 and 1918, has come in for much criticism because it rejected present day valuation, and substituted for such real values an artificial concept. Not only that, but this artificial concept of invested capital is rendered more difficult by reason of its expression through the medium of accounting ideas and terminology. Accounting is not an exact and settled science, and accounting principles and practice involve many uncertainties, many disputed questions, and many divergent usages, customs and methods. The mining industry has had its share, and perhaps more than its share, of these disputed questions relating to invested capital. None of these questions, however, has been more disputed than the proper adjustment of the original basic invested capital of a corporation engaged in mining, which is required by reason of removal of minerals from the property from the commencement of operations down to the taxable year. The question, concisely expressed, is as to the effect of depletion upon invested capital.

New Basic Rule Opposed

For the purpose of this adjustment of the invested capital of a mining corporation, the Bureau of Internal Revenue has adopted a basic principle and rule, which has encountered unanimous dissent and opposition from the mining corporations to which it has been applied. The occasion is opportune, therefore, to examine this rule, to show its workings, and to expose its fundamental error. Inasmuch as the rule rests pri-

marily upon accounting methods, the burden of refuting the rule depends mainly upon accounting considerations. The present discussion is confined largely to these considerations, leaving the strictly legal and statutory objections to the rule for later discussion by others.

The broad principle underlying the rule adopted by the Bureau is that every unit of mineral removed from a mining property, from the commencement of operations down to the taxable year, impairs the original cost-value or original invested capital value of the mine, at a constant rate per unit, necessarily, invariably, and regardless of actual conditions, facts and valuation of the mining property. The Bureau declares that its rule rests upon accounting principles established for the computation of the surplus and undivided profits of mining corporations. The formal declaration is as follows:

Art. 839 *Surplus and Undivided Profits: Allowance for Depletion and Depreciation.*—Depletion, like depreciation, must be recognized in all cases in which it occurs. Depletion attaches to each unit of mineral or other property removed, and the denial of a deduction in computing net income under the Act of August 5, 1909, or the limitation upon the amount of the deduction allowed under the Act of October 3, 1913, does not relieve the corporation of its obligation to make proper provision for depletion of its property *in computing its surplus and undivided profits.*

A Specific Instance

In order that we may visualize and understand this rule clearly, it is well to illustrate by an actual case and definite figures. The company referred to owns and operates a large copper mining property in Arizona. It was incorporated 20 years ago with a capital of \$3,000,000, although at the time of incorporation the mine was worth many times this nominal capitalization. Under the Treasury regulations administering the excess-profits tax law of 1917, the company was allowed to establish the value of the orebodies definitely known to exist at the time of incorporation in the year 1900, in order that the excess of this value over the aggregate par of the shares issued for the property might be included in invested capital as paid-in surplus. It was established that the commercial value of the orebodies definitely known to exist at that time was at least

\$26,500,000, and this sum was allowed as the basic invested capital of the company.

During the period from January, 1900, to March 1, 1913, this company mined about 400,000,000 pounds of copper, and simultaneously developed a much greater quantity by extensions of its orebodies. The value of the mining property at March 1, 1913, was fixed by the Valuation Unit of the Bureau, for purposes of depletion, at \$41,500,000. Between March 1, 1913, and the beginning of the taxable year 1917, the company mined about 200,000,000 pounds of copper, equivalent to one-fifth of the quantity estimated to be in the property on March 1, 1913.

At the beginning of the taxable year 1917 the company had an accumulation of surplus earnings, in excess of \$16,000,000, derived mainly from the operation of its mining property.

Application of the Rule

Under the rule adopted by the Bureau, it is claimed that this company's invested capital for the taxable year 1917 should be reduced by over \$11,000,000 for alleged impairment of the original paid-in capital of \$26,500,000. This deduction of \$11,000,000 from the invested capital was reached by multiplying the number of pounds of copper mined during the 17 years between January, 1900, and December, 1916 (600,000,000 pounds) by a constant unit rate of 1.8457 cents per pound. This unit rate was obtained by dividing the original capital value of the mine (\$26,500,000) by the number of pounds of copper estimated to have been in the mining property in 1900, based upon the figures available as of March 1, 1913.

We see, then, by the actual case above cited, that the administrative rule adopted by the Bureau is based upon the principle that, although the commercial value of the mining property increased during the 17-year period by nearly 50 per cent., it is necessary to deduct \$11,000,000 from the invested capital in order to recognize impairment of the original invested capital value of the mining property, which is regarded as having occurred during this identical period. By this rule, \$11,000,000 of actual profits are deducted in order to recognize an impairment of original commercial value which is wholly imaginary.

We have seen, by the citation heretofore made from the Regulations, that the Bureau justifies its rule by declaring that it represents a fundamental accounting principle in the computation of surplus and undivided profits of mining corporations. The Bureau contends that its rule embodies a permanent and established profit accounting rule for mines. It must be remembered that invested capital consists, broadly speaking, of two main elements: first, the original paid-in capital; second, the accumulated surplus earnings. It was open to the Bureau, in making its rule for the recognition of the effect of depletion upon invested capital of mining corporations, to attack the first element—the paid-in capital. The Bureau decided, however, against this course, and concentrated its attention upon the second element of invested capital—the surplus earnings. It is most important to keep in mind that the Bureau's rule is an attack on the status of the surplus earnings, and its justification is proclaimed as resting upon an established profit accounting rule for mines. It makes no difference that the surplus earnings may have been distributed as dividends: for the attack is then merely diverted to the paid-in capital, on the ground that the amounts so distributed were not wholly "profits," but included a part liquidation of such capital.

Past Accounting Systems Considered Incorrect

It becomes important, therefore, to arrive at a correct understanding of, and to re-affirm certain established accounting rules which are fundamental in determining the true profits of mining. (We are not now referring to the ascertainment of present-day taxable income from mines, but to true profits, which is an entirely different affair.) The Bureau has decided that profits of mining computed during a generation past pursuant to our accepted accounting rules were incorrectly computed; that the custom was unsound, and the teaching of the accountancy manuals on the subject of mining profits at fault. It has decided that the profits from mining during these bygone years must be re-computed under a new set of accounting rules which the mining industry never thought of adopting in those days, which it has not adopted today, and which may never be accepted. The Bureau has decided that the undistributed min-

ing profits, whether accumulated recently or accumulated over a long term of years, must be adjusted to conform to new ideas.

The practical effect of all this procedure is to attack the status of the surplus earnings of mining corporations shown by their books and accounts, an authorized element of invested capital in the profits tax laws of 1917 and 1918. By means of this procedure, mining corporations have been deprived of scores of millions of dollars of invested capital, and their profits taxes increased correspondingly.

Relation of Profits to Original Value

The hypothesis upon which the Bureau has proceeded is, that no reckoning of the true profits of mining, past, present and future, is valid unless a portion of each year's revenues is assigned toward the wiping out of the original cost or the original capital value of the mining property. The underlying principle is declared to be that depletion of the original cost or original capital-value attaches to each unit of mineral removed, at a constant rate per unit. The method relied upon is to provide annually such proportion of the original cost or original capital-value of the mine as the year's output of minerals bears to the total estimated original mineral contents of the mine. This formula is considered to apply to all mineral deposits, regardless of the actual condition and value of the mine at the end of the accounting period. The formula is considered to apply to all mineral deposits, without regard to any restoration of the ore reserves comprehended in the original cost or original capital-value, which may have resulted from exploration and development work carried on contemporaneously with extraction and removal of minerals. The formula is considered to apply to all mineral deposits even though, as is usually the case, it is impossible to estimate the original mineral contents of the mine with any degree of accuracy, until most of the contents have been removed.

It is possible that for a certain small class of mining properties this hypothesis adopted by the Bureau embodies a logical method for determining the true profits from mining, whether past, present or future. The small class of mines referred to contains deposits in which the character and extent of the valuable content is known and determinable at the time of acquire-

ment, and forms the basis of the purchase. But, for the great bulk of mining properties, in which the character and extent of the valuable content cannot be determined with any degree of certainty until many years have elapsed, the method is neither logical nor practicable.

Accountants Doubtful About New System

It is not germane to the question, however, how far the Bureau's hypothesis and method may be defended on logical grounds, and by *a priori* reasoning. The question is not a speculative, but a practical, one; not what *ought to be* the rule for testing the true profits of mining, but what *is*. The mining corporations whose surplus earnings are attacked as an element of invested capital to the extent of millions of dollars, who are now told that during all these years their books and accounts have been kept incorrectly, that their true profits have been wrongly computed each year by hundreds of thousands of dollars, and that their accountants were wandering in darkness, will require a good deal of convincing. They will scarcely be consoled for their loss when the Bureau tells them that the long-prevailing rules under which mining profits were reckoned were unsound and invalid; that while such rules were the basis of all profit accounting required by legislatures, courts, and business men, nevertheless they were erroneous in principle and method, and that it is time to revise all this profit accounting of past years and put it on a correct foundation. It seems that, according to the Bureau, these profit accountings of past years were tainted with an element of original capital; and this element is to be removed by actuarial calculations of "pure" income, so that no trace shall remain. True, the original cost or capital-value of the mineral deposit may be wholly intact, and the mine operator unable to understand why he must provide out of his profits for the "recovery" of something which he has not lost. True, also, this "recovery" is to be figured by means of mathematical computations resting upon very uncertain and variable data. Apparently, however, the perfection and durability of the logical and actuarial structure does not depend upon its very sandy foundation.

Previous Decisions Quite Different to New Ruling

The fact is that the reckoning of the profits from mining is distinguished by a peculiar principle and by special rules which have been recognized during a long term of years not only by the lay mind, but by legislators, by the courts and by accountants, and which are totally at variance with the Bureau's hypothesis. It is important not only to understand this peculiar principle, and these special rules for determining the periodic true gains or losses from mining, but also to realize that they were confirmed by the authority of a memorable group of decisions of the Supreme Court, which settled the questions once and for all. The leading case, *Stratton's Independence v. Howbert* (231 U. S., 399), was decided in December, 1913, and the subsequent cases in the group at various times in 1916, 1917 and 1918, upon the principles upheld in the *Stratton* case. It is equally important to bear in mind that nothing in recent tax legislation has impaired the validity of the principles upheld by the Court in these cases, and that the true profits and losses from the operations of mining property (as distinguished from present day net taxable income) must be reckoned today by the same principles

Before considering the fundamental principles upon which the accounting rules for determining the true profits of mining rest, it is necessary to explain the three peculiar characteristics of mining which have caused the accounting practice. They have been stated concisely and lucidly by the Supreme Court in the leading case:

"The peculiar character of mining property is sufficiently obvious. Prior to development it may present to the naked eye a mere tract of land with barren surface, and of no practical value except for what may be found beneath. Then follow excavation, discovery, development, extraction of ores, resulting eventually, if the process be thorough, in the complete exhaustion of the mineral contents so far as they are worth removing. Theoretically, and according to the argument, the entire value of the mine, as ultimately developed, existed from the beginning. Practically, however, and from the commercial standpoint, the value—that is, the exchangeable or market value—depends upon different considerations. Beginning with little, when the existence, character and extent of the ore

deposits are problematical, it may increase steadily or rapidly so long as discovery and development outrun depletion and the wiping out of the value by the practical exhaustion of the mine may be deferred for a long term of years."

(*Stratton's Independence v. Howbert*, 231 U. S., 399.)

Brief of the Stratton Decision

Thus we see that the three peculiar features which have determined the special accounting rules are (1) the impossibility of determining the existence, character and extent of the ore-bodies until many years have elapsed; (2) the distinction between the original cost or original commercial value of the mine, and the true intrinsic or latent value ultimately disclosed by exploration and development; and (3) the fact that removal of minerals does not necessarily imply a shrinkage in the original cost or original commercial value of the mining property; on the contrary, the commercial value may increase coincidentally with removal of minerals by reason of discovery and development outrunning depletion.

Out of these peculiar characteristics there arose special rules in the reckoning of profits from mining differing sharply from the rules for ascertaining the profits of commercial enterprises generally:

FIRST: In the reckoning of earnings from mines, the entire revenues derived from mining constitute income and profits, without any deduction whatever for original cost or original commercial or market value of the mineral deposit, as the case may be. The wiping out of the original cost or commercial value, through the exhaustion of the mine, is considered and booked as a loss of capital, and is entirely separate and distinct from a loss of profits.

Cost of Mining Not an Ordinary Expense

The cost or the commercial value of ore or minerals removed during the operation of a mining property may not be booked in the accounts as an ordinary and necessary expense of mining, nor as part of the cost of goods sold, nor as depreciation, nor as a charge against profit or loss, directly or indirectly.

SECOND: The foundation of mine accounts is the original cost of the mineral deposit if acquired for cash, or its exchange-

able or market-value if acquired in exchange for stock of the purchasing company. When any shrinkage or impairment of this original cost or original commercial value occurs, it should be entered in the accounts as a loss of capital. Such shrinkage or impairment is a question of fact, which can be established only by means of a valuation, and which depends mainly upon the character and extent of the delimited ore reserves in the mine at the date of acquisition, and at the date of valuation.

So long as the commercial value of the mine is at least equal to its original cost or original commercial value; and so long as the known ore reserves are at least equal in character and extent to those known originally, the accounts do not provide for the wiping out of the original cost or original commercial value.

Mining Ore Implies Shrinkage of Intrinsic Capital-Value

The removal of minerals from a deposit implies a shrinkage of economic or intrinsic capital-value, but does not necessarily or even usually connote a shrinkage of original cost-value or original commercial-value, for frequently the removal of minerals is offset by discovery and development of orebodies not previously known and delimited. The shrinkage of economic or theoretical capital-value, as distinguished from impairment of original cost-value or original commercial-value, is not recognized in mine accounts.

I. One of the chief difficulties in determining profits arises in connection with writing off or amortizing the capital-value of assets which waste in the process of producing income, but which may last over a long period of years. The assets referred to may be regarded generically, as sources out of which income emerges; not only inherently wasting material assets, such as plant, machinery, buildings, etc., and the proprietorship of natural resources, such as mines, but also the right to an income, such as leaseholds, annuities, royalties, etc. The source of all incomes is subject to a process more or less akin to waste, and no source of income may be regarded as perpetual. Theoretically, therefore, an annual appropriation out of the net receipts is required for the replacement of the capital used in earning the income. The process may be described as eliminating from profits the element of capital. Practically, how-

ever, there are insuperable difficulties in eliminating from every income every element of capital. The sources of incomes are so many and so varied that general principles suitable on all occasions, and in every set of circumstances, cannot be laid down and followed. The problem involves the question as to when and in what cases a deduction is permissible; upon what basis the deduction shall be computed; whether or not a time limit to the recognition of wastage should be set; finally, whether changes in the value of the asset occurring during its use affect the question.

What Is Income

It is not necessary in this place to discuss these highly controversial and much debated questions, or to concern ourselves with theoretical definitions of "capital," "income," "profits," etc. The reckoning of income and profits is at best an estimate, an approximation—it is not a mathematical abstraction, nor the result of theoretically perfect rules rigorously applied. Income must be, and can only be, what is usually and commonly regarded as income. In that practical world, with which alone the accountant must deal, there is no place for fine-drawn distinctions and involved mathematical computations, in determining what are profits.

In the case of mining, however, although the asset which produces the income (the mine itself) must necessarily waste in the process, we are able to avoid the difficult questions that arise in connection with the wiping out of the original cost or original capital-value of the mining property, as a charge against revenue in order to ascertain profits, for the reason that a special rule prevails, owing to the peculiar nature of mining. This rule is that the entire revenues derived from mining are to be regarded as profits, within the technical accounting meaning of the term, and that no deduction whatever may be made from these revenues in order to recover the original cost of the mine, or its original exchangeable or market-value at the time when it was acquired. The ultimate loss that arises from the wiping out of the original cost or original market-value by the exhaustion of the mineral deposits is a loss of capital, which loss is considered separate and distinct from a loss of profits. Even though, as a practical matter, the entire

revenues derived from the working of the mine from the commencement until it is entirely exhausted, must necessarily contain an element of capital corresponding to the original cost of the mineral deposit, or its original commercial value, this element of original capital is of an exceptional character which may not be eliminated from the revenues in order to leave technical profits.

Previous Accepted Views

This accounting principle and rule for the reckoning of mining profits has prevailed invariably in cases decided under British income-tax laws. It was the accepted view in this country under Federal income-tax laws of 50 years ago, and in more modern State income-tax laws. It is the accepted view in the Western States, where the value of a productive mining property for purposes of tax assessment is computed by capitalization of average profits. It was the principle and rule accepted by Congress when the excise tax law of 1909 was passed, in which a tax was levied upon the "entire net income" of corporations. Under this Act, as interpreted by the Supreme Court, the legislative purpose was to tax the conduct of business of corporations organized for profit by a measure "based upon the gainful returns from their business operations" (*Doyle v. Mitchell Brothers Company*, 247 U. S., 179).

The prevailing rule was recognized by the Supreme Court in the decision handed down on December 1, 1913, in the *Stratton* case, where it was said:

"It is true that the revenues derived from the working of mines result to some extent in the exhaustion of the capital * * * yet such earnings are commonly dealt with in legislation as income."

Citations of Decisions Concerning Profits

This fundamental rule that governs the ascertainment of profits from mining, by which no allowance out of revenues may be taken in respect of wastage of the original capital-value of the mine, was repeated and re-affirmed in 1916, 1917, and 1918 in *Von Baumbach v. Sargent Land Co.*, 242 U. S., 503; *Goldfield Consolidated Mines Co. v. Scott*, 247 U. S., 126; *United States v. Biwabik Mining Co.*, 247 U. S., 116; *Stanton*

v. *Baltic Mining Co.*, 240 U. S., 103, and *Doyle v. Mitchell Bros. Co.*, 247 U. S., 179.

In *Doyle v. Mitchell Brothers Co.* (247 U. S., 179) in which it was held by the Supreme Court on May 20, 1918, that in order to determine the loss or gain in the cutting of standing timber and the manufacture of lumber therefrom during 1909 to 1912, there must be withdrawn from the gross proceeds an amount sufficient to restore the capital-value of the timber which existed at the commencement of the period under consideration, the Court refuted the argument that these gains should be determined by the same principle as the profits from mining, and stated that the two cases presented "only a superficial analogy."

Hardships on Non-Profitable Mines

Under ordinary circumstances, and in times when no income or profits taxes are in effect, the special rule whereby the profits derived from mining are calculated without any deduction for the original cost or original market-value of the mine, does not work any particular hardship, and its interest is rather speculative and theoretical than practical. When, however, income and profits taxes come to be assessed, the long-prevailing rule may work injustice to many proprietors of mining property, and place them at a disadvantage compared with other industries. This hardship and injustice was recognized by the Supreme Court in the *Sargent Land Co.* case, and inspired its opinion of January 15, 1917, that *in assessing income taxes* a fair argument from *equitable considerations* arises for relief from the severity of the prevailing accounting principle and rule for the ascertainment of the profits from mining. In this case it was said:

"A fair argument arises from *equitable considerations*, that owing to the nature of mining property, an allowance *in assessing income taxes* should be made for the removal of the ore deposits from time to time."

In recent years, Congress has been impressed with such "fair argument from equitable considerations," and for the purpose of mitigating the hardship of the established accounting rule, a concession was made in the Income Tax Law of 1913, as follows:

"In the case of mines a reasonable allowance for depletion of ores and all other natural deposits, not to exceed 5 per cent. of the gross value at the mine of the output for the year for which the computation is made."

In many cases the concession offered by the foregoing clause of the 1913 law was quite inadequate when measured by the actual depletion of the mineral stock; yet the Supreme Court upheld the law, and approved the idea that the reckoning of taxable income was correct, even though an inadequate allowance was made for the exhaustion of the orebodies. (*Stanton v. Baltic Mining Co.*, 240 U. S., 103.) This was a consistent decision; for under the established principle and rule all the mine revenues were essentially and technically profits, and any allowance granted therefrom by Congress was gratuitous, a statutory benefit and relief, not an inherent right.

How the Law of 1916 Operated

In the 1916 Income Tax Law, the statutory benefit and relief to the mining industry was continued, but the restrictive formula was less rigorous. Under that law there might be a reasonable allowance for the loss of capital, "not to exceed the market-value in the mine of the product thereof which has been mined and sold during the year."

In the Revenue Act of 1918, the statutory benefit and relief to the mining industry was greatly enlarged, the restrictive formula disappeared, and the scope of the capital sum to be recovered by these allowances was expanded to admit new discoveries of orebodies.

The progressive improvement in the position of the mining corporations made by the Income Tax Laws of 1913, 1916, and 1918, was the result of concessions made to the industry by Congress, whereby increasingly liberal allowances were granted to cover the loss of capital known as depletion. These concessions, however, were expedients for counteracting the severity of income taxes that would be levied, otherwise, upon the profits of mining computed under an accounting principle and rule which had long prevailed, and which regarded all mine revenues as profits, and none as assignable to recovery of original cost or capital. These concessions, expedients of tax legislation, do not impair the validity of the accounting principle and rule. They are designed to counteract its effect.

Accounting Principles of a Generation Past

It is true that, a generation ago, the prevailing accounting principle and rule whereby the annual profits from mining were reckoned without any deduction for original cost or original market-value of the mineral deposits, encountered a measure of opposition from writers on accountancy. These writers could see no logical reason for the rule, and instead "that the mining company can no more legitimately treat the net annual receipts as net profits than can the merchant neglect the cost price of his commodity, or the manufacturer disregard the factory cost of his product in his estimate of profits." The trouble with this reasoning is that it relies exclusively upon analogy, and an analogy which the Supreme Court has well characterized as "superficial." It does not take into consideration the peculiar nature of mining, so concisely and lucidly pointed out by the Supreme Court in the citation heretofore made from the *Stratton* case. The great majority of investments in mineral deposits do not even remotely suggest the conditions or exhibit the characteristics of an ordinary purchase of a stock of materials for consumption in productive processes, etc.

The objections that the accounting writers of a generation ago entertained to the authorized rule for computing the annual profits from mining, without any deduction for original cost of the mineral deposits, were strengthened by technical reasons. They were accustomed to the general rule whereby all changes in the book-value of certain assets, implying changes in the net wealth which had occurred during the accounting period, must be reflected in the profit and loss account during the period. They could see no reason why a shrinkage in the cost-value of a mining property should be excepted from the general rule; and could see no reason why the profits of the period should not be charged with any such shrinkage which took place during the period. Here again their reasoning was based upon analogy; an analogy that did not exist, essentially, owing to the peculiar characteristics of mining.

Hatfield's Theories

Later, the technical accounting difficulty arising from the concept of a loss of original capital, separate and distinct from a loss of profits, was solved by Professor Hatfield in his stand-

ard work on 'Modern Accounting,' chapters XI and XII on the subject of 'Profits.' Realizing that the general rule requiring changes in the book-value of certain assets to be reflected in the current profit and loss account is not without exceptions, he posed the main question thus :

"Can capital be lost, without having such a technical loss as must appear in the debit of the Profit and Loss account?" (p. 199).

Accountants are familiar with Professor Hatfield's analysis and settlement of this question, and we need not go over the old ground. He found no difficulty in accepting the idea that there can be a loss in the value of capital assets which would affect only the capital accounts, and would leave the profits of the year undisturbed. Nor did he find any special difficulty in disposing of such capital losses in the balance sheet :

"If law requires or permits the reduction of nominal capital stock and that is done, the loss is deducted immediately from the Capital account" (p. 220).

If, on the other hand, the legal steps necessary to reduce the nominal capital have not been taken, the shrinkages in original cost or original value of the assets are to be shown under separate caption as "Loss on Capital Account," or "some other descriptive term may be used, the only requirement being that it be not misleading" (p. 221).

Surplus Constitutes Part of Capital

In commenting upon Professor Hatfield's treatment of this subject of capital losses, and the proper way of showing them in the accounts and the balance sheet, a recent text-book advanced the suggestion that while "the best practice compels the showing of impairment items as direct deductions from capital," yet, "if a surplus has been accumulated out of previous profits, such surplus constitutes part of the capital, and provides the logical place for setting up the charge." This suggestion cannot be admitted, however, in the case of a corporation; for the premise upon which the argument rests will not bear examination. The argument is based wholly upon the proposition that surplus "constitutes part of the capital"; but this proposition does not hold in the case of a corporation, except in

a loose sense. The term "surplus" is here used in its sense of profits withheld from distribution by appropriate corporate action. But, the status of such reserved profits is entirely different from that of the permanent and fixed capital, both legally and in the accounting sense. The surplus is not immovably fixed in the business, nor does it constitute part of the permanent capital of the corporation. It may be turned back into undivided profits account, if the directors so decide; or it may be distributed as dividends by appropriate action.

No Changes in Capital-Value if Reserves Are Maintained

II. Under long-established practice in the industry, no entries are made in the accounts affecting the original cost or original commercial value of a mining property unless there is an actual impairment of such original commercial value, established by an actual valuation. So long as the original cost or capital-value is maintained intact, that is to say, so long as the known ore reserves remain at least equal to those known originally, no entries are required. The general rule is that in stating the accounts of a given year any shrinkage of original cost-value or original capital-value of the mine which has actually occurred should be shown; but such shrinkage of capital is a question of fact, dependent mainly upon the comparative extent and character of the delimited ore reserves at the date of acquisition, and at the date of valuation.

That actual impairment of the original cost-value or original capital-value of a mining property, established by a valuation, must take place before any necessity arises for a provision in the accounts toward wiping out the original value is not only universal practice in the mining industry, but is admitted by the text-writers who have touched on the subject. The rule is even extended to cover cases where an actual shrinkage of original capital-value of the mining property is suspected, but cannot be demonstrated by precise tonnage and valuation figures.

"Where the amount of shrinkage is known, it must appear in the accounts. But where the accuracy of a *valuation* is specious, where the only ascertainable *value* is the original cost, it may be less harmful for the balance sheet to show the cost, indicating that it does not represent the *present value*." (Hatfield, 'Modern Accounting,' p. 222.)

In 1904, a prominent accounting practitioner in a paper read at the St. Louis Congress of Accountants, and afterwards quoted in certain text-books, appeared to take issue with the universal practice and the accepted accounting rule, whereby extraction of minerals from a mine was disregarded in the accounts unless an actual impairment of cost-value or original capital-value had taken place, established by a valuation. This writer argued that provision should be made for exhaustion of sub-soil products even though the quantity "known to be in a definite tract at the end of the period is largely in excess of that which had been discovered at the beginning of the period." Unfortunately for the success of his argument, it was announced as resting upon a premise that does not bear examination. Further, it admitted the very necessity of valuation which it was designed to combat:

"The product taken out of the land becomes stock in trade as soon as it is extracted, and whatever the land *was worth* before its extraction, it *is* clearly *worth* an appreciable amount less thereafter." (Dickinson, 'Accounting Practice and Procedure,' p. 174.)

The above premise relies, first, upon the fancied analogy between ores extracted from a mineral deposit, and the stock in trade of a merchant or manufacturer. This analogy has already been disposed of as worthless and unsound in most cases, or as the Supreme Court terms it, "superficial." The premise next relies upon the supposition that the extraction of minerals from a mine invariably reduces the "worth" of the property, and it is fair to assume that the word "worth" was used in its ordinary significance of exchangeable or market-value. It is well known, however, that the extraction of minerals from many mining properties, year by year, does not result, either invariably or even usually, in a shrinkage in commercial value. On the contrary, the commercial value of the mining property frequently increases, steadily and rapidly, during a long term of years while extraction is proceeding, for the reason that discovery and development of new orebodies proceeds simultaneously.

Valuation of Mines Necessary in Accounting

The necessity for the valuation of a mineral deposit as an indispensable prerequisite to the booking of any shrinkage in

the original cost-value or original capital-value, a necessity supported by universal mining practice and admitted by the text-writers, is a phase of the much discussed question whether changes in the market-value of assets during their use have any bearing upon the writing off or amortizing of the capital-value of assets, which waste in the process of producing income. The general rule is well-established, by custom and accounting teaching, that in the case of inherently wasting material assets, such as plant, machinery, buildings, etc., any changes in value during their use are ignored, and the writing off or amortizing of such capital-values proceeds without regard to valuation. Natural resources, such as mines, however, constitute a well-known exception to the general rule, as we have shown.

Opinion of the Bureau

This exception is not admitted by the Bureau, as we have seen. On the contrary, the Bureau has adopted a rule whereby the original cost-value or original commercial-value of a mining property must be wiped out in the accounts, in all cases, continuously and progressively as extraction of mineral units takes place, regardless of valuation, and regardless of changes in value which may have occurred during the accounting or taxable period. It is commonly said that the Bureau relies upon the decision of the Supreme Court in *Doyle v. Mitchell Brothers Co.* (247 U. S., 179) for justification of the principle that changes in value of the mineral deposit during the accounting or taxable period may be ignored, and the depletion allowance made even though the value has increased. The decision in that important case, however, neither supports nor condemns the principle mentioned, for the reason that it was not an issue in the case. The Court decided that the timber company, in determining its gains or losses during a specified period, was entitled under the circumstances alleged to a deduction from its gross revenues "to restore the capital value that existed at the commencement of the period under consideration." One of the conditions which the plaintiff proved, apparently, was that no change in market-value of stumpage or timber lands occurred during the accounting period; and the

decision of the Court took this circumstance into account expressly in its conclusion. The Court said:

“There having been no change in market values during these years, the deduction did but restore to the capital in money that which had been withdrawn in stumpage cut, leaving the aggregate of capital neither increased nor decreased.”

It is, of course, useless to speculate what the decision of the Court would have been if, during the taxable period under review, the value of the timber which had been cut had been restored by newly-created values, such as higher market prices or increment or growth in the substance.

It is evident, therefore, that the reasoning in *Doyle v. Mitchell Brothers Co.* supports rather than weakens the established accounting rule whereby no entries are made in the accounts affecting the original cost-value or original commercial value of a mining property, unless and until there has been an impairment of such basic investment established by an actual valuation.

Adjustment of Capital

III. In this discussion we must keep clearly in mind that the essential question is what, if any, adjustment of invested capital of a mining company is required in respect of minerals extracted and sold from the commencement of mining operations down to the taxable year.

We have seen that the Bureau in approaching this subject has focussed its attention upon the surplus earnings of the mining company accumulated during the years prior to the taxable year, an authorized element of invested capital. The Bureau has proceeded upon the hypothesis that revenues derived since the commencement of operations from the extraction of minerals are not “true” profits unless a portion of such revenues has been assigned toward recovery of the cost of the mine, or its original invested-capital value. We have shown that this theory is untenable, for it is in conflict with custom and firmly-established accounting principles under which true profits from mining must be reckoned without any deduction whatever for this purpose. The mine revenues, without any deductions for depletion of the mineral stock, being true profits, and the accu-

mulations of such profits being admissible as invested capital, no adjustment thereof in respect of minerals extracted and sold since the commencement of operations is permitted.

It follows that any adjustment of invested capital required by the gradual exhaustion of the mining property can be made only in the capital account itself. We have shown that, in the case of mining property, no adjustment of the capital account in respect of removal of minerals is permitted by the accounting rule, until there occurs a shrinkage in the value of the mining property as a whole below the cost or original commercial value thereof, established by an actual valuation. In disregard of this principle, however, the depletion rule adopted by the Bureau for adjustment of the cost or invested-capital value of the mining property ignores actual conditions, rejects valuation, and adopts the theory that every unit of mineral extracted from the mine from the commencement of operations connotes, necessarily and invariably, an impairment of paid-in capital.

Bureau Tries to Make Its System Permanent

The conflict between the rule adopted by the Bureau and the established accounting practice arises from the effort of the Bureau to expand into permanent and universal accounting principles, and apply retroactively, the statutory provisions for depletion allowances granted by recent Income Tax Laws. Under the laws of 1916, 1917 and 1918, as we have seen, Congress granted relief to the mining industry from the hardship of the accounting rule which reckoned profits from mining without any deduction for recovery of original cost or capital-value of the mine. The relief so granted took the form of "reasonable" allowances, to be based on cost or fair market-value at March 1, 1913, according to circumstances, and under rules and regulations to be prescribed by the department. The Bureau decided, in interpreting the intent of Congress, and in exercising the discretionary and administrative powers granted to it by Congress, that an administrative rule for computing annual allowances for depletion should be adopted which allows a definite rate for each unit of mineral extracted and sold during the year, and which ignores actual valuation of the mine and periodic appraisals.

We see, then, that the fundamental distinction between the permanent accounting rules for booking depletion, on the one hand, and the administrative tax rule for the ascertainment of present-day depletion allowances, on the other, is that the former requires and is based upon periodic valuation of the mining property, whereas the administrative tax rule disregards such valuation. The established accounting rule prevails as the permanent and universal method of keeping the mining accounts, of ascertaining the impairment of paid-in capital, and determining the true profits derived from mining operations. The administrative rule prevails as the authorized rule for ascertaining present-day depletion allowances for purposes of income and profits taxes. Each of the two rules has its distinctive purpose and its special justification. The accounting rule is justified by established custom, precedent and authority. The administrative rule is justified as giving effect to the intent of Congress as expressed in the particular tax laws to which it is applied. Further, it is justified by practical considerations incident to tax administration.

Meaning of Depletion Clauses

It is evident from the wording of the depletion clauses of the 1916 and 1917 Income Tax Laws, that Congress did not intend the annual allowances to be reckoned under the permanent accounting rule for booking depletion, which rests upon real impairment of the cost-value established by actual valuation of the mining property. The depletion clauses of those laws contain a proviso to the effect that, after the authorized capital sum shall have been recovered tax-free through such allowances, "no further allowance shall be made." This expression would have no meaning if Congress had intended the annual depletion allowances to be determined under the accounting rule. The words may be interpreted as contemplating the possibility of a depletion rule, for purposes of tax administration, under which the annual depletion allowances, on the one hand, and the original cost or original capital-value of the mineral deposit, on the other, need not expire simultaneously, as they must do under the permanent accounting rule which requires periodic appraisals.

The recent Income Tax Laws, in using such a broad and gen-

eral term as "reasonable allowances" for depletion, and in directing the Treasury to formulate rules and regulations, gave to the Bureau the widest latitude in adopting administrative rules. Under this broad power the Bureau rejected the accounting rule, and has adopted for administrative purposes what is probably the only workable rule. It is evident that the permanent accounting rule, by requiring an annual valuation of the mineral deposit in order to determine depletion, involves all the practical difficulties inseparable from such appraisals; and its adoption as a basis for administering a tax measure would have raised well-nigh insuperable administrative difficulties.

Bureau's Ruling Artificial; No Effect on Established Principles

The depletion rule adopted by the Bureau in 1917, while suitable and valid for its purpose of administering recent income and profits-tax laws, has no validity apart from that purpose. The rule is an artificial product of income-tax administration, which has no bearing or effect upon permanent principles of accounting, or upon the established accounting rules for ascertaining the true profits or losses derived from mining. Much less may the administrative depletion rule be regarded, as the Bureau appears to regard it as embodying accepted accounting principles which may be applied to a revision of the profit accountings of mining corporations for a generation back, for the purpose of removing an imaginary taint of original capital from the residue of their past profits, and by this means deprive them of scores of millions of dollars of invested capital.

Income and profits, as was said by the Supreme Court in the *Stratton* case, must be, and can only be, what are "commonly dealt with in legislation" as income and profits. They are to be determined by considerations which have their influence upon men of affairs, and not by actuarial calculations of "pure" income, or subtle mathematical abstractions.

In the foregoing discussion we have dealt broadly with the concept of true profits from mining, as an element of invested capital. It must be kept in mind, however, that since 1912 there has been a statutory concept of mine income, which differs from true profits from mining, various allowances having

been granted by Congress in the tax measures. The effect of these allowances upon invested capital is not within the scope of this article.

METHODS AND PROBLEMS OF FEDERAL TAXATION OF THE MINING INDUSTRY.

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The subject of taxation is a vexatious and troublesome problem, yet from personal necessity, on the one hand, and patriotic duty, on the other, it commands our attention and best efforts for proper solution so that industry will not be throttled, but that it will move with accelerated speed in order to carry the great burden that the recent war placed upon this Nation. If the public utterances of some of our greatest statesmen and politicians of either party during the recent campaign are in harmony with the thought of Congress when it convenes, we can look for radical changes in the present tax law, at least in the present excess-profits law. It may be difficult for some to conceive of a just tax on corporations that does not give due consideration to the capital invested, as well as to the income derived from the investment. However, regardless of repeals, modifications or substitutions, these changes cannot materially lessen the tax burden; making laws will not decrease the public debt—that will be dissipated in the direct ratio of increased efficiency throughout the entire industrial United States. Our aim should be 100 per cent. efficiency, and that can be realized only when all economize to the limit as well as spending every effort to increase production. The word 'slacker,' coined during the war, is quite applicable to any individual in this country who, during this reconstruction period, will not take hold of the wheel of progress and assist in forcing it to revolve in its normal manner. To my mind, a campaign of publicity along these lines would do more to lessen the tax burden than the making of untried laws. No tax law can be enacted that will function with equal justice toward all the diversified interests of our vast Republic, but we might correct the imperfections in

the present law as time and experience dictate rather than go into unknown and speculative fields for a new system that means but little other than changing the form as to how this Government shall assess the four billions of money that are needed annually. It is not my province to extol the virtues of the present tax law, but whether it is good or bad, it is on the statutes, and as a Government employe in my present capacity my work is to assist in the administration of the Act as it stands, and Regulations 45, which have been cussed and discussed, is still the primary, as it is also the post-graduate, textbook in the Internal Revenue school of taxation.

Natural Resources Section of Income-tax Unit

One feature of Government work, I have noticed, is that the individual believes that the particular section in which he toils is the most important one in the Bureau. I shall speak of the Natural Resources Sub-division of the Income Tax Unit, because it is the most important to members of the Mining Congress. This Sub-division was created to handle all cases requiring valuation for depletion purposes, and the function of the valuation sections is to examine the tax returns and the data that the taxpayer submits as to his valuation and determine whether or not the depletion deduction made in the return is a reasonable one. When the valuation sections were first organized, the manner in which valuation should be made, or rather the yardstick that the Bureau should use to test the valuations made by the taxpayer, was discussed at great length for some months prior to beginning the work. Engineers from the oil industry were brought into the Bureau to handle valuation problems of oil and gas properties; engineers from the metal mines were secured to handle problems relating to metal-mine valuation, and likewise engineers from the coal and timber industries to handle their particular problems. There are still a number of cases in the valuation sections of the Natural Resources Sub-division awaiting information from the taxpayer relative to the determination of his depletion deduction that a brief outline of the work being done may answer the inquiry, "Why still worry the taxpayer"? To get at the fair market-value of the property as of any particular date requires the most intimate knowledge of its condition at the specified

time. In order to learn of this condition, questionnaires were compiled for the different industries, and sent to the taxpayer to assist him in furnishing necessary information required to get at a fair value. There have been a great many criticisms as to the form of this questionnaire, and the form can probably be improved, and yet as the questionnaire must fit all cases, it includes not only the questions pertinent to an individual case, but is sufficiently broad in scope to comprehend any and all cases that might arise in the given industry. The results the Department gets are quite varied. In some instances all the questions are answered and the questionnaire of the taxpayer is completely filled out. In other cases the information contained is meagre and necessitates correspondence before the value can be fairly determined. The valuation engineer must see that the valuation submitted by the taxpayer has been substantiated in order to arrive at a reasonable depletion based thereon, as no depletion deductions are allowed until the fair value is determined. It is therefore absolutely necessary that this valuation data be submitted, or an unavoidable injustice might be done the taxpayer in determining his tax. To substantiate this value as of March 1, 1913, the engineer examines the questionnaire to see whether or not there are sales on or about the specified date that would determine the market-value; or if there had been leases given about that time on this or similar properties, where the royalty rates in the agreement would reflect the value of the mineral in the ground; or whether or not there have been sales of similar property in the neighborhood that would reflect the value of the taxpayer's property. By investigating the profits made in 1913, the taxpayer's valuation may be checked by estimating the probable profits over a term of years and these profits reduced to a present value. In a valuation of this kind there are several factors of a debatable character that enter into the computation, namely, the mineral reserves, the price at which the product will probably sell during the life of the property, the operating cost of production, the discount rate that should be used in reducing the estimated profits to a present value, and the necessary plant and physical equipment that will be necessary to derive these profits. In applying this method to a metals valuation, the engineer would use the tonnage, grade of ore, and pro-

duction cost set forth in the questionnaire and substantiated by the records. The rate of production is determined by investigation of the operations of the taxpayer at the date of valuation, and also taking into consideration the economic conditions, which factors determine the probable life of the property.

Future Prices and Interest

The price for which the product will sell during future years and the rate of interest that should be applied to reduce the operating profits to present worth have been much debated, and are questions upon which there was a great deal of technical discussion a year ago. In the case of metal mines, viewing the conditions as of March 1, 1913, it was determined that 65 cents an ounce would have been a fair price for silver, $4\frac{1}{2}$ cents a pound for lead, $16\frac{1}{4}$ cents for copper, 5.70 cents for zinc, etc. In the matter of discount rates it was thought advisable to use a rate of interest commensurate with the risk involved in the enterprise and a safe rate to apply for return of capital. Where the ore is practically assured, an interest rate of 7 per cent. on investment and 4 per cent. for return of capital is used; where the ore is but partly developed, the interest rates increase up to to as high as 20 per cent. when the risks in the enterprise seemed to warrant such high expectancy of profit. There has been a great deal of debate as to why the Government uses these two rates rather than a straight discount rate. There is no necessity of entering into a technical discussion of the merits or demerits of this plan, which assumes that the total operating profits are returned in equal annual installments and consist of two parts, first, a fair rate of interest on the investment, and second, a definite annual sum which, at a safe rate of interest, compounded annually, will redeem the investment.

Data From Questionnaires Important to Bureau

Whatever method has been used by the taxpayer to determine the value of his property, the questionnaire requires that answers be made to all questions and thus supply the means of checking the result. The regulations prescribe no method, but state that due consideration will be given all factors, such as cost, actual transfers of similar property, royalties and rentals, appraisals by approved methods, market value of stock, and others. All these factors are given consideration in the valua-

tion section. After the depletion has been determined, the case goes to the audit section, where, in connection with the field agent's report, all other questions in the returns of the taxpayer are examined. This subject has been re-hashed and is old, but has been reviewed briefly in hopes that it might show the taxpayer whose property is not yet valued the necessity of promptly supplying the data requested by the Bureau.

Referring briefly to changes in the law, among those suggested might be listed depletion as a percentage of income rather than depletion on unit cost.

The regulations prescribe how the taxpayer shall derive the unit of depletion in order to determine the deductions from income. It does not suggest a percentage of income as a depletion deduction, and I understand there is doubt as to the present law permitting a regulation prescribing such a method. Though it may have no foundation in law, and to a great many not sound in principle, it nevertheless appeals strongly to me, and I believe it has considerable merit.

What Is a Fair Market-Value?

Where a property has been purchased for cash, or where this value may be ascertained by the sales of similar property on a normal market, or can be fairly determined by the prevailing royalties or rentals of similar property during a normal period, these transactions probably establish the fair market-value. Sales of similar property during periods of depression or boom periods do not fairly nor equitably determine a basis of valuation that results in a reasonable depletion when you apply the unit method, yet said sales value may reflect the fair market value of the taxpayer's property at the specified date.

Properties that have a history, with assured orebodies, so that the future spread of profits can be determined with sufficient accuracy, may permit a willing buyer and a willing seller to agree upon the purchase-price, and yet the unit method of depletion might not accurately measure the actual depletion of capital-value sustained during the future operation of the mine.

An Example of Depletion

To illustrate: Suppose we have a mine with 1,000,000 tons of ore in 1920; that we can foresee the economic conditions

that will prevail during the next 10 years, and can ascertain definitely that in 1921 to 1923 the operating profits will be \$1 a ton, from 1923 to 1926 we can make \$4 a ton profit, from 1926 to 1927 \$2 a ton profit, and from 1927 to 1930 \$1 a ton profit, or a total of \$2,000,000 operating earnings. Let us further assume that conditions are such that we must mine at the rate of 100,000 tons annually and that we had paid \$1,000,000 for the mine. Would we deplete the mine at \$1 a ton annually, or on the basis of 50 per cent. of the profits? I think the depletion account kept on a basis that would represent the ratio of cost to known value of ore reserves, namely, on a percentage of profits basis, would more accurately measure the true depletion. The fair market-value, as determined by the present-value method, may be a close approximation of the truth, but a depletion deduction from income, based upon a percentage that comprehends the relationship of cost and earnings, or the anticipated spread of profits that was used in the calculation for valuation, more accurately expresses the true depletion that the ore reserves suffer annually. In the illustration used above, whether you take 50 per cent. of your income as an annual deduction for depletion, or deplete on a unit method basis of \$1 per ton, you obtain \$1,000,000 of capital-value through depletion deductions during the 10 years. But as you did not sustain like depletion annually, would it not have been more logical to have taken depletion on actual amounts sustained, or 50 per cent. of the profits? If it were logical in this case, it seems to me it would be still more so where the ore reserves, cost of production and sales price of metals are but an approximation.

The percentage of income as depletion deduction will return to the taxpayer a much closer approximation of the intrinsic value of the property than a unit method of depletion would, and in any appraisal method the closer the fair market value approaches the intrinsic value, the more accurate was the appraisal. Likewise, as the percentage method of depletion more closely approaches the true depletion, to that extent does the true depletion approach the reasonable depletion mentioned in the law.

EFFECT OF REVENUE ACT OF 1918 ON METHODS OF VALUATION OF OIL-LANDS

By C. A. FISHER.

Widespread dissatisfaction has been expressed with the Revenue Act of 1918, particularly the Excess Profits Tax provision, and with our present system of Federal taxation in general, mainly on the grounds of its inequities, difficulty of administration, and damaging effect on the expansion of industry. There is great need for radical revision of the present system along sound and rational lines, which it is hoped will take place during the next session of Congress. The laws now in force, with their exacting provisions, have had certain advantageous effects in the matter of keeping records by the oil operator, and on methods of estimating future oil reserves, which are believed to be both timely and far-reaching in their bearing on the production of petroleum.

Allowances for Depletion

Under the present Federal tax laws, as applied to the oil producer, every claim for deduction allowance on account of depletion which the taxpayer sets up must be accompanied by complete and detailed information concerning geologic conditions, thickness of sand, history and present status of development, operating conditions, records of production, and market price of oil, together with other data of a general character upon which the estimate of the oil reserves and the value of the property must be based.

The far-reaching requirements of the Revenue Act of 1918 were early recognized by the Commissioner of Internal Revenue, and a new department, known as the Natural Resources Subdivision, was created for the purpose of collecting and making a systematic study of data relating to oil deposits and other natural resources throughout the country, for use in administering the tax law as applied to these conditions. Mr. Ralph Arnold was placed in charge of the oil and gas section of this new Department, and directed to call on petroleum engineers for assistance.

Detailed Study of Oil-fields

The ultimate object of this movement, as applied to oil and gas, was to make a detailed study of all oil-field information thus collected, in the belief that by the thorough analysis of such a large accumulation of information the accuracy of the present methods of estimating oil reserves could be tested and confirmed or, failing in this, that new, more accurate and more generally applicable methods of appraisal might be devised. It was generally believed by the engineers engaged in this work that the recovery of oil was controlled by scientific laws, and when enough facts were known, these laws would make themselves manifest. It was the intention of the Commissioner that, when the investigation was completed, a manual could be published for the oil and gas industry containing the results of the enquiry and suggesting methods of procedure, which might assist the taxpayer to prepare his Federal tax return correctly and expeditiously.

This work was undertaken by an experienced corps of geologists, technicians, and engineers, carefully selected with respect to their fitness for the work and drawn from all the larger oil-producing fields. The country was divided into seven districts for this purpose, and regional supervising engineers were selected for each. These engineers were each supplied with several assistants who were also familiar with the local conditions in their respective districts, and a general canvass of the oil-fields of the country was begun. The object of this investigation, as stated above, was to furnish a basis for arriving at valuation and depletion deductions in connection with tax returns made on oil and gas properties. Owing to the fact that the Bureau of Internal Revenue regarded these subjects of great importance, a most careful inquiry was instituted. Production records of thousands of individual wells and properties, as well as a large amount of general statistical data, were collected. The productions were tabulated and classified. This investigation resulted in more information concerning oil-field operation and production being collected than had probably ever been brought together before.

Recoverable Oil in a Property

An estimate of the amount of oil that a well might yield during its productive life, or the amount of recoverable oil under-

lying a property, was formerly regarded by operators and oil-men generally as little better than a guess; or, as almost unsolvable. However, during the past few years, petroleum engineers have made substantial progress along this line, and their scientific study of the various factors affecting the problem has disclosed a reasonably accurate solution, based on production records and past history of a well or number of wells.

The methods generally employed for estimating the quantity of oil in the ground are the so-called saturation and production-curve method, also the appraisal-curve method which, like the latter, is based on past yields. These methods are not closely comparable, the one being used to ascertain the total quantity of oil in the ground, and the other the quantity of recoverable oil. They also have separate application. The saturation method may be used to ascertain the total quantity of oil and gas in an undrilled area, while the production-curve method is mainly applicable to a partly-developed field for ascertaining the quantity of recoverable oil. Briefly, the saturation method is based on the calculation of the porosity of the oil-bearing sand; that is, the factors involved are the degree of porosity, thickness, extent, and saturation of the producing sand. The first three of these factors are usually susceptible of determination with a fair degree of accuracy, but the degree of saturation and the percentage of the total amount of oil that can be recovered are questions which are very difficult, if not impossible to answer, and have often led in the past to erroneous appraisements. This method, formerly in general use, is now seldom employed, owing to the many uncertain factors involved. It should not be used when any other method is available.

Only 20 Per Cent. of Available Oil Recovered

Formerly the percentage of recoverable oil to the total oil-content of a sand was thought to be much larger than scientific study now indicates to be the case; in fact, it is now held by authorities on this subject that perhaps as low as 20% of the total oil-content of a sand is often recovered by present methods.

The production-curve method, as the name implies, is based entirely on records of production of wells. By it the necessity

of estimating the percentage of oil recoverable is eliminated, as past production is an index of extractable rather than total oil-content. In applying this method, the yield of the well for time-periods is plotted extending over the entire time the well has produced. The production curve thus obtained is then projected to the point of economic exhaustion. Future production is then calculated from the projected part of the curve. Experience has shown that by plotting thousands of decline curves the relationship between the production for a number of succeeding years is such, when plotted, as to approach closely a symmetrical curve, which, when extended in accordance with its symmetry, will constitute a reasonably reliable basis for calculating the future production of a well. The symmetry of the curve of the past production of a well, which, when projected, is relied upon to indicate the future output, is not accidental, but is the result of underlying natural laws controlling the expulsion of oil from the producing sand. It is obvious that the above method requires a record of several years' production before a reliable estimate can be made of the future yield of the well, so that it is only directly applicable to wells that have yielded for a certain part of their productive life.

The appraisal-curve method is based on the relation existing between the first years' output of the well, and the amount that it will ultimately yield. This curve is built up from records of individual wells in a given district, and then applied to younger wells in the same or similar districts, whose productive life is not yet sufficient to make a curve that can safely be projected for estimating their future yield. This method permits of not only the use of the first years' production of a well to determine its yield, but the most recent years' production can be used with equal safety. This fact is based on a conclusion for which, according to its authors—Messrs. Lewis and Beal—there appears abundant satisfactory proof; that is, "if two wells under similar conditions produce equal amounts during any given year, the amounts they will produce thereafter, on the average, will be approximately equal regardless of their ages."

Calculation of Oil Reserves

When the Manual for the Oil and Gas Industry was completed and issued to the oil operator by the Commissioner, a

general application of the method of calculating underground reserves, which the Department had adopted for the appraisal of oil-lands, was made by the different oil companies. Needless to say the method was not found to be applicable to all cases. In fields where unusual conditions were found, its application led to erroneous and unreliable results. However, where conditions were normal or fairly uniform, the production-curve method, or one of its related forms for estimating future oil reserves, was found to apply and give results that could be relied upon.

At the present time there are few large producing oil companies in the United States who are not, through their engineering departments, employing the production-curve method in some one of its modified forms to arrive at the oil reserves underlying their properties for purposes of taxation. These methods are being applied not only for tax consideration, but are coming more and more to be used in all transactions where valuation of petroleum lands is involved. The security departments of the various States, which have enacted blue-sky laws, have also adopted this method for determining values of oil-lands.

Source of Future Oil Supply

The oil that this country will produce in the future must necessarily come from three sources, namely, the discovery of new fields, the distillation of oil-shales, and the stimulation of fields already discovered. To increase the supply by the discovery of new fields is growing more and more difficult; the distillation of oil-shales awaits the discovery and perfection of mechanical processes to put it on a commercial basis; so that perhaps the most immediate source of increasing our domestic production lies in an increase in the percentage of recovery from our present producing fields. Perhaps one of the most important branches of petroleum engineering for the future is what is known as "petroleum production engineering." Such engineering calls for a thorough familiarity with drilling and general conditions, also an intimate, continuous and analytical study of individual wells and their daily production. Oil companies more and more appreciate the importance of this line of investigation. One need only to examine casually the field-

production curve of an operating company to detect the time when changes in field management took place, such changes being indicated by the sudden increase or falling off of field production. The production man of the future will be the one who keeps a daily check on the mechanical conditions and general behavior of every well under his supervision, and who is able to detect quickly and suggest a remedy for any cause retarding production. The service that will be required of the geologist or petroleum engineer in general in the future will be not only to find new oil-fields for the operator, but to increase and maintain the production of the one he already owns. As the number of new fields brought in decreases, our supply must necessarily be obtained from an increasing number of declining fields, which will require the constant vigilance of the petroleum production engineer to maintain their maximum yield.

Work of the Bureau of Mines

The U. S. Bureau of Mines has not been unmindful of this line of work, and for the past two years has been co-operating with oil companies in many of the larger fields in maintaining a corps of production engineers whose business it is to make a careful scientific study of all the factors affecting production, especially of the mechanical conditions and state of efficiency of the wells under their supervision. This work has already proved its value by materially increasing production, but greater appreciation is in store for it. As work of this character can only be done effectively where the most complete and detailed records of production of individual wells is kept and available, it will readily be seen that the present tendency inspired by tax requirements towards keeping better records of development and production in the different oil-fields is paving the way for new and improved methods of field operation.

In summing up the more important effects that the present Revenue Law has had on the oil producer at large, the following are noteworthy: It has pointed out the defects and inadequacies of production records as they have been kept by oil companies in the past, and has impressed on the oil operator the advantage of keeping more complete records in the future. Such a course will enable the producing companies to summarize, at any time, the existing knowledge concerning the

extent of their deposits and thus enable them to formulate a more rational business policy. In this way they will eliminate, to a certain extent, some of the speculative features of the oil-producing business.

Results of the Revenue Act on the Oil Industry

In conclusion, it must be admitted that the exacting requirements of the Revenue Act of 1918, burdensome as they have been, have nevertheless stimulated a country-wide study of oil-field operating conditions, and have been directly responsible for the assembling of a large amount of important information. This will certainly prove valuable in paving the way for new and more efficient methods of oil-field operation, which the increasing demand for oil and the decreasing supply is forcing upon the industry. It is also responsible, in a large measure, for better and more reliable methods of oil-field appraisalment. While these methods at present are not all that could be desired, and more complete records will doubtless permit of improvements and refinements, it must be regarded as a movement in the right direction, which will ultimately enable the oil operator to make closer estimates of future oil reserves.

PROCEDURE UNDER THE FEDERAL REVENUE LAW.

By **ROBERT N. MILLER.**

The subject of my address is the question of modus of method, rather than of substance. The part of the program this falls into is the question of the relation of the taxpayer and the Bureau.

There are two sides to every matter that comes up for presentation before the Department. One is, What is the exact, theoretical answer to this question? Having decided that, there the taxpayer must decide another question—How can he present the problem to the man in the Bureau who must decide it?

Difficulties of the Department

I am not connected with the Bureau of Internal Revenue, not for nine or ten months. Any sympathy that I have with the

viewpoint of the Department does not arise from any obligation to defend it, or any obligation to take care of it; it arises from my knowledge of the conditions confronting it; from the clear conviction in my mind that there is hardly one of these questions which has an actual yes or no answer to it; also which of several alternatives is adopted as the working rule—and there must be one—you can pull it to pieces. If the Department, for instance, had taken the view that Mr. Gower advocated—and it is a view I see a great deal in—there would be some people dissecting that, and partly successful. The regrettable thing about this is that it is lacking in certainty. This uncertainty in administration of law is undoubtedly due to the difficulty of the problem. Congress has not yet given to the Commissioner of Internal Revenue or anybody else the power to decide what tax is fair for each taxpayer. It has given him the task of administering the law, which, with few exceptions, is laid down unchangeably. If Congress had given the incumbent of that office the opportunity of being a despot of that kind, this would not have been a very enviable position. To train the force at Washington to deal with many millions of highly-involved tax returns each year is, in itself, a tremendous task. The task of educating the revenue agents, who necessarily work in small groups all over the country, and keeping these field agents up to date is very difficult.

Taking the situation as it is, rather than as it would be under different laws or lower tax rates, the wise taxpayer, in dealing with the Department, will seek, first of all, to understand sympathetically the theory upon which the Department is working.

Taxpayers Must Present Full Details

However well informed the Department is concerning the general theory and the particular facts of any case, the taxpayer, in presenting his question, ought to know more about the theory of the law as applied to his case, and know more about the material facts of his case, than he expects the Department to at the outset. If the question depends on your statutory income and your capital, he ought to know more about it than you, and the Department welcomes such knowledge just as a well-qualified judge expects lawyers to know in

any case. We must pick out these facts for them. Specific examples for relief will be found under Section 327. Of the thousand facts peculiar to your business there would be perhaps one hundred that would be material as possibly entitling you to the particular relief you are after. The Government undoubtedly honestly desires to give you what you ought to have. It will do all it can to dig up facts material in your case. This is true—I know it is true—but it is hardly reasonable to rely upon the Government entirely when the law has put the burden on you to do this long job of finding out the particular facts that are material in your particular case. The practical truth of this is easily realized when you know the man auditing your case has probably piled up on his desk a lot of other cases which are pressing for action. You must help. An analysis of the particular issues involved is the biggest help we can give to the Department, and to our own interest also.

Favorable Answers Seldom Given

Another thing we realize in a general way, but ought to realize very sharply, is that the Bureau cannot afford to give any taxpayer a favorable answer, however much it wants to, and however just it would be to give such, unless that fits in with a general rule that the Bureau has had to establish. Those general rules being based on a large number of separate cases, the Government has been driven to that rule, however unsatisfactory in some cases. Every principle as consistently carried out hurts some taxpayers and helps some others. That is a peculiar thing about taxation. There is a case pending in Newark, N. J., where a taxpayer happens to be contending for something which, if he succeeds, is likely to give the Government in other cases many times the amount involved in that particular case. A simple example is the conflict between taxpayers who are not much interested in invested capital and anxious to get a lot of expenses, and want a pull with reference to certain items to get them into the taxable column, and the other taxpayer who is much interested in invested capital and excess-profits tax and needs those things in his invested capital. This has a bearing on this question that all of us ask right off—what will happen with this change of administration? Won't there be a broadening of the view now that a different party is

in power? The practical aspect of that question seems to be this: It is always a question what is the "broad view." Here is the poor Commissioner, with fifteen people sitting like blackbirds waiting to come up to him—a delegation of people who say, this principle is absolutely wrong that you have tried to set up, and they will argue half an hour and sound pretty convincing; and then another group will come in, another lot of taxpayers, and say, "We hear you are thinking about changing that ruling. To change that would be to go back on all the decisions of the courts." Each one will cite half a dozen decisions, and some language in other decisions, showing he is right. Now, a Commissioner who meets with that obvious difference of personal interest is going to settle down after a while to the feeling that he had best get the best advice he can and realize that he must make about half of the taxpayers angry anyhow; it is only a question of which half. That question of theory comes up over and over again. Of course, I have made that rather broad: there are some questions that are favorable to a comparatively small group of taxpayers, and adverse to a comparatively large one. I was trying to bring out the principle.

Influence Will Not Help

In dealing with the Internal Revenue Bureau I will say this (most of you know it): there are thousands of people all over the country who have a vague idea that to get anything in Washington the way to do is to get somebody powerful to introduce you—the old-fashioned notion that Washington is the place where influence is the thing that counts. I think that there is no doubt what the fact is in the Bureau of Internal Revenue, and I think those of us who know that fact by experience would do well to let other people know it. The real truth is this: whatever mistakes that Department makes—and it makes a lot of them, I made a lot of them myself—anybody who deals with the responsible heads realizes that they are trying to get the right answer. And to attempt to exert influence is to suggest to the man who listens to you that your case has no merits at all, that you are relying on influence instead of merit in your case. They will try to give you a square deal even if you come with influence, but the best introduction that you can have is to come in there relying on the

justice of your case, and knowing your own case, having analyzed it to find out what are the real points and presenting those facts; that is the real and perfect introduction, whether they ever saw you before or not.

Many Court Decisions on Taxes

One interesting thing is the constant effect of court decisions on these questions. Court decisions on income-tax questions, including excise taxes, are being rendered from time to time. There have been 63 or 64 cases decided in the last 12 months; altogether there are about 206 income-tax decisions. Of those decided during last year (1919) seventeen were under the corporation excise-tax law, involving general principles of taxation; 40 related to income tax, and 3 to excess profits; I might say 4, but the fourth was a State decision which does not really give much light on the question. It pays to analyze those questions and see what is in the cases as decided, although they are certainly not conclusive. The Department is interested in knowing the taxpayer's analysis of the decisions as they affect his case.

The Department has provided a very careful way for you to be heard. There is the A-2 letter which goes out, stating you will be assessed a certain sum, but a hearing is provided for, and if you are not satisfied with that hearing you can appeal to the Committee on Appeal and Review. The Department planned for an appeal because it realized the necessity of such.

De-centralization and Substitute for Excess-Profits Tax

We all know too many relatively elementary questions have to be settled at Washington, and the trouble goes back to what we were discussing in connection with our bill. With the Government short of money to build up an adequate department at Washington, it becomes hard indeed to keep well-trained men out in the field, which is essential if there is to be de-centralization.

The whole problem of trying to solve the question of taxes can only be done by having a less aggregate tax to raise. The excess-profits tax is bad, and we ought to get rid of it, but we must get a substitute at once, because of the amount of money it takes to run the Government. The best thing any of us can do is to find a plan to cut down the Government expenditures, so that the Government will not have to take away so much from the people by any form of taxation.

STANDARDIZATION

ORIGINAL PAPERS PRESENTED AT THE TWENTY-THIRD ANNUAL CONVENTION OF THE AMERICAN MIN- ING CONGRESS, DENVER, COL., NOVEMBER 15-20, 1920—STANDARDIZATION SECTION

JOINT REPORT OF SUB-COMMITTEES ON STANDARDIZA- TION OF UNDERGROUND POWER TRANSMISSION AND STANDARDIZATION OF POWER EQUIPMENT

Submitted by K. A. PAULY and A. B. KISER, Chairmen of the Sub-Committees on Power Equipment and Underground Transmission

On account of the intimate relationship between power transmission and power equipment, workable standards in these two fields can be developed only through closest co-operation between those interested in these two phases of the general problem of standardization of mining equipment. Appreciation of this fact from the first, lead the Chairmen of Sub-Committees No. 3 (Underground Power Transmission) and No. 7 (Power Equipment) to hold their meetings jointly. Not only did this procedure permit of the closest co-operation between the two Committees, but gave each the benefit of the experience of the members of both.

We wish here to express our appreciation of the keen interest shown by the members of our Sub-Committees and the valuable assistance which they afforded us by their constructive suggestions concerning many of the perplexing problems. We are also indebted to the United States Bureau of Mines for providing us with a meeting-place and a secretary during our meetings.

Two joint meetings were held at Pittsburgh on May 20 and 21, and October 19 and 20.

Those present at the first meeting were: Messrs. R. L. Kingsland, R. Kudlich and L. D. Ilsley, representing O. P.

Hood, Graham Bright, R. W. Moore, A. L. Nicht, F. L. Stone, A. B. Kiser, Chairman of Sub-Committee No. 3, and K. A. Pauly, Chairman of Sub-Committee No. 7.

Those present at the second meeting were: Messrs. R. L. Kingsland, R. Kudlich and L. D. Ilsley, representing O. P. Hood, Graham Bright, A. J. Nicht, A. B. Kiser and K. A. Pauly.

In considering the problem of standardization, we have divided it into two parts—the standardization of equipment, and the standardization of practice in the installation and operation of equipment.

As the Electric Power Club has for its object the standardization of the capacities, voltages, speeds and essential mechanical features of electric motors, generators, transformers, etc.; and as its standards are accepted throughout the country, it was suggested that we adopt them as our standards of equipment. It was also suggested that the standardization rules of the American Institute of Electrical Engineers be adopted as our standards of technical matters.

With the standardization of equipment disposed of, we devoted our time and attention to the standardization of practice. This field has been thoroughly covered by the Bureau of Mines in its Technical Paper No. 138, entitled 'Suggested Rules for Installing and Using Electrical Equipment in Bituminous Coal Mines,' and these were taken as the basis of our work. Each rule was thoroughly discussed and revised where it seemed advisable to do so, for the purpose of clarifying it, or making it conform to present-day practice.

The rules as modified at our first meeting were sent to each member of both Sub-Committees, with the request that they act as chairmen of local committees and obtain suggestions as to further modifications from the engineers in their respective districts. This brought many valuable suggestions from the districts that were not represented at the Pittsburgh meeting.

The suggestions obtained in this way were circularized and thoroughly discussed at our second meeting, and a final draft of the suggested rules made.

It has been impossible, with the time at our disposal, to devote as much attention to some matters as we would like to

have given them before submitting our report, but it is felt that the best results can be accomplished by submitting the rules in their present form.

The rules as they appear in Technical Paper No. 138, and as modified by our Committees, cover coal-mining conditions, but they are applicable to metal mining by omitting those paragraphs that apply to the existence of gas or coal dust in explosive mixtures.

We therefore submit the following as the joint recommendations of the Sub-Committee on Underground Power Transmission and on Power Equipment:

That the standards of the Electric Power Club be adopted to our standards of electrical equipment:

That the standardization rules of the American Institute of Electrical Engineers be adopted as our technical standards; and

That the following rules be adopted as our standards of practice in the installation and operation of transmission and power equipment:

Basis of the Rules

Five basic measures for safeguarding the use of electricity in mines are as follows:

1. Remove the contributory causes of accidents or danger.
2. Remove from the vicinity of electric apparatus all elements susceptible to the influence of electricity.
3. Keep the electric current where it belongs, if possible. If not, limit the area of its activity by protective devices.
4. Use a large factor of safety in the selection, installation and inspection of equipment.
5. Have full control of the movements of electrically driven machines.

Each rule that is given in this report is proposed as necessary or helpful to the accomplishment of one or more of these measures.

Definitions of Terms Used

The meanings of some of the terms and expressions as used in this report are defined below in order to avoid confusion:

Alive

See definition of "live."

Approved

This term means accepted as suitable by a competent committee, board or organization designated by those adopting the rules.

Authorized Person

A person appointed or permitted by the official designated by the State mining laws as the one in charge of the operation of the mine to carry out certain duties incident to the generation, transformation and distribution or use of electric energy in the mine, such person being one who is competent within the purpose of the rule in which the term is used.

Electric System

This includes all electric apparatus pertaining to the operation of the mine, and under the control of the mine officials, which is connected electrically to a common source of voltage or which is installed so that it can be thus connected.

Grounded Circuit

A circuit that is permanently grounded at one or more points.

Grounding

As applied to any object used in connection with a permanently grounded electric system, this term means connecting such object to the earth in such a way that a path of low resistance is provided between the object and the permanently grounded point of the system. A connection to a thoroughly bonded rail is an example of a good ground connection.

Grounding, as applied to any object used in connection with an electric system that is not provided with a permanent ground, means making connection to the general mass of

earth in such a manner as will ensure at all times an immediate discharge of electrical energy without danger.

Ground Return

That part of a circuit which is the earth, or metallic conductors intimately associated with the earth, and which is practically at earth potential at all points, is a ground return.

Live

The word "live" means electrically connected to a source of voltage difference, or electrically charged so as to have a voltage different from that of the earth.

Permissible Equipment

This refers to any equipment that is listed with the United States Bureau of Mines as permissible for use in such places as containing gas or coal dust in explosive mixtures.

Portable Electric Lamps

Electric lamps that may be carried about while lighted are portable. This general term includes lamps operated by batteries and lamps connected to a source of power by a flexible conductor, whose length limits the range over which the lamp may be used.

Self-contained Portable Electric Lamps

Electric lamps that are operated by an electric battery, which is designed to be carried about by the user of the lamp, are self-contained.

Portable Motors

Motors that are intended for service here and there as occasion requires, and that are so constructed or mounted as to facilitate moving them from place to place, are termed portable.

Stationary Motors

All motors not included in the class of portable motors shall be considered as stationary motors.

Potential

The words "potential" and "voltage" are synonymous, and mean electric pressure.

Difference of Potential

This expression means the difference in electric pressure existing between any two points in an electric system, or between any point of such a system and the earth, as determined by a voltmeter.

Potential of a Circuit

The potential or voltage of a circuit, machine, or any piece of electric apparatus, means the voltage normally existing between the conductors of such circuit or the terminals of such machine or apparatus. In alternating current systems the voltage of the system shall be that indicated by a voltmeter.

- (a) Any voltage less than 301 volts shall be deemed a low voltage.
- (b) Any voltage greater than 301 volts, but less than 651 volts, shall be deemed medium voltage.
- (c) Any voltage in excess of 651 volts shall be deemed a high voltage.

Protected

This word when applied to the current-carrying parts of an electric system, means that accidental contact with such parts is prevented by approved guards.

Shock-proof

As applied to the current-carrying parts of an electric system, excepting trolley wires, this term is taken to mean that contact with such parts is prevented by the use of grounded metallic coverings or sheaths.

Generating Station

A station in which electric generators are operated by prime movers.

Sub-station

A station in which the current is changed in character or voltage.

Underground Station

A place underground in which there are transformers, switchboards or electric machines other than portable motors, or any one of them.

Switchboard

The essential mounting common to several pieces of switch-gear or controlling appliances.

Voltage

See definition of "potential."

DIVISION 1.—GENERAL RULES

Man in Charge of Electrical Equipment

1. At each mine where electricity is used underground, there shall be in charge of the electrical equipment a man fitted for his position by ability, training and experience. The character of the equipment will determine the qualifications of the mine electrician, and he shall be thoroughly familiar with the operation and maintenance of the equipment under his charge.

Persons Working on Electrical Equipment

2. No person shall be allowed to work on or with electrical equipment of any kind unless he has been previously instructed by an authorized person in the performance of his duties.

Construction and Rating of Apparatus and Relation of Capacity to Duty

3. All electrical equipment shall be rated in accordance with the current-standardization rules of the American Institute of Electrical Engineers.

4. The rating of each piece of electrical equipment shall be stamped on it, or inscribed on a metal plate suitably mounted and maintained upon the equipment. The inscription on the plate shall indicate whether the rating is for continuous or intermittent service, and shall be in accordance with the name-plate requirements of the American Institute of Electrical Engineers.

5. All equipment shall be operated within its rated capacity as defined by the standardization rules of the American Institute of Electrical Engineers.

Permissible Voltages

6. High voltages may be used for transmission purposes underground, provided that such circuits are carried within

metallic sheaths or coverings, with the sheath or covering permanently grounded. This voltage may be applied only to transformers or to motors in which the high-voltage windings are a part of the stationary element. Medium or low voltage may be applied to all electrical equipment.

Mechanical Construction of Installation

7. Care shall be taken to ensure good mechanical construction and neat workmanship in connection with all wiring and the installation of equipment.

Prevention of Accidental Contact

8. Space shall be provided for free movement where regular passing is required or permitted around all unprotected parts of the electric system, and places where persons must pass close to or adjust permanently installed electrical machinery shall be sufficiently lighted.

9. The standing room around all electrical equipment shall be kept as dry as practicable. At any place where it is necessary to manipulate or adjust medium or high-voltage live equipment—including switches, motor starters, and other controlling appliances, excepting locomotives and machines that are moved so frequently that they are provided with trailing cables—there shall be provided and available an insulated platform or mat, which may be of a form and character most in keeping with the circumstances of its use, and which shall be not less effective than a dry board 3 feet by 15 inches by $\frac{7}{8}$ inch.

10. All metallic frames, casings and coverings, except those of mining machines and drills, that may become alive, shall be permanently grounded.* All metallic pipe-lines, 1000 feet or over in the interior of the mine, and all pipe-lines leading outside shall be bonded to the return at ends and at intervals not exceeding 500 feet. All metallic pipes in shafts shall be bonded to the return at top and bottom of shafts.

11. Where danger exists of accidental contact with wires carrying electric current, the wiring shall be protected. In haulage roads used as traveling ways the wires need not be

*It is assumed that the ordinary conditions of operation of locomotives fulfill the requirement of this rule.

protected, if a traveling way of approved dimensions is provided on the side of the entry opposite from the wires. Where wires are run in an entry, in which no one but authorized persons are allowed to travel, or where no hazard from contact exists, the wires need not be protected.

12. Weather-proof varnished cloth, rubber, or similar insulation, unless inclosed in a metallic sheath, when used underground will not be considered as a protection against shock.

13. In unfrequented places where the roof is likely to fall, all electrical conductors shall be especially protected from injury by falling roof.

Carrying Capacity of Conductors

14. The carrying capacity of insulated conductors of distributing circuits shall be determined by reference to the table of carrying capacities laid down in the National Electric Code.

The carrying capacity of bare conductors shall be determined by reference to Table 1, following:

CURRENT-CARRYING CAPACITY OF BARE COPPER CONDUCTORS USED IN MINES

Size of conductor	Current capacity	Size of conductor	Current capacity	Size of conductor	Current capacity
B. & S. gauge	Amperes	Circular mils	Amperes	Circular mils	Amperes
10	80	250,000	690	750,000	1,520
8	105	300,000	790	800,000	1,590
6	145	350,000	880	850,000	1,660
4	210	400,000	965	900,000	1,730
2	280	450,000	1,050	950,000	1,800
1	320	500,000	1,140	1,000,000	1,870
0	375	550,000	1,215	.....	.....
00	435	600,000	1,285	.....	.....
000	525	650,000	1,370	.....	.....
0000	615	700,000	1,450	.....	.....

Use of Permissible Equipment

15. The decision as to where and when permissible equipment is required will be made from time to time as necessary by the properly constituted State authority. The term equipment as here used includes everything in the electric circuit.

See also rules 14, 112, 124, 132, 136, 138, 140, 141, 144 and 164.

Inspection and Maintenance

16. At each mine where electricity is used underground, a systematic inspection of all wiring and equipment shall be made at regular intervals, at least once every month. A report of each inspection shall be made by the mine electrician or inspector, and a copy of this report shall be furnished to the man legally in charge of the operation of the mine and kept on file at the mine. The report shall definitely state the condition of each underground station, of the conductors and controlling appliances of each main and branch, power and lighting circuit, and of the motors and controlling appliances of each locomotive, mining machine, pump, hoist, or other piece of electrical apparatus connected to the electrical system of the mine.

Notices and Warnings

17. Caution notices shall be posted at points where such warnings will be most effective in reducing the likelihood of contact, and prohibitory notices shall be posted wherever electrical apparatus that should not be manipulated by unauthorized persons is installed.

Instruction for Resuscitation

18. There shall be posted prominently in every surface and underground station and at the entrance to the mine, instructions for the restoration of persons suffering from electric shock.

All employees who work with or on electrical apparatus must know how to carry out these instructions without delay.

Plan of Electrical System

19. A plan shall be kept at the mine showing the position of all permanently installed electrical machinery and apparatus in connection with the mine electrical system, including cables, conductors, lights, motors, switches, trolley lines and transformers. The plan shall be of sufficient size to show clearly the location of such apparatus, and the scale shall be not less than 200 feet per inch. There shall be stated on the plan the capacity in horse-power or kilowatts of each motor and transformer, and the nature of its duty. Such plan shall

be corrected as often as may be necessary to keep it up to date, at intervals not exceeding six months.

Fire Protection

20. Buckets filled with clean, dry sand shall be kept in all underground stations for immediate use in extinguishing fires. The minimum amount of sand thus stored in any one station shall not be less than 2 cubic feet. No sand will be required if two or more approved fire extinguishers are kept in each station.

DIVISION 2.—SURFACE AND UNDERGROUND STATIONS, GENERATING STATIONS AND SURFACE SUB-STATIONS

General Rules of Safety

See Rules 8 to 11, inclusive.

Generators

21. Generators shall be installed upon adequate foundations in a dry place, free from explosive vapors or flammable material.

22. Machines generating a voltage shall have their outgoing leads and connections entirely within the generator frame or bed-plate, or protected by an approved guard.

Switchboards and Controlling Appliances

See Rules 36 to 42, inclusive.

ELECTRICALLY-DRIVEN VENTILATING FAN: HOUSING, POWER SUPPLY, AND ATTENDANT

Fireproof Buildings

23. All electrically-driven mine-ventilating fans, together with the housing of the motor, shall be built of fireproof materials. Underground electric fans shall not be used where the air current contains gas or coal dust in explosive mixtures, and when used the surroundings shall be fireproofed within a radius of 15 feet from the motor, unless this has a permissible casing.

Power Supply

24. If the line supplying the power is exposed to the influence of lightning, lightning arresters shall be placed near the point where the wires enter the fan-house.

25. The fan attendant shall report immediately any stoppage of the fan to the man legally in charge of the operation of the mine, and means for direct communication between the fan-house and generating station or sub-station supplying the power shall be provided.

Attendant

26. The responsibility for the operation of electrically-driven mine-ventilating fans shall devolve upon an authorized person.

ELECTRICAL EQUIPMENT ON TIPPLES AND OTHER SURFACE STRUCTURES

27. All electrical equipment on tipples and other surface structures shall be installed in accordance with the rules of the National Board of Fire Underwriters.

28. Starters of motors on tipples shall be provided with a no-voltage release, and if practicable, shall be located within sight of the motors that they control or the machines that they operate. A switch or other means for disconnecting the motor from the power supply shall be installed near the machinery.

UNDERGROUND STATIONS

General Rules of Safety

See also Rules 8 to 11, inclusive; also Rule 20.

29. All underground stations shall be fireproof and well ventilated with fresh air, and shall be wired in accordance with the requirements of the National Board of Fire Underwriters.

30. Ventilation may be accomplished through openings in the walls, but with the exception of underground stations in which only switches are installed, the openings shall be provided with non-combustible doors which will either close automatically in case of fire, or can be closed easily from outside the room by the attendant.

Transformer-Stations

See also "Underground Transformers" and Rules 30, 36 to 42, inclusive; 84 and 85.

31. Transformer-stations shall be so arranged that if a transformer explodes the oil will not flow outside the room.

32. Wires shall be carried on non-combustible supporting framework, and the use of wood shall be entirely eliminated. The supporting framework shall be grounded.

33. All transformers in excess of 50-kilowatt capacity shall be equipped with suitable ammeters in either the primary or secondary circuits, or have provision for connecting portable instruments into such circuits.

Pump-Stations

See also Rules 50 to 72, inclusive.

34. Pump-motors operating at voltages exceeding the limits of low voltage shall be wired inside the pump-station, with approved wires carried in conduit sealed to exclude moisture, or sheathed with lead and so placed or protected as to avoid mechanical injury. The metallic covering shall be permanently grounded.

Battery Charging-Station

See also Rules 29 and 30.

35. For ventilating battery charging-stations, means shall be provided for obtaining the air from the intake ways and discharging same to the returning air-way.

Hoist Stations

See "General Rules of Safety for Underground Stations," Rule 34, and Rules 50 to 72.

DIVISION 3.—MACHINES AND APPARATUS

General Rules of Safety

See Rules 3 to 6.

Switchboards

See also Rules 60 to 72 and 75 to 85.

36. Switchboards shall consist of a substantial framework of iron pipe, or structural steel, on which shall be mounted a panel or panels of non-combustible, non-absorbent, insulating material which is mechanically strong, and has insulating qualities suitable for the voltage at which it is

used. All switchboard mountings, instrument transformers and motor casings shall be grounded.

37. The panels of insulating material may be omitted if each piece of equipment carried on the switchboard is provided with an individual base of insulating material of the character specified for the panels and of adequate dimensions, or has its current-carrying parts mounted on approved insulation self-contained in the equipment, which shall be especially designed for mounting on iron pipe or structural-steel framework.

38. Switchboards shall be so placed that there should be a straight passageway of not less than 3 ft. in front and in back of the switchboard. These 3-ft. passageways shall be clear of all apparatus mounted on the board and shall be kept free of all obstructions. The space back of the switchboards shall be provided with 3-ft. exits at both ends, but shall not be entered by an unauthorized person, and shall not be used for the storage of material or clothing.

39. The space behind switchboards where the voltage exceeds low voltage shall be kept closed by locked doors, which can be opened from within without the use of a key, but from without with the key only.

40. Where the voltage of the power supply exceeds the limits of medium voltage, the live high-voltage metal-work on the front of the switchboard within 7 ft. of the floor shall be protected. In case of existing installations that do not meet the requirements with this respect to passage space in back of the switchboard, no person shall be permitted back of the board while any apparatus or circuits connected therewith are alive.

41. Conductors shall not cross the passageways back of switchboards except below the floor or at a height of $6\frac{1}{2}$ ft. above the floor.

42. There shall be provided for each generator an indicating ammeter or wattmeter of suitable capacity, and for all generators a voltmeter, that, by closing a switch or manipulating a plug connection, can be connected to any generator.

ELECTRIC VENTILATING FAN EQUIPMENT**Housing and Power Supply**

See Rules 23 to 25.

Capacity of Motors

43. Motors that operate ventilating fans shall be of sufficient capacity to drive the fan at the maximum speed of the motor under normal conditions of service without overloading.

Control of Motors

44. Non-automatic motor-controlling appliances, which are used with motors that are not self-starting, shall be so arranged that the motor will be disconnected automatically from the supply circuit in case the power supply fails.

ELECTRIC HOISTING EQUIPMENT**Shaft Hoists**

45. All electrically-operated shaft hoists shall be provided with a device approved for the prevention of overwinding. Where the hoist is used for handling men, additional provision shall be made to prevent overwinding at the man landing. Where a separate overwind protection for men is used a visual signal shall be provided to indicate at all man landings that the overwind device is set for hoisting men. It shall not be possible to operate the signal lights without setting the man landing overwind.

46. Shaft hoists shall have a brake which will keep the hoisting drum under the control of the operator. The brake shall be provided with an automatic trip or release, which will apply the brake in case the power supply fails, in case of overwinding or overspeeding, and this brake shall have sufficient capacity to hold the maximum unbalanced load.

47. Hoists for handling men shall be so arranged that, when hoisting and lowering men and the legal rate of speed is exceeded, the hoist will automatically be brought to a stop. If hoists are designed to operate in balance, the driving motor shall be of sufficient size to hoist full loads of men in a maximum unbalanced condition in case of emergency.

48. All electric safety devices shall be tested at the begin-

ning of each shift and a record of such tests shall be made and signed by an authorized person and kept on file at the mine.

Slope Hoists

49. All electrically-operated slope, tail-rope, or endless-rope hoists in mines shall be fitted with adequate controlling devices of approved design.

UNDERGROUND MOTORS OTHER THAN LOCOMOTIVES

See Rules 3 to 7 and "General Rules for Safety for Underground Stations," and Rule 34.

General Construction

50. Motors for use in damp places shall have approved moisture-resisting insulation.

51. The outgoing leads and connections of all motors shall be protected from accidental contact by insulation or grounded coverings. Motors that operate at voltages exceeding low voltage shall have their outgoing leads and connections entirely within the motor-frame or bed-plates, or protected by an approved guard.

Permissible Motors

52. See Permissible Equipment, paragraph 15.

Portable Motors

53. The motors and controlling appliances of portable pumps, hoists, and similar portable apparatus shall be securely mounted and with frame grounded to a common base with the machine that is to be operated. All wiring between the motor and the controlling appliances shall be done in accordance with paragraph 7.

54. Mining-machine motors, and other motors that use a trailing cable, shall be provided where the cable enters the frame of the machine with an approved means for preventing abrasion of the insulating covering of the cable. An approved insulating clamp placed within the frame, or protected by an approved metallic covering, shall be provided for taking all mechanical strains upon the cable terminals. (See also Rule 55.)

Trailing Cables

55. Trailing cables for portable machines shall be especially flexible, heavily insulated, and protected with extra stout braiding, hose pipes, or other effective coverings. (See also Rule 74.)

56. Each trailing cable in use shall be examined daily by the machine operator for abrasion and other defects; and he shall also be required to observe carefully the trailing cable while in use, and shall at once repair any defect or report it to the person in charge of electrical equipment.

57. In the event of the trailing cable in service breaking down or becoming damaged in any way, or any person receiving a shock from it, it shall be at once put out of service. The faulty cable shall not again be used until it has been repaired and tested by an authorized person.

58. The trailing cable shall be divided at the motor, but only for such length as is necessary for making connection to the motor; and the cable, with its outer covering complete, shall be clamped securely to the motor-frame in such a manner as to protect the cable from injury, and to prevent any mechanical strain being borne by the signal ends that make electric connection to the motor.

Permissible Portable Motors

59. See Permissible Equipment, paragraph 15.

Control

60. Every stationary motor and every portable motor used underground, except mining machines and drills, shall be protected, together with its starting device.

Direct-Current Motors

61. On two-wire ungrounded circuits, each wire shall be protected by an automatic circuit-breaker, or by a fuse and switch. On two-wire grounded circuits, the ungrounded wire shall be protected by a switch, and either a fuse or an automatic circuit-breaker. When the circuit-breaker trips free from the closing handle, the switch may be omitted. On three-wire circuits each outside wire shall be protected by a fuse or automatic circuit-breaker, but no fuse or automatic circuit-

breaker shall be used in the neutral wire. A triple-pole switch, to isolate the fuses or circuit-breakers from live source, shall be used. In case circuit-breakers are used, they shall be so arranged that the opening of the circuit-breaker in one wire will cause the other circuit-breakers to trip.

Alternating-Current Motors

62. On three-phase delta or Y (star) connected circuits, each wire shall be provided with a fuse or automatic circuit-breaker. When circuit-breakers are used, two overload trip-coils shall be used for underground neutral systems, and three overload trip-coils for grounded neutral systems. In either case the automatic circuit-breakers shall be so arranged that the opening of one will open the others. Switches for isolating the fuses or circuit-breakers from live source shall be provided. When air-brake circuit-breakers, which trip free from the handle are used, the switch may be omitted.

63. The above devices shall be installed in a convenient position in sight of the motor or in sight of the equipment that the motor operates. The controlling appliances of stationary motors, except the controllers of hoist and similar equipment, shall be mounted upon a switchboard. Resistances may be mounted upon a separate metallic framework.

64. Underground motors that operate care or coal-handling equipment shall be provided at a point near such equipment with a switch, or other means for disconnecting the motor from the power supply.

65. Underground motors used to drive booster or auxiliary fans shall be so designed or equipped that they will start automatically, when their circuits are connected to the power supply.

66. All non-automatic, current-limiting starting devices, except those used with mining machines, drills, locomotives, and hoists, shall be provided with a no-voltage release.

67. Electrically-operated mining machines and drills may be protected by a single fuse, and need not be equipped with a line-switch if an approved current-rupturing device is installed at that end of the trailing cable which is nearest to the power supply. If a hook is used for this purpose it shall

be provided with an insulated handle of approved construction. If cable reels are used, they shall be provided with an approved means for opening the circuit under full motor load. (See Rule 15.)

68. All insulating material used in connection with starting resistances shall be non-combustible. This includes the insulation of wire used for the internal wiring of resistances.

69. All switches shall be so installed that they can not close by gravity.

70. Every underground stationary motor of 100 brake horse-power or over shall be provided with a suitable meter to indicate the amount of load on the machine.

71. All wiring between motors and their controlling appliances shall be insulated.

72. Overload release devices on starting rheostats and compensators will not be considered as taking the place of circuit-breakers, if such devices are inoperative during the starting of the motor. If automatic starting devices are used they shall be inclosed in a fireproof inclosure, or mounted upon a metallic framework clear of all combustible material.

LOCOMOTIVES

73. Gathering locomotives may be operated with a single-conductor trailing cable if the track provides a good metallic return; otherwise double-conductor trailing cable must be used.

74. The trailing cable of gathering locomotives shall be provided with an approved insulated hook or other device for making connection to the trolley wire; and if a double-conductor cable is used a similar hook or device shall be provided for making connection to the track rail.

UNDERGROUND TRANSFORMERS

See "Underground Stations." "Transformer Stations" and Rules 84 and 85.

DIVISION 4.—CIRCUITS AND CONDUCTORS PROTECTION AND CONTROL

Protection of all Circuits

75. All circuits leading from generating stations and sub-stations, except transformer sub-stations, shall be provided at their source with current-interrupting devices of such capacities, and so installed and adjusted that the circuit will be opened if the current in the circuit exceeds the carrying capacity of the conductors leaving the station. All circuits leading underground exceeding 50 kilowatts capacity shall be provided with a suitable ammeter or means for inserting a portable ammeter.

76. Two-wire ungrounded direct-current circuits shall be protected by an automatic circuit-breaker or by a fuse and switch in each wire. Two-wire grounded direct-current circuits shall be protected by a switch, and either an automatic circuit-breaker or a fuse in the ungrounded wire. When the circuit-breaker trips free from the closing handle the switch may be omitted. Three-wire ungrounded direct-current circuits shall be protected by a fuse or automatic circuit-breaker in each outside conductor, but no fuse or circuit-breaker in the neutral conductor, and in addition a triple-pole switch to isolate the fuse or circuit-breaker from live sources. Where one of the outside wires is grounded, this should be treated as neutral and protection provided only in the other two wires.

77. Three-phase delta or Y (star) connected alternating-current circuits shall be protected by a fuse or an automatic circuit-breaker in each wire. When automatic circuit-breakers are used, two overload trip-coils shall be provided for ungrounded neutral systems, and three overload trip-coils for grounded neutral systems. In either case the automatic circuit-breakers shall be so arranged that the opening of one will open the others. Switches for isolating the fuses or circuit-breakers from live sources shall be provided.

Protection of Circuits Leading Underground

78. Each outgoing circuit that leads underground, and extends over the surface of the ground 500 ft. or more from the generating station or sub-station, shall be equipped with lightning arresters of approved type, with proper ground con-

nection at the generating station or sub-station, and also at the point where the circuit enters the mine.

79. Lightning arresters shall be connected on the secondary side of all transformers that feed underground circuits, unless there is provided other suitable means for discharging abnormal voltages. Lightning arresters on the primary side will be considered suitable if the secondary circuit above ground is less than 50 ft. long.

80. Each power circuit leading underground shall be provided with a disconnecting switch in each conductor capable of opening the circuit under load. This switch shall be placed where the circuit enters the mine or within 100 ft. of this point.

81. Each individual circuit leading underground, whether alternating or direct current, shall be provided with automatic overload protection at or before the point where it enters the mine working. If two circuit-breakers are used, they must be so interlocked that both will open in the event of one opening.

Protection of Underground Circuits

82. All branch circuits of a network shall be provided with current-rupturing devices of such capacity, and so installed, that the current in any part of the branch circuit cannot exceed the carrying capacity of that part as defined by Rule 14, if the length of the complete branch circuit exceeds two miles.

83. Minimum size of conductors used to supply power to coal-cutting equipment shall be No. 4 B. & S. Minimum size of conductors for supplying pumps shall be No. 8 B. & S. All conductors supplying pumps and motors shall come within the limits given under paragraph 14.

Protection of Underground Transformer Circuits

84. All transformers shall be equipped with automatic current-interrupting devices in at least the primary side of the transformer; and also in the secondary side of the transformer, if the current-interrupting devices in the primary are not readily accessible from the transformer.

85. When the voltage of circuits entering or leaving underground transformers exceeds the limits of medium voltage, current-interrupting devices shall consist of an oil circuit-breaker in each conductor, and each switch shall be provided with an automatic overload-trip.

86. When the voltage of circuits entering or leaving transformers does not exceed the limits of medium voltage, their protective devices may consist of an oil circuit-breaker as described above, or of a knife-switch and automatic circuit-breaker in each conductor, except that approved fuses may be substituted for circuit-breakers.

INSTALLING OF SURFACE CIRCUITS

Surface Transmission-Lines

87. Power wires shall not be placed on the same cross-arms with telegraph, telephone, or signal wires. When placed on the same pole with such wires and below them, the distance between the two inside pins of each cross-arm carrying power wires shall not be less than 26 inches.

88. Transmission-lines operating at voltages in excess of 5000 volts shall not be placed on the same poles with telephone circuits which are or can be connected underground, unless the telephone lines are provided with approved protective devices capable of preventing the higher voltage from entering the underground telephone circuits.

Surface Trolley-Lines

89. All surface trolley-lines shall be kept at least 6½ ft. above the top of the rail, and shall be protected at all regularly provided crossings by a guard, which will prevent men from coming in contact with the wire either directly or by bringing tools in contact with the wire.

90. That part of the trolley circuit used for surface operations shall be so arranged that it can be entirely disconnected from the power supply without cutting off the current inside of the mine, or interfering with the operation of other apparatus not a part of the trolley system.

91. Trolley-wires shall not be smaller than No. 8 B. & S. gauge copper wire or No. 4 B. & S. gauge silicon-bronze wire,

and shall withstand easily the strain put upon them when in use.

92. Trolley wires shall have double insulation from the ground unless an approved single insulator is used. In wooden-pole construction the pole will be considered as one insulation.

METHODS OF CARRYING CIRCUITS UNDERGROUND

Suspension in Shafts

93. All power conductors installed in shafts shall be covered with approved insulating material throughout or protected in an approved manner, and shall be firmly fastened to or suspended from properly supported insulators, unless the conductors are sheathed with lead or inclosed in conduit. Conductors used as returns in shafts for ground-return systems shall be supported on insulators, but need not be covered with insulation.

94. Shaft cables which are so constructed that the whole or any part of the cable is not self-sustaining, shall be supported in an approved manner at such intervals as may be necessary to prevent the occurrence of undue strains in sheath, insulation, or conductors.

95. Shaft cables shall be so placed or protected that they are not liable to injury from falling material.

Suspension in Bore-Holes

96. All power conductors, except grounded returns installed in bore-holes, shall be covered with insulation and supported in an approved manner, which shall prevent the occurrence of undue strains in sheath, insulation or conductors.

97. Telephone or signal wires shall not be installed in the same bore-hole with power wires, unless either the signal or the power conductors in the bore-hole are encased in metallic coverings that are permanently grounded.

Entrance of Conductors Through Drifts or Slopes

98. Low and medium-voltage power conductors in drifts or slopes may be installed bare, but shall be carried on suitable insulators securely fastened to the sides or roof of the

entry. If the drift or slope is used for traveling, the conductors shall be protected as required in Rule 105.

INSTALLATION OF UNDERGROUND POWER CIRCUITS AND CONDUCTORS

99. All joints in wires shall be made electrically and mechanically efficient either by the use of an approved mechanical connector or by soldering.

100. Underground conductors will not be considered as shock-proof unless they are encased in metallic covering that is thoroughly grounded.

101. Low and medium-voltage conductors shall be carried at least 6 in. from the trolley-line and on the nearest rib side of it, and shall be supported on insulators of an approved type. When the height of the entry does not exceed 5 ft., the insulators shall be placed not more than 20 ft. apart and as much closer as is necessary to support the wires properly.

102. If the height of the entry is more than 5 ft., the insulators shall be placed not more than 30 ft. apart, and as much closer as may be necessary to support the line properly.

103. High-voltage conductors shall be carried in metallic coverings, and shall be installed in an approved manner with special reference to the conditions under which they are installed.

104. The negative or return wire of grounded systems shall be treated in exactly the same manner as the positive or live wire, and afforded the same support and insulation.

105. All conductors in traveling ways, except haulage-roads used for traveling (see Rule 11) and medium-voltage conductors in room entries, shall be protected throughout that part of the entry that is used for traveling, unless the conductors are at least $6\frac{1}{2}$ ft. above the rail, in which case protection will be necessary only at those points where men are required to work beneath the conductors or pass under them. The insulators may be supported directly from the roof or side or may be attached to timbers not less than 3 by 4-inch size, or may be secured to steel mine timbers. The insulators shall be placed so that the height of the conductors above the bottom will be comparatively uniform.

106. All conductors shall be strung with the least practicable sag between the supporting insulators, and shall be maintained in this condition and kept from contact with rock, coal, timber, or other non-insulating material.

107. All main conductors shall be sectionalized by approved switches at points not more than 2500 ft. apart.

Branch Conductors

108. Branch conductors shall be supported and maintained in the same manner as main conductors, and given the same protection.

109. At the point where branch circuits leave the main circuits there shall be placed a switch for cutting off all current from the branch circuits.

110. Where wires pass through partitions or wooden or other brattices, they shall be protected with approved insulating tubes held in place with tape or thoroughly cemented in place so that they can not move.

111. Entries or passageways in which wires are installed must be kept sufficiently free from rock, slate, or other material to permit ready access to the wires at all times.

Room Wiring*

112. Rooms in which gas or coal dust exist in explosive mixtures shall not be wired. Where room wiring is permissible it shall be treated as branch circuits, and equipped at the room entrance with switches or some other device that will entirely disconnect the wiring when not in use.

Trolley-Wires

113. Trolley-wires shall be of hard-drawn copper not smaller in size than 1/0 B. & S. gauge, and shall be securely supported on approved hangers, which may be attached directly to the roof or securely fastened to timber or equivalent.

114. The height of trolley-wires above the top of the rail shall be made as uniform as practicable.

115. Trolley-wires shall be so placed as to give the maximum clearance practicable, and kept in as straight a line as possible.

*The U. S. Bureau of Mines recommends that rooms be not wired.

116. On straight runs, the hangers shall be placed not more than 20 ft. apart where the height of the roof above the track is 5 ft. or less, and not more than 30 ft. apart where the roof is more than 5 ft. above the track. On curves, the hangers shall be placed so close together that the trolley-wire at any one hanger may be entirely disconnected without exposing the locomotive runner to danger of contact.

117. Underground trolley-lines shall be sectionalized every 2500 ft. by placing in the line a switch by which the line can be entirely disconnected from the power supply. All branch trolley-lines shall be provided with a frog at the point where they leave the main, and also with a switch installed at or near the frog, by which the branch can be disconnected from the main.

118. Trolley-wires that are less than $6\frac{1}{2}$ ft. above the top of the rail shall be protected at all points where men are regularly required to work or pass under them, and at all points where men may come in contact with the wires.

Bonding

119. The tracks of all main haulage systems that use a rail return shall be bonded at every rail joint, and cross bonding shall be placed at intervals not exceeding 200 ft. Special provision shall be made for bonding around all switches, frogs, or openings in the track so as to insure a continuous return.

Lighting Circuits in Places Where Gas or Coal Dust Do Not Occur in Dangerous Mixtures

See also Rules 133 to 135; 137 to 139.

120. Lighting wires shall be attached to power wires by soldering or by fastening under a set-screw in a lug attached to the trolley-hanger, or by such other devices as will prevent the wires from becoming loose.

121. All wiring shall be supported on non-combustible, non-absorbent insulators, which shall separate the wires by at least 1 in. from the surfaces wired over. Wires of opposite polarity shall be kept at least $2\frac{1}{2}$ in. apart for low voltage, and 5 in. apart for medium voltage.

122. No wires smaller than No. 14 B. & S. gauge shall be used for lighting circuits in non-gaseous places.

123. When the ground is used as a return for lighting circuits, the return wire shall be attached to the track by bonding to the rail or by attachment to regular bonding in an approved manner. This ground connection shall be made of not less than No. 8 B. & S. gauge copper wire, which shall be buried below the surface and carried to the side of the entry, and thence on porcelain insulators to the roof or a point at least 5 ft. above the track.

Lighting Circuits in Places Where Gas or Coal Dust Occurs in Dangerous Mixtures*

See also Rules 136 and 140.

124. The potential of lighting circuits shall not exceed the limits of low voltage.

125. Only permissible equipment shall be used for lighting circuits.

126. The circuits shall be run from the outside, with all switches and protective devices on the surface, or by using permissible switches, fuses, or circuit-breakers situated underground, or by ventilating with fresh air the place where the switches and fuses are installed.

127. If the circuits are run from the outside with the controlling devices installed on the surface, the conductors leading underground shall be not smaller than No. 8 B. & S. gauge, and each circuit shall be provided above ground with a suitable ammeter.

128. Each circuit shall have a double-pole switch and fuses or circuit-breakers in the case of two-wire systems, and a three-pole switch and fuses or circuit-breakers in the case of three-wire systems.

129. The fuses or circuit-breakers shall be designed or arranged to operate when the allowable load is exceeded by 25%.

*Bureau of Mines recommends that in mines in which fire-damp is given off in dangerous quantities, the use of lighting circuits be confined to those entries and places that are ventilated by intake air-currents which have not passed by or through abandoned or active workings, except that a lighting circuit may be used in a shaft or slope bottom ventilated by a return air-current in which the percentage of methane does not exceed 1%.

130. No wire smaller than No. 12 B. & S. gauge shall be used in lighting circuits except for the leads of weather-proof sockets, and these shall not be less than No. 14 B. & S. gauge.

131. In case distribution is made from a point underground, the distribution switches and fuses shall be mounted on a non-combustible panel, placed in a metal cabinet and fitted with a hinged door. This cabinet shall be used whether permissible switches are required or not. The cabinet shall be fitted with a door properly hinged, so that it will close tightly and shall be provided with a fastening which will hold the door securely in a closed position.

132. Flexible lamp-cord connections are prohibited except for portable lamps, as covered by Rule 141.

DIVISION 5.—MISCELLANEOUS EQUIPMENT FIXED ELECTRIC LAMPS

For wiring and control requirements of fixed electric lamps, see Rules 120 to 132, inclusive.

133. Electric lamps used to illuminate haulage-roads, side tracks, and similar passageways where gas or coal dust do not exist in explosive mixtures, may be connected to power and trolley-lines.

134. Lamps may be connected in multiple or in series, and no fuse or switch will be required for one lamp or series of lamps. A switch may be used if it is desired to switch the lamps on or off, and a fuse must be used if it is necessary to protect any considerable length of wire.

135. All sockets shall be of the keyless weather-proof type, and have no exposed metallic parts. Lead wires shall be rubber-covered, and of a size not smaller than No. 14 B. & S. gauge. The lead wires shall be made a part of the socket and permanently connected thereto. These wires shall be attached directly to the line wires by soldering or by mechanical connectors. Sockets shall not be supported by the line wires, but by an additional insulator or insulators, or some other device that will be entirely independent of the line wires.

136. In mines that contain gas or coal dust in explosive mixtures, and in which electricity is used only for lighting

or where the lighting circuits are separate from the power circuits, the voltage of such circuits shall not exceed the limits of low voltage, and all lamps shall be connected in multiple.

137. Not more than 24 lamps shall be attached to any one circuit, and the power taken by any one circuit shall not exceed 1300 watts.

138. Permissible mine incandescent lamps shall be used where gas or coal dust occurs in explosive mixtures.

139. Incandescent lamps shall be so installed that they cannot come in contact with combustible material.

140. Electric lamps shall be replaced by an authorized person only, and in places where gas or coal dust exist in explosive mixtures, only after an examination for gas has been made with a safety-lamp.

Portable Electric Lamps

141. Portable incandescent lamps, other than permissible battery-lamps, shall be protected by a heavy wire cage, which completely encloses both lamp and socket, and shall be provided with a handle to which both cage and socket are firmly attached, and through which the cord supplying the current is carried. The socket shall be keyless, and the lamp circuit shall be protected by a fuse.

142. When a portable lamp is one of several connected in series between a source of voltage and the earth, the portable lamp shall be the one in the series electrically nearest to the earth connection.

143. The use of portable lamps with leads of ordinary flexible cord is prohibited. Only lamp cords approved for this purpose shall be used.

Self-Contained Portable Electric Lamps*

144. Permissible self-contained portable electric lamps shall be used in places where gas or coal dust occurs in explosive mixtures.

*The use of self-contained portable electric lamps of suitable design and construction is recommended for all coal mines, provided that in places where gas or coal dust occur in dangerous mixtures, or in places where blackdamp is given off in large quantities, frequent inspections with safety-lamps are made.

Electric Shot-Firing Equipment

145. Electricity from any grounded circuit shall not be used for firing shots.†

146. Special precautions shall be taken to prevent shot-firing conductors from becoming grounded, or from getting in contact with other electric circuits.

147. Only authorized persons shall be allowed to fire shots with electricity in a mine.

148. The electric detonators or igniters and leads thereto shall be suitable for the conditions under which the blasting is carried on and shall be approved by the United States Bureau of Mines.

149. Portable shot-firing machines shall be of efficient design and shall be substantially constructed. All such machines shall be enclosed in strong, tight casings.

150. Primary or secondary batteries used for shot-firing shall be enclosed in a well-constructed casing provided with a special form of contact-plug for making the connection between the batteries and shot-firing leads. The design of the plug shall be such that considerable pressure will be required to make the contact, which will be immediately broken unless the plug is forcibly held in position.

151. There shall be no exposed contacts on the outside of the battery casings.

152. All portable shot-firing machines shall be equipped with a detachable handle, connecting plug, key, or similar approved device without which the shot-firing circuit cannot be closed, and which shall under no circumstances pass from the custody of the person authorized to fire the shots.

153. No shot-firing device shall be connected to the shot-firing leads until all other steps preparatory to the firing of the shot have been completed, and all persons have moved to a position of safety.

Disconnection of Leads

154. Immediately after the firing of a shot, the firing leads

†It is recommended that all shots be fired electrically, and for inside firing, shots be fired separately—and one at a time, on account of the danger of causing blown-out shots and resultant explosions. If fired in groups, the firing should be done only from the surface.

shall be disconnected from the supply of electricity, and no person shall approach a shot which electricity has failed to explode until the firing leads have been so disconnected, and an interval of 10 minutes has elapsed since the last attempt to fire the shot.

Shot-Firing From Surface

155. In coal mines employing the system of firing shots electrically from above ground when everyone is out of the mine, a complete metallic circuit shall be employed, and both wires shall be covered with insulation and supported upon glass or porcelain insulators.

156. There shall be a switch at the mouth of each working place, so that the circuit can be kept open while miners are at work, and closed only when the shots have been prepared, and the miner or miners are leaving the place.

157. There shall be a locked switch in the circuit at the entrance to each heading or side entry, which shall be locked open and be thrown-in only by an authorized person, when all the men are out of the respective heading or branch entry.

158. There shall be in the circuit at the foot of the shaft or slope, two plugs with flexible leads not less than 5 ft. long, to break further the main circuit of the shot-firing system until all the men in the mine have gone out, when the plugs will be put in by the one man authorized to do so. Provision shall be made for locking the plugs out of circuit.

159. There shall be placed in the power-house a locked switch to be used for connecting the shot-firing circuit to the generator or power-line. This switch shall be thrown-in only by the man who is authorized to do the shot-firing, and not until the men have been checked out of the mine.

160. There shall be placed in the shot-firer's cabin a locked firing-switch, which shall be thrown only by the authorized shot-firer after all the men are out of the mine, and after all other switches have been thrown-in. In firing shots, this switch shall be thrown but once.

161. To insure that all men are out of the mine, an approved system of checking shall be employed.

162. All shot-firing lines shall be carefully insulated and the two wires that form the circuit shall be placed on the side of the entry or passageway opposite from that on which the trolley-wire is placed, and so far as possible other roads than the trolley road shall be used for carrying the wires into the working places.

Electric Signaling Equipment

163. The parts of electric signaling systems used in connection with mines shall be designed, constructed, and installed in an approved manner. No voltage in excess of 25 volts shall be applied to signal circuits in places where gas or coal dust occur in explosive mixtures.

164. Only permissible equipment shall be used in places where gas or coal dust occurs in explosive mixtures.

165. Suitable precautions shall be taken to prevent electric signal or telephone wires from becoming grounded or from coming in contact with electric conductors, whether insulated or not. Signal circuits and telephone wires shall not be installed on the same side of an entry as power conductors.

BRIEF OF DISCUSSION ON JOINT REPORT OF SUB-COMMITTEES ON STANDARDIZATION OF UNDERGROUND POWER TRANSMISSION AND STANDARDIZATION OF POWER EQUIPMENT

By WARREN R. ROBERTS, Chairman of General Committee

The Chairman of these two Committees decided that the subject matter each of them had under consideration was so interwoven that it was best to consolidate their efforts, and their work was therefore carried on in joint sessions, and they rendered a joint report.

The Committees were most fortunate in having Mr. Kiser, chairman of one of the Sub-Committees, present at the Standardization Conference to present their joint report. He stated that the report was entirely too long, and contained too much technical data, he thought, to make it of interest to the Conference, and therefore discussed the most salient features of the joint report.

Mr. Kiser first expressed, on behalf of the Chairman of both

these Committees their sincere appreciation of the keen interest shown in the work by the members of these Committees. He also placed in the record an expression of the Committees' indebtedness to the U. S. Bureau of Mines for providing not only a meeting place, but a secretary during their joint meetings. Mr. Kiser explained that the work of their Committees, and therefore their report, was separated into two general divisions: first, the standardization of practice in the installation and operation of equipment, and the standardization of equipment.

As the Electric Power Club has for its object the standardization of capacities, voltages, speeds, and essential mechanical features of electric motors, generators, transformers, etc., and as its standards are the accepted standards throughout the country, it was suggested that the Committee adopt them as their standards for such equipment. It was also suggested that the standardization rules of the A. I. E. E. be adopted as our standards of technical matters. In giving attention to the standardization of practice, the Committee considered that this work was very thoroughly covered by the U. S. Bureau of Mines Technical Paper No. 138, entitled 'Suggested Rules for Installing and Using Electrical Equipment in Bituminous Coal Mines.' The data contained in this Bulletin was therefore taken as the basis for the work of the Committee. Each rule was thoroughly discussed and revised when it seemed advisable to do so for the purpose of clarifying it, or making it conform to present day practice.

Lastly, the Committee advises that the rules as they appear in the report of this Committee are prepared especially to cover coal-mining conditions, but they are applicable to metal mines, by omitting certain paragraphs which concern the existence of gas or coal dust in explosive mixtures.

This brief digest of the verbal presentation of this most valuable report is intended simply to give an insight into the methods of procedure by this Joint Committee, and to indicate the careful and thorough manner in which they have done their work. A study of this joint report, however, is necessary to appreciate the amount of good work performed on behalf of the industry by this Joint Committee.

DIGEST OF PAPER ON SUGGESTIONS FOR THE STANDARDIZATION OF HAMMER DRILLS AND ACCESSORIES

Prepared by GEORGE H. GILMAN, East Boston, Mass. Member of the
Sub-Committee on Drilling-Machines and Drilling

Presented at the Meeting of the Sub-Committee on Drilling-Machines

I do not recommend an attempt being made to restrict the quantity of sizes and types of standard machines to a point that will tend to lower the overall efficiency of the drilling operation, regardless of the fact that from the manufacturer's viewpoint the fewer the number and types of machines the greater will be the volume of each type built, with a consequent reduction in manufacturing costs. However, with a variety of types and sizes of machines to choose from, the individual mine operator will be able to select the minimum number to meet to the best advantage the requirements of the work, and after the selection is made, it will then be necessary for the manufacturer's engineer to regulate the mechanism of the drill in order that it may be adapted to the conditions of ground and air pressure to the best advantage. With this in view, I recommend the standardization of the following machines:

Details, Capacity and Use of Machines

- (1) A hand-held hammer-drill to weigh 25 to 30 lb., having automatic bit rotation, double-grip handle, drill-steel retainer, automatic lubricator, means for cleaning the drill-hole with air only, and a chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel, having $\frac{7}{8}$ -in. quarter-octagon collared shank $\frac{3}{4}$ in. long.
Capacity—holes to a maximum depth of 4 ft. with a bottom diameter of $1\frac{1}{4}$ inches.
Use—scaling walls and hitch cutting from ladder or staging, light pop-holing, etc.
- (2) A hand-held hammer-drill to weigh 30 to 40 lb., having automatic bit rotation, double-grip handle, drill-steel retainer, automatic lubrication, water attachment, and chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-

steel having a $\frac{7}{8}$ -in. quarter-octagon collared shank $3\frac{1}{4}$ in. long.

Capacity—holes to a maximum depth of 8 in. with a bottom diameter of $1\frac{1}{4}$ inches.

Use—pop-holing in boulders, blast-holes in shrinkage stopes, quarry work, etc.

- (3) A hand-held hammer-drill to weigh 30 to 40 lb., having automatic bit rotation, double-grip handle, drill-steel retainer, automatic lubrication, and chuck adapted for collared solid auger drill-steel of cruciform section $1\frac{1}{2}$ -in. diameter (spiral to be $3\frac{1}{2}$ turns per foot), having a $\frac{7}{8}$ -in. quarter-octagon collared shank $3\frac{1}{4}$ in. long.

Capacity—holes to a maximum depth of 9 ft., with a bottom diameter of $1\frac{3}{4}$ inches.

Use—blast-hole drilling in hematite iron ore, hard pan, gravel, and earth formations.

- (4) A hand-held hammer-drill to weigh 55 to 60 lb., having automatic bit rotation, double-grip handle, drill-steel retainer, automatic lubrication, water attachment, and chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel having a quarter-octagon collared shank $3\frac{1}{4}$ in. long.

Capacity—holes to maximum depth of 12 ft. with a bottom diameter of $1\frac{1}{4}$ inches.

Use—blast-hole drilling in shafts, open-pit mining and deep-hole drilling in quarries.

- (5) A mounted hammer-drill to weigh 115 to 125 lb., having a shell and feed-screw equipped with a sliding trunnion and adapted for a normal drill-steel change of 24 in. The hammer engine to have automatic drill-bit rotation, drill-steel retainer, automatic lubrication, water attachment, and chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel having a quarter-octagon collared shank $3\frac{1}{4}$ in. long.

Capacity—holes to be a maximum depth of 12 ft. with a bottom diameter of $1\frac{1}{4}$ inches.

Use—breast stoping, light drifting, and tripod drilling.

- (6) A mounted hammer-drill to weigh 160 to 180 lb., having a shell and feed-screw adapted for a normal

steel change of 24 in. The hammer engine to have automatic drill-bit rotation, automatic lubrication, water attachment, and chuck with bayonet lock adapted for 1 $\frac{1}{4}$ -in. round, lugged hollow drill-steel having a round shank 3 13-16 in. long.

Capacity—holes to a maximum depth of 20 ft., with a bottom diameter of 1 $\frac{5}{8}$ inches.

Use—heavy drifting and tripod work.

- (7) A pneumatic feed hammer-drill to weigh 80 to 90 lb., having a pneumatic-feed extension to the hammer engine adapted for a normal steel change of 18 in. The hammer engine to have automatic drill-bit rotation, automatic lubrication, water attachment, and chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel, equipped with a quarter-octagon collared shank 3 $\frac{1}{4}$ in. long.

Capacity—holes to a maximum depth of 12 ft. with a bottom diameter of 1 $\frac{1}{4}$ inches.

Use—overhead drilling in stopes and raises.

- (8) A pneumatic feed hammer-drill to weigh 60 to 65 lb., having a pneumatic-feed extension to the hammer engine adapted for a normal steel change of 18 in. and adapted to be oscillated by hand. The hammer engine to have automatic lubrication, water attachment, and chuck adapted for $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel, equipped with a quarter-octagon collared shank 3 $\frac{1}{4}$ in. long.

Capacity—holes to a maximum depth of 8 ft. with a bottom diameter of 1 $\frac{1}{4}$ inches.

Use—overhead drilling in stopes and raises where the conditions of the work do not demand that the drill be equipped for automatic rotation of the drill-steel.

Size of Drill-Steel

In making recommendations for machine standardization the standardization of drill-steel should be embodied, for to my knowledge there is no good reason why for 98% of the underground conditions encountered in metal mining there should be more than three sizes and shapes employed.

- (a) $\frac{7}{8}$ -in. quarter-octagon hollow drill-steel equipped with a $\frac{7}{8}$ -in. collared quarter-octagon shank $3\frac{1}{4}$ in. long.
Applicable to machines 1, 2, 4, 5, 7, and 8.
- (b) $1\frac{1}{2}$ -in. solid cruciform twisted drill-steel equipped with a $\frac{7}{8}$ -in. collared quarter-octagon shank $3\frac{1}{4}$ in. long.
Applicable to machine 3.
- (c) $1\frac{1}{4}$ -in. round, hollow drill-steel equipped with a $1\frac{1}{4}$ -in. round, lugged shank 3 13-16 in. long.
Applicable to machine 6.

The $\frac{7}{8}$ -in. hollow quarter-octagon section is recommended under (a) because of its angular shape, which, when rotated in the drill-hole, facilitates the ejection of the sludge and prevents mud collars from forming. In cross-sectional area it exceeds that of the hexagon, round, and cruciform shapes of corresponding diameter, thus providing greater strength in comparison, and when the shanks are made in this section, greater bearing surface to resist wear both in the shank and chuck bushing. The shape of the quarter-octagon steel also facilitates the forging of a four-winged bit as the wings may be drawn from the four flattened corners of the bar, and in addition it provides an ideal gripping surface for the dies of the drill-sharpening machine.

Heretofore it has been an accepted theory that in the case of pneumatic-feed drills, a collarless drill-shank is desirable, for by its use the work of putting the collar on the steel is obviated. This assumed advantage is, however, subject to question when it is considered that the employment of shankless drill-steel necessitates the use of an anvil-block or striking-pin interposed between the hammer-piston and the drill-steel, which depending upon its weight and the character of the blow delivered by the pneumatic hammer, results in a loss of from 20 to 30% of the effectiveness of the blow in transmission through the part. That it precludes the possibility of standardizing on two sizes or types of drill-steel for the average hard-rock metal mine and, furthermore, that it precludes the employment of a drill-steel retained as an integral part of the machine for extracting the drill-steel from the drill-hole. The desirability of a collar or lugs at the base of the shank of drill-

steel that is adapted for drifting, sinking, pop-holing, drilling, etc., needs no comment; therefore, as a suggestion in view of simplifying the steel equipment of the mine and its standardization that the same $\frac{7}{8}$ -in. quarter-octagon, collared drill-steel recommended for other machines employed for sinking, light drifting, breast stoping, and pop-hole drilling be employed for all pneumatic feed stoping-drills.

After the type and size of drill-steel bar and its shank is settled upon, careful consideration should be given to the change length and also to the gauge of the bit for the different steels that comprise a set to drill to a stated depth, it is recommended that a normal change length of 12 in. be adopted for the $\frac{7}{8}$ -in. collared quarter-octagon steel as applied to machines 1, 2, 4, 5, 7, and 8, an 18-in. change length for the $1\frac{1}{2}$ -in. cruciform, twisted solid steel as applied to machine 3, and a 24-in. change length for the $1\frac{1}{4}$ -in. round, hollow lugged steel as applied to machine 6.

Importance of the Drill-Bit

Very often one of the biggest 'leaks' in a mine is to be found in the cutting end of the drill-bit and as this is the 'business' end of metal mining it is the logical starting point in the campaign to raise efficiency. The start should, therefore, be made, first, by selecting drill-steel of the required shape and quality for the work; secondly, by forging the bit end of the drill-steel to the required shape; and thirdly, by subjecting it to proper heat-treatment.

Heretofore, many mine operators have adopted the practice of hiring a blacksmith or drill-sharpener, bestowing upon him the responsibility of keeping the mine supplied with drill-steel and have trusted to the 'four-leaf clover' that they carry around in their notebooks, for results. Under such conditions they usually get them, but they are not as a rule of a kind that justify the signification of the 'four-leaf clover.'

The material from which the drill-steel is made should be selected to meet the existing conditions of the work, after which the selection should be rigidly adhered to, and a standard method of procedure adopted for working it. Metallurgy has made such rapid strides that it is now a comparatively simple matter to secure the chemical composition and physical

characteristics of any particular kind of steel which, after being determined, should be used as the basis of a standard set of specifications. There is nothing more disconcerting to the drill-steel smith than to be forced to work steel of varying chemical composition that invariably is found about at the mine where material is purchased from several sources, with no more rigid specifications than the mere statement that hollow or solid drill-steel is what is wanted.

Sharpening Drills at Correct Heat

After the material is standardized for the work, smiths should be taught to forge the material at a safe working heat. All blacksmiths know that the hotter steel is heated preparatory to forging the earlier will be the work of hammering it into shape; while but few realize the disastrous effect of overheating, which is detected only when the finished drill-bit is subjected to service perhaps in an inaccessible working place a mile or two underground and away from the shop. Then it is usually the steel that is condemned instead of the real cause of trouble being determined and checked.

The next important lesson that the blacksmith should be taught is the fact that in the operation of tempering or heat-treating, all straight carbon drill-steel should be quenched when heated to the critical point regardless of the method employed for drawing the temper. It is called the critical point, because it is the point in the temperature of the piece being heated at which a change takes place in the structure of the steel due to the carbon being dissolved. It is the point below which steel will not harden when quenched, and by coincidence it is the point at which the steel loses its magnetism.

When high, straight carbon-steel is heated to the critical point, and cooled rapidly by quenching in ice-cold water, maximum hardness and density is obtained; and it must be remembered that density of structure is equally as important a factor as hardness in rendering the tool both shock and wear-resisting. The required degree of toughness is secured by varying the rate of cooling, when the piece is quenched at the critical temperature, and as applied to the cutting point of the tool, this must be varied to suit the requirements of the work.

For the shank or striking-end of the tool, density and toughness are more to be desired than hardness, so for general work

the desired result may be secured by heating to the critical temperature the entire shank-end for a short distance below the collar or shoulder, dipping the tip-end in cyanide of potassium and then quenching in oil, allowing it to remain there until cool.

Effect of Over-Heating Steel

Let us consider the resultant effect of operating on a drill-steel that has been injured in the smith's shop. Regardless of whether it has been over-heated preparatory to forging, over-heated preparatory to quenching, or quenched at too low a heat, the general result is the same. The cutting end of the tool is rapidly dulled in service, due to the absence of wear-resisting qualities. It loses its ability to penetrate the rock when struck, so that the shock must of necessity be absorbed in the steel itself, or transmitted back to the actuating engine. The effect of continued hammering with a dulled cutting tool upon the rock is exactly the same as that of operating against an impenetrable substance such as a hardened anvil. Minute fatigue-checks are established throughout the length of the drill, and as the strength of a chain is determined by its weakest link, the ability of a piece of steel to withstand vibratory shock is determined by its weakest point. It is at this point that one at least of the fatigue-checks will have been established. Initially, it may be so small as to be hardly detectable by the naked eye, but with continued operation it gradually grows larger by assuming a semi-circular or arc-shaped appearance, extending into the body of the material. As this check enlarges it is caused to open and shut as the vibratory stresses to which the cutting tool is subjected affect it. Eventually, the steel or cutting tool is broken apart with the balance of the section, disclosing a good, clear fracture of the metal in its original condition.

Unfortunately the effect of the abuse to which the drill-steel or cutting tool is subjected, does not as a rule end with the initial fracture of the bar. When a drill-steel breaks apart in service, the shorter end only is as a rule discarded and the longer is set aside to be either re-shanked or re-sharpened at the convenience of the drill-steel smith. A defective piece of steel is thus again put in commission, and often is broken again in service before it is subjected to undue shock.

The effect of operating on a dulled drill-bit is not confined to the cutting tool, for it must be remembered that the cushioning effect due to the penetration of the chisel in the material worked upon, alone makes possible the successful operation of every part comprised in the make-up of the rock-drilling engine.

Standardization of Hose and Hose Fittings

It is recommended that the inside diameter, outside diameter, length, and type of hose employed for supplying the rock-drill with air and water under pressure should be standardized, and the following suggestions are advanced with this in view.

For the air supply of machines 1, 2, 3, 4, 5, 7, and 8, $\frac{3}{4}$ -in. plain pneumatic hose, without wire winding.

For the air supply of machine 6, a 1-in. plain pneumatic air hose without wire winding.

The length of all air-supply hose to be 50 feet.

For the water supply of all machines $\frac{1}{2}$ -in. half round wire-wound hose.

The length of water hose to be 25 feet.

My suggestions relative to the standardization of hose fittings for hammer rock-drill service were embodied in an article that was published in the *Engineering and Mining Journal* of June 5, 1920.

Standardization of Mining Columns for Hammer Rock-Drills

Of the hammer rock-drills recommended, two only require mountings, namely, 5 and 6. In order to keep the saddle of the mining columns limited to two sizes, and incidentally provide the required strength of column for the varying conditions of use, the following is recommended:

For machine 5, a $2\frac{1}{2}$ -in. single-screw column with $2\frac{1}{2}$ -in. arm when single drill is employed, and 3-in. double-screw column with $2\frac{1}{2}$ -in. arms when two drills are used on the same column.

For machine 6, single-screw column with $3\frac{1}{2}$ -in. arm when single drill is employed, and 4-in. double-screw column with $3\frac{1}{2}$ -in. arms when two drills are used on the same column.

PRELIMINARY INVESTIGATION ON THE STANDARDIZATION OF DRILLING-MACHINES AND DRILL-STEEL

Prepared Under the Direction of ARTHUR NOTMAN, Superintendent, Mine Department, Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Ariz. (Member of the Sub-Committee on Drilling-Machines and Drill-Steel).*

Standardization of Rock-Drill Fittings

interchangeable between many of the machines of the manufacturer, but also to have the rock-drill companies adopt the same specifications in making these minor parts. At the present time this condition is far from realization.

For example: in the case of water and air spuds, the only course for a large mining company to pursue today is to accept the product of one manufacturer as the standard. This means scrapping the spuds on many of the newly-purchased machines. Though such a standard has been adopted at the Copper Queen Branch of the Phelps Dodge Corporation, it requires three sizes of water spuds to fit out the three types of Ingersoll-Rand machines in use. They must be machined down or bushed up to fit other makes. A change in this condition would greatly benefit mining companies, and it would work no hardship upon rock-drill manufacturers.

The following discussion is based upon the principle that differences in the sizes of bolts, nuts, and spuds should be reduced to a minimum. It is important that as few wrenches as possible be needed to operate the machine. The more wrenches required, the greater will be the chance of losing them underground, as well as loss of time on the part of the miner in operating the machine. It must be realized that in drifting, only about 30% of what is charged as drilling time is actually spent with the bit hitting the face. Through standardization, the operating efficiency should be slightly

*This report, according to Mr. Mitke, must in no way be considered as the report of the Sub-Committee on drilling machines and drill-steel, but are merely the individual views of two members of the Committee, and as such contain much valuable data. Mr. Braly, Chairman of the Committee, reported that while considerable work had already been accomplished, the Committee, as a whole, was not yet ready to submit a report.

increased. An additional advantage would be the reduction in the number of repair parts to be carried.

The chuck-wrench is the chief tool used in operating drifting machines. As many nuts should fit this wrench as is practical. The monkey-wrench should be eliminated, because it is expensive and unsatisfactory. It must be admitted that it is a very handy tool, but underground conditions cause rust to ruin the threads long before actual hard usage would necessitate scrapping. Stillson wrenches are too valuable for other purposes to remain long on the job, unless owned by the operator, and are also subject to damage from corrosive water.

While many of the following suggestions may seem radical, they are offered in the hope that they will help to bring about a much-needed standardization.

Suggested Improvements in Machine-Drills

(1) Larger oil reservoirs, if practical, would reduce troubles due to lack of lubrication by lessening the responsibility of the operator in this regard. At present, the tendency of rock-drill manufacturers seems to be to make the lubricators too small.

(2) Some of the latest type rock-drills call for both grease and oil. Requiring two kinds of lubricant is a disadvantage, as it adds one more duty to the miner. In the past, the drill-runner has not proved himself able to handle even one oil-can, to say nothing of two.

(3) With the introduction of wet machines, the tendency has been to develop drifting rounds with an increased number of upper holes. In the Copper Queen mines, practically all of the drifting is done with the standard V-cut round, using either 16 or 13 holes. About 85% of the drifts require 16 holes to break the ground. The 16 and 13-hole rounds have 9 and 7 holes, respectively, drilled from under the arm. This means that plugs in the lubricators should be so placed as to allow filling when the machine is in either the over or the under-arm position. It is acknowledged that doubling the number of plugs doubles the chances of their working loose and getting lost. To place the extra oil-plugs properly will require a slight extension of the lubricator costings.

(I wish to make no apology for any attempt to show drill manufacturers how to change their design, or to do any of these things, because I do not pretend to know. This is merely offered as a suggestion and without any right of opinion in the matter.)

Lubrication

The under oil-plugs should be on the opposite side of the rock-drill from the hose connections. In any event, some means should be devised for lubricating the machine in this position.

Under present conditions, what little oil a drifter gets when it is under the arms, comes through the hose, as few men will take the time or trouble to loosen the clamps and 'dump over' their machine to permit filling the lubricators. Even to oil through the hose means two trips to the air head, which generally results in the machines running dry most of the time. The under-arm position comes in the last half of the shift, when time is inclined to be short, and lubrication is forgotten as long as the piston moves. It is unnecessary to more than mention the fact that sufficient lubrication is very necessary with the modern high-speed machines.

To comply with the safety regulations, the stopper handles should point down; the end of the handle can be enlarged to form a rest for the driller's hand. If the handle must extend upward, it should be bent to extend over the arm. In this case, the handle length must be somewhat greater than the average width of a man's hand.

The position of the stopper handle leads up to the location of the oil-plugs. At present, the usual place for the plugs is at the end of either the arm or handle. All oil-plugs should be placed in such a position as to allow filling of the lubricators when the stopper is in the running position. This would ensure more frequent oiling. The necessity of having to lay the stopper on its side, or turn it upside down, to fill the oil-cups, does not work toward sufficient machine lubrication.

With some of the new mechanically rotated stoppers, the forward oiling or greasing point is in no sense an oil reservoir. The opening is really nothing but a hole into the machine, and it is valueless as regards lubrication.

Position of Fittings

(4) Some of the self-rotating stopers exhaust at right angles to the machines. Not confining the exhaust to a breeching reduces the back pressure and the tendency to freeze.

The direct exhaust certainly is a mechanical advantage, but on the other hand, it is a handicap to the drill-runner, who must keep his light from being blown out. From the miner's point of view, the exhaust along the feed cylinder is the most satisfactory. However, side exhaust on a self-rotator is not as objectionable as it should be on a 'wiggletail.'

(5) It is possible that it might be more satisfactory to disregard the oil reservoirs on the plugger-drills and go back to the lubricating throttle-valves. This will depend on the capacity of the machine oil-cups and the cost of the valves.

(6) On the drifters, the air and water connections should be on the same side of the back head, and yet not interfere with removing the side-rod. Probably it is better to have the connections on the right (exhaust) side of the machine.

If one connection is made through the rear of the back head, the hose gets in the way of the crank-handle when changing steel. If the hose connections are on opposite sides, they interfere with moving close to the column to drill the center-line holes.

The question of which side both the spuds should be on is somewhat a matter of choice, depending upon the shape of the back of the drift, and whether the operator is right or left-handed. This is the case since the side next to the column, when the machine is over the arm, is the far side when the machine is under the arm. When possible, it is better to collar the top center-line holes on center and swing the lower ones to bring their bottoms on line.

Design of Chuck-Wrenches

(7) It is essential to have a chuck-wrench that fits all of the frequently used nuts and fittings about the drill which are used in rotative operations. Those parts are the nuts on the arm, collar, clamp, and swing bolts. It is also important that the small end of the chuck-wrench should fit the water connection nut, oil-plugs, and the back-head cap. This wrench

should be double-ended and of proper design. The weight of the wrench should be between $5\frac{1}{2}$ and 7 lbs., and it should be strong enough to withstand being used as a hammer. Pounding of the machine should not be tolerated, but the compromise of occasionally hitting the drill-steel seems to be a necessary evil. A chuck-wrench with jaw openings of $1\frac{1}{16}$ and $1\frac{5}{16}$ in. has proved satisfactory in the Copper Queen mines.

If the chuck-wrench had attached to it a short chain with a thin ring over the swing or arm-bolts, it would help increase efficiency when drilling over the arm. The chain must be attached to the wrench by a sliding link; the ring to hang on the bolts should be 2 inches in diameter.

(8) To move the smaller nuts about the drifters, at least one other two-ended wrench will be required. These two will be all that are needed, if the $\frac{1}{2}$ -in. valve-chest and side-rod bolts can be eliminated from a few types of machines. It may be that the miner will have but little need of the smaller wrench, except occasionally to tighten the side-rods of certain types of drills. If it were possible to handle the side-rods with the chuck-wrench it would be a big advantage. Perhaps this can be done by locking the side-rod nut instead of the bolt, and enlarging the bolt-head to fit the small end of the wrench. With some machines, the bolt-head is in too tight a place to permit turning with chuck-wrench. Even then nothing would prevent the use of the enlarged bolt-head, though the small wrench would have to be used on the nuts.

It may be possible to combine the box-wrench with either of the two double wrenches, by placing it between the jaws to be used in withdrawing the steel from the hole.

Bolts and Threads

In the suggestions that follow, all bolts referred to should have U. S. Standard bolt threads. For various bolt dimensions, the table given below lists the thread per inch and the width in inches, across the flats of hexagon and square nuts, according to U. S. Standards.

Diameter of bolt—inches	Threads per inch	Width across flats of hexagon and square nuts, inches—rough	Width across flats of hexagon nuts, inches—finished
$1\frac{1}{8}$	7	$1\frac{13}{16}$	$1\frac{3}{4}$
1	8		
$\frac{7}{8}$	9	$1\frac{7}{16}$	$1\frac{3}{8}$
$\frac{3}{4}$	10	$1\frac{1}{4}$	$1\frac{3}{16}$
$\frac{5}{8}$	11	$1\frac{1}{16}$	1
$\frac{1}{2}$	13	$\frac{7}{8}$	$1\frac{13}{16}$
$\frac{7}{16}$	14	$2\frac{5}{32}$	$2\frac{3}{32}$
$\frac{3}{8}$	16	$1\frac{1}{16}$	$\frac{5}{8}$
$\frac{5}{16}$	18	$1\frac{3}{32}$	$1\frac{7}{32}$
$\frac{1}{4}$	20	$\frac{1}{2}$	$\frac{7}{16}$

BRIGGS PIPE-THREADS

Pipe diameter—inches	Threads per inch
$\frac{3}{8}$	18
$\frac{1}{2}$ and $\frac{3}{4}$	14
1 to 2	11 $\frac{1}{2}$

The taper of threads is $\frac{3}{4}$ inch per foot

As to the shape of nuts used, the square ones are more durable and, when practical, should be adopted as standard. If necessary, the square nut can always be replaced by the hexagon, except in a few cases, such as on the arms, clamp, swing, and a few other bolts.

Water-Hose Connection

The same size water-spud should fit all machines. A standard pipe-thread should be on the machine side of the spud. The connection with the water-hose should be made with parallel threads on account of excessive wear due to frequent breaking of connection. The head on the water-spuds might be round to prevent unnecessary tinkering with it by the machine-man.

The nut to fit the water-spud should be of hexagon shape and $1\frac{1}{4}$ in. across flats. It is very important that this nut should fit the small end of the chuck-wrench.

In practice, the water-spuds seem to wear out long before the nuts. The nut should be made of the softer material as it should be the first to need replacing. The spud, while easier to change, is the more expensive.

Table No. 1 gives some data on the water-spuds and nuts that are now on hand.

TABLE No. 1
I-R SPUDS

Used on	Spud-Head Shape and inches across flats	Pipe- thread—inches	Spud			Parallel threads	Nut across flats—inches
			To machine Taper threads per inch	Threads per inch	Hose end Diameter— inches		
Plugging Stopper Leyner	Round 1 5/8 Hex. 1 1/2 Hex. 1 1/2	1 + 1/2 3/4	1 1/16 1 3/16 1-in. parallel	13 14 (Std.) 14	1 3/16 1 3/16 1 3/16	10 10 10	1 1/2 1 1/2 1 1/2
SULLIVAN SPUDS							
Plugging Stopper	Hex. 1 1/4 Hex. 1 1/4			12 12	1 1	12 12	1 1/4 1 1/4
WAUGH SPUDS							
Plugging Stopper	Hex. 1 1/4			14	1 1/4	12	1 3/8

Each of the six spuds listed above are different in detail. As stated before, it takes three sizes of I.-R. water-spuds to rig out the various types of I.-R. machines alone in use in the Copper Queen mines. Only the Sullivan water-spud nut fits the chuck-wrench. For convenience, the I.-R. has been adopted as standard, but must be machined down or bushed up to fit other makes.

Water-Needle Connection

It is often a hard job to remove the back-head cap with a monkey-wrench. The cap should be hexagon shaped and $1\frac{1}{4}$ in. across flats. This size cap can be handled by the small end of the chuck-wrench. The same size back-head cap and plug should be on the drifters, pluggers, and even the stopers, when the needle is held in place by the cap and plug method. The plugger handle standards should be wide enough to permit the use of the chuck-wrench on the back-head cap.

The head of the back-head plug should be so shaped as to fit the $\frac{3}{8}$ -in. bolt end of the small nut-wrench.

The combined back-head plug and cap is an improvement over the two separate fittings. The threads on the back-head cap and plug need not necessarily be standard ones.

TABLE No. 2
BACK-HEAD CAP AND PLUG DETAILS

Machine	Cap outside		Threads per inch	B. H. gland gasket— inches	To cap		Inches across plug	To machine	
	Across flats— inches	Diameter threads— inches			Diameter— inches	Threads per inch		Diameter— inches	Threads per inch
Clipper	$\frac{7}{8}$ Hex.	$\frac{7}{8}$	14	$\frac{3}{4}$ by $\frac{3}{8}$	No Plug				
{ Waugh Turbro	$1\frac{1}{4}$ Hex.	$\frac{7}{8}$	14		No Plug				
DP 33	$1\frac{7}{16}$			$\frac{3}{4}$ by $\frac{5}{8}$	12	$1\frac{1}{8}$	$\frac{7}{8}$	1	12
Jackhamer	$1\frac{1}{4}$			$\frac{5}{8}$ by $\frac{1}{2}$	12	1	$\frac{5}{8}$	1	12
NRW 93	1	$1\frac{1}{8}$	12	$\frac{7}{8}$ by $\frac{3}{8}$	No Plug				
DX 61	$1\frac{1}{4}$			$\frac{3}{4}$ by $\frac{3}{16}$	10	$\frac{3}{4}$	$1\frac{1}{16}$ sq.	$1\frac{3}{16}$	12
550 D	$1\frac{1}{4}$			$\frac{5}{8}$ by $\frac{1}{2}$	12	1	$\frac{5}{8}$	1	12
13 Leyner	$1\frac{1}{2}$			$\frac{3}{4}$ by $\frac{5}{8}$	10	$1\frac{3}{16}$	$\frac{3}{4}$	$1\frac{3}{16}$	10
148 Leyner	Same as 18 Leyner								

Of the above listed back-head caps those on the Waugh Turbo, DX 61, 550 D, and the Jackhamer, will fit the small end of the chuck-wrench. The B. H. plugs on the 550 D and the Jackhamer could be handled with the $\frac{3}{8}$ -in. bolt-wrench. The 148 and 18 Leyner back-head plugs are the same and those on the 550 D and Jackhamer are alike.

No doubt these important parts can be standardized. Similarly, of the nine water-needle connections examined, those on the 18 and 148 Leyners are the same and those on the 550 D and Jackhamer drill.

Oil-Plugs

One of the features of an ideal oil-plug is that it will not shake loose with the vibration of the machine. The diameter of the plugs should probably be about $\frac{7}{8}$ in. Standard bolt-threads will hardly do for the plugs. Whether the threads should be tapered or parallel, is perhaps a matter not fully determined. The coarse threads seem to have gained more favor here than the fine ones. If the oil-plugs that have the eight parallel threads per inch had a split-lock washer hold between the threads and head they might prove efficient. The leather gaskets cause the plugs to hold, but as they fit tightly when new and are difficult to put in place, it is impossible to get the drill-runners to use them. A lubricator plug that would require only hand tightening would be a big improvement.

One size of oil-plug can be made to do for the drifters, stopers and pluggers.

The lubricator plugs should be handled by the small end of the chuck-wrench.

A hexagon-shaped head $1\frac{1}{4}$ in. across flats would fit the chuck-wrench, and yet take no more room than the plugs now used on the I.-R. drifters. The present form of head with the hole affords a means of strapping the plug to the drill. If the hole is necessary, both the hexagon and present type of head can be combined.

TABLE No. 3
OIL-PLUG DATA

Machine	Plug diameter— inches	Threads per inch	Width of head— inches
DX 61	$\frac{5}{8}$	18—Taper	
Turbro	$\frac{5}{8}$	12—Parallel	
18 Leyner	$\frac{7}{8}$	12—Parallel	$\frac{1}{2}$
550 D	$\frac{7}{8}$	12—Parallel	$\frac{3}{8}$ and $\frac{1}{2}$
148 Leyner	$\frac{7}{8}$	12—Parallel	
CC II	1	14—Parallel	
71	$\frac{5}{8}$	18—Taper (Special Bushing)	
DP 33	$\frac{5}{8}$	18—Taper	
NRW 93	$\frac{5}{8}$	18—Taper	
BCRW 430	$\frac{5}{8}$	12—Parallel	
Clipper	$\frac{5}{8}$	18—Taper	

The above figures show that there are listed three sizes of Ingersoll-Rand plugs. The Sullivan and Waugh reservoir plugs are interchangeable.

Hose Clamp-Bolts

The sizes of the bolts and nuts now furnished with the hose clamps are:

DIXON HOSE CLAMPS

Hose— inches	Bolt— inches	Nut	Nut across flats—inches
1	$\frac{7}{16}$ by 2	Square	$2\frac{3}{32}$ finished
$\frac{3}{4}$	$\frac{3}{8}$ by $1\frac{1}{2}$	Square	$\frac{5}{8}$ finished
$\frac{1}{2}$	$\frac{5}{16}$ by $1\frac{1}{4}$	Square	$1\frac{7}{32}$ finished

SULLIVAN HOSE CLAMPS

Hose— inches	Bolt— inches	Nut	Nut across flats—inches (hex.)
1	$\frac{3}{8}$ by $2\frac{1}{4}$	Hexagon	$1\frac{1}{16}$ rough
$\frac{3}{4}$	$\frac{3}{8}$ by $1\frac{3}{4}$	Square	$1\frac{1}{16}$ rough
$\frac{1}{2}$	$\frac{3}{8}$ by $1\frac{3}{4}$	Square	$1\frac{1}{16}$ rough

With the Sullivan clamps, two lengths of bolts are needed for the three sizes of hose. The Dixon make calls for three different bolts varying in both diameter and length.

The hose-clamps should be so made that one size of bolt will do for the three hoses. When the clamp is in place on the hose, the end of the bolts should not project more than $\frac{1}{8}$ -inch beyond the top of the nut. A bolt that is a little long for the smaller clamps could be easily cut off after being put in place on the hose.

It is recommended that the clamps for 1, $\frac{3}{4}$, and $\frac{1}{2}$ -in. hoses be designed to use $\frac{3}{8}$ by 2-in. bolts with square nuts. If this is done, the hose-clamps, crank, and throttle-bolts will be the same.

Drill-Column

The $3\frac{1}{2}$ -in. drill-column seems to be large enough for any one-man drill. For the drifters, the double-jack column is preferred. The 3-in. mounting would do for the mounted plugger-machines.

The details of the connection between the column-pipe and cross-bar should be standardized.

The $3\frac{1}{2}$ -in. double-jack column is the only one in use in the Copper Queen mines.

$3\frac{1}{2}$ -Inch Column

The jack-screws and nuts should be of some accepted design and size. The details of the jack-screws used in the Copper Queen mines are square threads, with 3 threads per inch, and the diameter of jack-screw of $1\frac{3}{4}$ inches.

The holes in the screw-heads should be not less than 1 inch in diameter.

The cross-bar must be long enough to allow the arm and safety-collar to pass between the jack-screws and column-pipe.

The bolts that clamp the pipe to the cross-bar should be the same size as the safety collar-bolts, that is, $\frac{3}{4}$ by 5 in., with the regular square-shaped nut.

$3\frac{1}{2}$ -Inch Arm

The arm-bolts should be $1\frac{1}{8}$ by $6\frac{1}{4}$ in., with square nuts. The bolts now used on the arm have the regular square head.

$3\frac{1}{2}$ -Inch Clamp

The 5-in. cone should be taken as standard. The bolts now used with the I-R clamps are:

Clamp	$1\frac{1}{8}$ by $6\frac{1}{4}$ in.	Square head	Extra long sq. nut
Clamp	$1\frac{1}{8}$ by 6 in.	Bevel head	Extra long sq. nut
Swing	$\frac{7}{8}$ by 4 in.	Bevel head	Sq. nut $1\frac{1}{4}$ in. across flats
Jaw-bolt	$\frac{5}{8}$ by $3\frac{3}{4}$ in.		$\frac{3}{4}$ hexagon nut

For the sake of standardization, if the bevel head-bolt is sufficiently strong, the arm and clamp-bolts can all be of the bevel-head type— $1\frac{1}{8}$ by $6\frac{1}{4}$ in. The extra long nut is necessary for strength to provide a wide seat for the large end of the chuck-wrench.

The swing-bolt nut now in use is a special nut $1\frac{1}{4}$ in. across the flats, and therefore takes the small end of the chuck-wrench. If the width across the flats of this nut were increased to fit the large end of the wrench, it would no longer require both ends of the wrench to handle the swing and clamp. The thickness of this nut should be between 1 and $1\frac{1}{4}$ inches.

3½-Inch Safety Collar

The safety collar bolts should be $\frac{3}{4}$ by 5 in., and interchangeable with the column cross-bar bolts. The nuts should probably be the standard square ones. A larger nut to fit the big end of the chuck-wrench would mean another special, and would necessitate a shoulder on the collar casting; otherwise it would be an improvement.

Drifter Cradle

Some standard shape regarding depth, width, length, and distance between standard rod centers, guide-slide dimensions, etc., should be adopted. It is possible that there should be two standard shells—the narrower and lighter one being used with the smaller machines.

The adjustable guide-slide, with 'shims' to take care of wear, offers advantages. Instead of having the caps bolted on, would it not be better to replace the bolts with rivets?

The ends of the shell need to be reversible as regards the position of the crank.

Table No. 4 gives some information regarding a few of the shell castings now in use.

TABLE No. 4

Cradle	Total length line between casting— inches	Center of shell standard rods— inches	Inches between outside of guide-slides	Guide slide dimensions— inches	Type of screw support	From shell bottom to center of feed-screw— inches	Total length of feed-screw support— inches	Size of forward screw support bolt (inches) and type of nut	Reversible
Waugh Plugger	26 $\frac{1}{4}$	3 $\frac{5}{8}$	3 $\frac{7}{8}$	$\frac{3}{8}$ by 1 $\frac{1}{16}$	Vertical	1 $\frac{1}{8}$	3 $\frac{1}{8}$	$\frac{3}{4}$ Hexagon	No
Waugh Clipper	26 $\frac{1}{4}$	3 $\frac{5}{8}$	3 $\frac{7}{8}$	$\frac{3}{8}$ by 1 $\frac{1}{16}$	Vertical	1 $\frac{1}{8}$	3 $\frac{1}{8}$	$\frac{3}{4}$ Hexagon	No
Jackthamer	30 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{3}{8}$	$\frac{7}{16}$ by $\frac{9}{16}$	Horizontal	1 $\frac{1}{4}$		$\frac{5}{8}$ by 2 $\frac{1}{2}$ Hexagon	No
DX 61	26	3 $\frac{13}{16}$	4 $\frac{9}{16}$	$\frac{9}{16}$ by 1	Vertical	1 $\frac{1}{4}$	3 $\frac{5}{16}$	$\frac{5}{8}$ Hexagon	Yes
Waugh Turbro	26 $\frac{1}{4}$	4 $\frac{1}{2}$	4 $\frac{1}{2}$	$\frac{1}{2}$ by $\frac{3}{4}$	Vertical	1 $\frac{1}{4}$	3 $\frac{1}{8}$	$\frac{3}{4}$ Hexagon	Yes
18 Leyner	27 $\frac{3}{4}$	4 $\frac{1}{4}$	4 $\frac{3}{4}$	$\frac{1}{2}$ by 1	Vertical	1 $\frac{1}{4}$	3 $\frac{1}{4}$	$\frac{5}{8}$ Hexagon	Yes
248 Leyner	27 $\frac{3}{4}$	4 $\frac{1}{4}$	4 $\frac{3}{4}$	$\frac{1}{2}$ by 1	Vertical	1 $\frac{1}{4}$	3 $\frac{1}{4}$	$\frac{5}{8}$ Hexagon	No
550 D	27 $\frac{1}{4}$	4 $\frac{1}{4}$	3 $\frac{7}{8}$	$\frac{1}{2}$ by $\frac{3}{4}$	Horizontal	1 $\frac{1}{4}$		$\frac{5}{8}$ by 1 $\frac{3}{4}$ Square	No
148 T-cyner	27 $\frac{1}{4}$	4 $\frac{1}{4}$	3 $\frac{7}{8}$	$\frac{1}{2}$ by $\frac{3}{4}$	Horizontal	1 $\frac{1}{4}$		$\frac{5}{8}$ by 1 $\frac{3}{4}$ Square	No

The above data shows that the shell castings of the Waugh Plugger and Clipper, the 18 and 248 Leyners, and the 550 D and 148 Leyners are the same. In the nine shell castings examined, there are six different ones.

Standard Rods

There probably should be two standard lengths of cradle standard rods. The length of rod will vary with the length of steel change. The diameter of the standard rods should be $\frac{5}{8}$ in.; square hexagon nuts should be on the cross-head end.

If the side and cradle standard rods can be made, to some extent, interchangeable, the standard rods should be threaded on one end; if not interchangeable, the standard rods should be threaded on both ends.

If the standard rods are to be made interchangeable, they should be of the same material and given the same treatment in manufacturing as the side-rods. The advantage of having these two parts the same is that it makes one less rod to order and carry in stock.

Table No. 5 gives some data pertaining to the standard rods on several makes of cradles.

The above figures show no reason why the standard rods cannot be easily standardized. With the exception of the DX 61 cradle, the maximum difference in length of the standards is 5 in. The DX 61 rod extends along the entire length of the shell casting.

Feed-Screws

The details of the feed-screw such as the diameter, pitch, depth, and type of threads, diameter of the shafting at the forward and cross-head support, and diameter and pitch of the threads at the crank connection, should all be standardized. There must be about three standard lengths to correspond with the lengths of shell standard rods.

In regard to the kind of threads, both the V and square type have their advantages. Either form could be accepted as standard. The square threads check more easily and therefore develop less vibration on the crank-handle. However, the square threads finally wear to the V shape and are more easily stripped.

The double-threaded screw, with two threads per inch, seems to be in general use. Table No. 6 shows the diameter of the feed-screw threads in the nine cradles examined to vary between 1 and $1\frac{1}{2}$ inches.

The above figures show that in examining the nine feed-screws listed, there are two types of threads, three different diameters of screws, three depths of threads, six lengths, five different sizes of shafting at the forward support, and two different pitches of threads at the crank connection. In all nine sizes, the diameters of the shaft at the cross-head bearing and crank connection are 1 inch. With the exception of the Ingersoll-Rand plugger cradle screw, all the others are nearly the same in detail. There are six different feed-screws out of a total of nine.

All the figures given in Table No. 6 may not be exactly correct, as some of the parts measured were not new, and wear may have developed.

It is recommended, as mentioned before, that there be three standard lengths of feed-screws and that the type, pitch, and depth of threads be also standardized. The diameter of the front support shafting should be fixed between $\frac{5}{8}$ and $\frac{3}{4}$ in. The specifications should call for the feed-screw shaft to be 1 inch diameter at the cross-head and at the crank connection. The threads to the crank should be the standard U. S. bolt threads, which are eight per inch.

Forward Feed-Screw Support

Either the horizontal or vertical type can be accepted as the standard form of support. It should be made according to the assumed standard specifications regarding size of bolts, shape of nuts, total length, and height of bearing above the shell bottom. Table No. 4 gives some information of these details. Of the nine cradles examined, there are six supports that differ slightly in construction.

Regardless of which type of support is taken as the standard form, the bearing for the feed-screw shaft should be open at both ends. The bolts needed to hold the support to the shell casting should be $\frac{5}{8}$ in. diameter, with square nuts.

If this fitting is necessary, it might be an improvement if it were riveted instead of bolted to the shell. At the Copper Queen mines, this part of the cradle does not last very long, as it is taken off by the drill-runner during the first shift.

Cross-Head

The cross-head should be made according to some accepted standard regarding thickness, diameter of bearing for feed-screw shaft, and distance between holes for standard rods.

Crank, Crank and Throttle-Handle Bolts

The actual shape of the crank and handle makes but little difference.

The threads to fit the 1-inch feed-screw shafting should be the standard of eight per inch. The feed-screw connection should be open at both ends.

Table No. 7 gives some data on the types and sizes of crank and throttle bolts now in use.

This table shows that each drill manufacturer uses a different size of crank-bolt; out of eight throttle-handle bolts, three are alike.

From the above table, it looks as if the throttle handle and crank-bolt could be standardized and made interchangeable. While the heavier crank-bolts with the special threaded heads may have their advantages, yet the $\frac{3}{8}$ -in. bolt on the Waugh Turbro crank seems to answer all purposes. It is suggested that the standard throttle and crank-bolt should be $\frac{3}{8}$ by 2 in., with square-shaped nuts.

Plugger-Cradle

If the plugger machine is the regular form of shell plus a mounting slide, the cradle itself should coincide with one of the standard drifter cradles. The diameter of the bolts that help to form the forward and rear mounting slide clamps, should be $\frac{5}{8}$ inch.

If the plugger-cradle is of the slide-extension type, the feed-screw should be the shortest adopted length of the standard feed-screw. The forward and rear clamp-bolts should be the same size ($\frac{5}{8}$ -in. diam.), as the corresponding bolts on the

TABLE NO. 7

Cradle	Crank Bolt		Machine	Throttle-Bolt		Shape and size of inches, of throttle-valve stem
	Size, inches	Shape of nut		Size, inches	Shape of nut	
Waugh Plugger.....	$\frac{1}{2}$ by $1\frac{1}{4}$	Square				
Waugh Clipper.....	$\frac{1}{2}$ by $1\frac{1}{4}$	Square				
Jackhammer.....	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }				
DX 61.....	$\frac{1}{2}$ by 2 $\frac{1}{2}$	Hexagon	DX 61	$\frac{1}{16}$ by $1\frac{1}{2}$	Hexagon	$1\frac{1}{16}$ round
Waugh Turbo.....	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }	Waugh Turbo	$\frac{3}{8}$ by $1\frac{3}{4}$	Hexagon	$\frac{1}{2}$ square
18 Leyner.....	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }	18 Leyner	$\frac{3}{8}$ by $1\frac{1}{2}$	Hexagon	$\frac{1}{2}$ Square
248 Leyner	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }				
550 D.....	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }	550 D	$\frac{1}{2}$ by $1\frac{1}{2}$	Hexagon	$\frac{1}{2}$ square
148 Leyner.....	$\frac{1}{2}$ by $1\frac{1}{4}$	{ Special threaded head }	148 Leyner	$\frac{1}{2}$ by $1\frac{1}{2}$	Hexagon	$\frac{1}{2}$ square
			71 Waugh stoper 16 "V" Waugh CC 11 I-R Stoper	$\frac{1}{16}$ by 2 $\frac{1}{4}$ by 2 (cotter key $\frac{1}{16}$ by 2)	Hexagon Hexagon	1 round 1 round $\frac{1}{2}$ square

other type of plugger machine cradle. The slide-bolt should be the standard $\frac{3}{4}$ -in. bolt with a square nut.

It would make one less part to order, if the $\frac{3}{4}$ -in. slide and safety collar-bolts were of the same length. At present the slide-bolt is $2\frac{1}{2}$ in. the longer.

Table No. 8 shows some figures pertaining to the plugger-cradles.

The above figures show that three out of four sets of mounting clamps require different sizes of bolts. The Jackhammer system of mounting is probably the best, only the eye-bolt should be replaced by one with a regular head. It is possible that by slightly widening the crank end of the Jackhammer shell casting, the need of a cut head-bolt for the cross-head can be avoided. The size of the cross-head and mounting slide forward clamp-bolts can probably be the same ($\frac{5}{8}$ by about $2\frac{1}{2}$ to 3 in.), though this is a matter of small importance. The size of the rear clamp-bolt can probably be standardized at $\frac{5}{8}$ by 5 to 6 inches.

The nuts for the $\frac{5}{8}$ -in. cross-head bolts should be the regular square ones. The $\frac{5}{8}$ -in. mounting slide clamp-bolts must have special square nuts $1\frac{1}{4}$ in. across flats, as are provided with the I.-R. cradle. The special nut fits the small end of the chuck-wrench.

The details of the feed nut on the plugger-cradles should be the same as on the larger drifters.

Summary

An observation of Table No. 9, which is a combination of Tables No. 4, 5, 6, 7, and 8, shows that of the nine cradles listed, six are unlike. The cradles listed include the types that are required to mount practically all classes of rock-drills. By close standardization, the number of different cradles could be decreased to three, and probably two. The length of steel change, except with the I.-R. plugger-cradle, can be varied by using either of the two lengths of standard feed-screws.

It would be impossible to attempt to standardize the shape of the clamp-straps that hold the pluggers to the mounting slide.

TABLE NO. 8

	CROSS-HEAD BOLT		SLIDE-BOLTS NUT		FORWARD CLAMP-BOLT NUT			REAR CLAMP-BOLT NUT		
	Bolt size, inches	Nut	Bolt size, inches	Inches across flats	Bolt Size, inches	Shape	Inches across flats	Bolt size, inches	Shape	Inches across flats
Pluggor Cradle										
Wough.....					$\frac{1}{2}$ by $6\frac{1}{2}$	Hex.	Reg.	$\frac{1}{2}$ by $4\frac{1}{4}$	Hex.	Regular.
Pluggor.....					("T" head)			(Special)		Regular.
Wough.....					$\frac{1}{2}$ by 4	Hex.	Reg.	$\frac{1}{2}$ by $3\frac{1}{2}$	Hex.	Regular.
Clipper.....										
Jackhamer.....	$\frac{1}{2}$ by $2\frac{1}{2}$	Hex.	$\frac{1}{4}$ by $7\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{2}$ by $2\frac{1}{4}$	Hex.	Reg.	$\frac{1}{2}$ by 5	Hex.	Regular.
	(Special head)				(Eye head)					
Jackhamer.....	$\frac{1}{2}$ by $2\frac{1}{2}$	Hex.	$\frac{1}{4}$ by $7\frac{1}{2}$	$1\frac{1}{4}$	$\frac{1}{2}$ by $2\frac{1}{4}$	Hex.	$1\frac{1}{4}$	$\frac{1}{2}$ by 5	Sq.	$1\frac{1}{4}$ special
	(Special head)				(Eye head)					

MACHINES

Machine Side-Rods

Table No. 10 gives some data regarding the side-rods on various machines.

This table shows that practically all the drifter and stoper side-rods are $\frac{5}{8}$ -in. bolts. The plugger machines have the $1\frac{1}{2}$ -in. side-rods.

It is thought that perhaps the bolts on the class of rock-drills considered in this paper can be limited in diameter to $\frac{5}{8}$ and $\frac{3}{8}$ -inch. Is it practical to put $\frac{5}{8}$ or $\frac{3}{8}$ -in. side-rods on the plugger drills?

From the figures in Table No. 10 it appears as if it would be possible to do some work in standardizing the side-rod bolts. In the list are included machines with rifle-bar, front-head, and turbine rotation. The smaller plugger side-rods are practically the same in all respects. There is little difference given between the lengths of the rods on the various drifters and stopers that have through side-rods.

A part standardization of the side-rod bolts would not affect the design of the drill to any extent. It would be possible, in many cases, to vary slightly the length of the spring as well as the position of the retaining lugs on the front-head forging. As mentioned before, the most commonly used length of side and standard rods could be more interchangeable. The nuts on the side-rods must be hexagon shaped.

Exhaust

The threads on the valve exhaust-port should be the $\frac{3}{4}$ -in. standard pipe-thread.

Valve-Chest

In Table No. 11 is given some data pertaining to the valve-chest bolts. (See page 755.)

TABLE NO. 9

Cradle	CRANK-BOLT		FORWARD CLAMP-BOLT NUT		REAR CLAMP-BOLT NUT			
	Size, inches	Shape of nut	Bolt inches	Shape	inches, across flats	Bolt, inches	Shape	inches, across flats
Waugh Plugger.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Square	$\frac{1}{2}$ by 6 $\frac{3}{4}$ (T, head)	Hex.	Reg.	$\frac{1}{2}$ by 4 $\frac{3}{4}$ (Special)	Hex.	Regular.
Waugh Clipper.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Square	$\frac{1}{2}$ by 4	Hex.	Reg.	$\frac{1}{2}$ by 8 $\frac{1}{2}$	Hex.	Regular.
Jackhammer.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Hexagon (Threaded head)	$\frac{3}{8}$ by 2 $\frac{3}{4}$ (Eye bolt)	Hex.-Sq.	Reg. & 1 $\frac{1}{4}$	$\frac{3}{8}$ by 5 or 6	Hex. & Sq.	Reg. 1 $\frac{1}{4}$
DX 61.....	$\frac{1}{2}$ by 2 $\frac{1}{2}$	Hexagon						
Waugh Turbo.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Square						Same
18 Leyner.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Hexagon (Threaded head)						
248 Leyner.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Hexagon (Threaded head)						Same
550 D.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Hexagon (Threaded head)						
148 Leyner.....	$\frac{1}{2}$ by 1 $\frac{1}{2}$	Hexagon (Threaded head)						Same

TABLE NO. 9—(Continued)

		FEED-SCREW										
Cradle	Shape of double threads	Approx. Dia. of feed-screw, inches	Approx. Depth of feed-threads, inches	Total length of feed-screw, ft. in.	Dia. of screw support shafting, inches	Dia. of cross-head support, inches	Crank Dia. of threads, inches	Connection Threads per inch	Size of bolt, inches	Standard Rods Type of nuts	Remarks	
Waugh Plugger.....	Square	1½	¾	3-3	¾	1	1	12	¾ by 17	Hex.	{Threads on both ends; nut on one end.	
Waugh Clipper.....	Square	1½	¾	3-3	¾	1	1	12	¾ by 17	Hex.	{No standard rods. Nuts on both ends. Threads on both ends nut on one end.	
Jackhammer	Square	1	½	2-10½	1½	1	1	8	¾ by 17	Hex.		
DX 61.....	Square	1½	¾	3-8½	1½	1	1	8	¾ by 44½	Hex.	{Threads on both ends. Threads on both ends nut on one end.	
Waugh Turbro.....	Square	1½	¾	3-6½	¾	1	1	12	¾ by 20	Hex.		
18 Leyner	Square	1½	¾	3-7½	¾	1	1	8	¾ by 22	Hex.	{Nuts both ends.	
248 Leyner.....	Square	1½	¾	3-7½	¾	1	1	8	¾ by 22	Hex.	{Nuts both ends.	
550 D.....	"V"	1½	¾	3-9	¾	1	1	8	¾ by 22	Hex.	{Nuts both ends.	
148 Leyner.....	"V"	1½	¾	3-9	¾	1	1	8	¾ by 22	Hex.	{Nuts both ends.	

SHELL CASTING

Cradle	Total Length of shell casting inches	Center line between standard rods, inches	Inches between outside of guide-slides	Guide-slide dimensions, inches	Type of screw support	From Shell bottom to center of feed-screw inches	Total Length of screw support inches	Size of Screw support inches, type of nut	Reversible
Waugh Plugger..	26 1/2	3 3/8	3 3/8	3/8 by 1 1/16	Vert. open	1 1/8	3 3/8	3/4, Hex. No	Same
Waugh Clipper..	26 1/2	3 3/8	3 3/8	3/8 by 1 1/16	Vert. open	1 1/8	3 3/8	3/4, Hex. No	Same
Jackhammer.....	30 1/4	3 3/8	3 3/8	3/16 by 3/16	Horiz. open	1 1/4	3 1/16	3/8 by 2 1/2 Hex. Yes	} Yes
DX 61.....	26	3 1/16	4 7/16	3/16 by 1	Vert. open	1 1/4	3 3/16	3/8, Hex. Yes	
Waugh Turbo.....	26 1/2	4 1/4	4 1/2	1/2 by 3/4	Vert. open	1 1/4	3 3/8	3/4, Hex. Yes	
18 Leyner.....	27 3/4	4 1/4	4 3/4	1/2 by 1	Vert. open	1 1/4	3 3/8	3/8, Hex. No	
248 Leyner.....	27 3/4	4 1/4	4 3/4	1/2 by 1	Vert. open	1 1/4	3 3/8	3/8, Hex. No	} Same
550 D.....	27 1/2	4 1/4	3 3/8	1/2 by 3/4	Horiz. open	1 1/4	3 3/8	% by 1 3/4 Sq. No	
148 Leyner.....	27 1/2	4 1/4	3 3/8	1/2 by 3/4	Horiz. open	1 1/4	3 3/8	% by 1 3/4 Sq. No	No

TABLE NO. 10

Machine	Side Rod Size—Inches	Nut	Remarks
DRIFTERS:			
DX 61.....	7 1/2 and 11 1/2	Hexagon	Threads on both ends; nut on one.
Waugh Turbo.....	% by 18 3/4	Hexagon	Threads on one end; head on other.
W Dreadnaught.....	% by 23 1/2	Hexagon	Special head.
18 Leyner.....	% by 25	Hexagon	Head 1 in. square; three on one end.
550 D.....	% by 17 1/4	Hexagon	Head on one end.
148 Leyner.....	% by 21 1/4	Hexagon	Head on one end.
STOPERS:			
16 V.....	3/4 by 13		Hollow rods.
CC 11.....	% by 17 1/2		Special head.
CC 11.....	% by 7 1/4 and 9	Hexagon	Head 1 in. hex. on one end.
71 Waugh.....	% by 17 3/4		Hollow rod.
DT 42 and 44.....	3/4 by 18		Threads on both ends.
PLUGGERS:			
DP 33.....	1/2 by 13 1/2	Hexagon	Threads on both ends.
NRW 93.....	1/2 by 12 1/4	Hexagon	
BCRW 430.....	1/2 by 13 3/4	Hexagon	
Waugh Clipper.....	1/2 by 18	Hexagon	Special head.

If the $\frac{1}{2}$ -in bolts are to be eliminated, the valve and motor-chest bolts will have to be $\frac{5}{8}$ and $\frac{3}{8}$ in. No standardization of these parts other than of the bolt diameter can be attempted. The special shaped bolt-heads should be avoided.

In the case of the 18 Leyner the valve-chest stud-bolts often turn when the nuts are moved. It would perhaps be an improvement if the valve-chest casting were slightly increased in width, and the $\frac{1}{2}$ -in. bolts replaced by $\frac{5}{8}$ -in. size.

Feed-Nut and Parts

The feed-nut washer and lock-nut should be of the design and size that was accepted as standard.

The following table lists some of the feed-nut details:

Machine	Total length, inches	Hexagon lock-nut across flats—inches
Waugh plugger.....	4	$1\frac{3}{4}$
Waugh clipper.....	4	$1\frac{3}{4}$
Jackhamer	$4\frac{1}{2}$	2
DX 61.....	$4\frac{1}{2}$	$1\frac{13}{16}$
Waugh turbro.....	4	$1\frac{3}{4}$
18 Leyner.....	$4\frac{3}{4}$	2
550 D.....	$4\frac{3}{4}$	2
148 Leyner.....	$4\frac{1}{2}$	2

It would be a slight advantage if the lock-nut were about $1\frac{13}{16}$ in. across flats. It would then fit the large end of the chuck-wrench.

On the I.-R. 550 D it is important that the needle-valve bushing and lock-nut can be handled by either the $\frac{5}{8}$ or $\frac{3}{8}$ -in. wrench. The details of the bushing and nut are:

Part	Size, inches	Threads per inch	Heads across flats—inches
Valve bushing.....	$1\frac{1}{16}$ by 1	14	$\frac{7}{8}$
Lock-nut.....		14	$1\frac{1}{4}$

As they are now made, the head on the valve bushing is too large for the $\frac{3}{8}$ -in. bolt-wrench, and the lock-nut head is $\frac{1}{16}$ -in. too large for the $\frac{5}{8}$ -in. wrench.

Plugger Handle-Bolts

On page 756 are a few figures regarding the plugger handle-bolts.

TABLE NO. 11

Machine	Valve-chest Bolt		Motor-chest Bolt		Remarks
	Size, inches	Nut	Size, Inches	Nut	
DX 61.....	None		$\frac{3}{8}$ by $3\frac{1}{2}$	Hexagon	Special head.
Waugh Turbo.....		Hexagon			
18 Leyner.....	$\frac{1}{2}$ by 5	Hexagon	$\frac{3}{16}$ by $3\frac{1}{2}$	Hexagon	Special head.
550 D.....	$\frac{1}{2}$ by 3	Hexagon			
148 Leyner.....		Special valve-spindle			
CC 11.....	$\frac{1}{2}$ by $2\frac{1}{2}$	Hexagon			
DP 33.....	$\frac{1}{2}$ by $5\frac{1}{2}$	Hexagon			
NRW 93.....	$\frac{3}{8}$ by $2\frac{1}{2}$	Hexagon			
BCRW 430.....	$\frac{3}{8}$ by $2\frac{3}{4}$ and $1\frac{1}{8}$	Hexagon			
Clipper.....	None				

TABLE NO. 13

Machine	Bolt, inches	Nut
DP 33.....	$\frac{1}{2}$ by $13\frac{1}{2}$	Hexagon
NRW 93.....	$\frac{1}{2}$ by $13\frac{1}{2}$	Square
BCRW 430.....	$\frac{3}{4}$ by $12\frac{1}{2}$	Square
Clipper	$\frac{1}{2}$ by 15	Square

The diameter of the handle-bolt can probably be increased to $\frac{5}{8}$ -in. It looks as if a bolt $\frac{5}{8}$ by about $11\frac{1}{4}$ -in. could be taken as the standard. The nut should be square.

Air Connections

It is a matter of choice between the bent nipple and pipe fitting connection. The bent nipple is neater, and it probably offers less resistance to the air than does the same size connection made up of pipe fittings. The sharper the curvature of the nipple, the less room will be taken up by the fitting.

The size of the air connections will depend on the air consumption of the machine. The two standard sizes should perhaps be $\frac{1}{2}$ and $\frac{3}{4}$ -inch.

The air-swivel connection nut, or bushing, can probably be made one standard size to serve both, the $\frac{1}{2}$ and $\frac{3}{4}$ -in. fittings. The head of the swivel-nut should fit either the large or small end of the chuck-wrench. The shape of the head should be hexagon, with $1\frac{13}{16}$ or $\frac{1}{4}$ -in. across flats.

There does not seem to be any reason why the threads on the swivel-nut cannot be made to correspond with standard pipe-threads. There is some doubt about the advisability of standard pipe-threads when the cylinder is a casting. Standard pipe-threads for the air connections are now used on many of the plugger and stoper-drills.

Parallel threads will have to be used on the hose nut end of the air-spud. No bushing should be needed to fasten the spud to the nipple or pipe fittings that lead to the drill. The hexagon head on the air-spud should be $1\frac{13}{16}$ -in. across flats to fit the large end of the chuck-wrench.

The air-connection nut should be either of the lugged or hexagon type, and be of such size as to permit turning by the chuck-wrench if necessary.

The inside diameter of the hose should approach the size of the hose as nearly as possible.

Table No. 14 lists more information on the details of the air-swivel nut and air-hose spud.

This table shows that the swivel-nuts are interchangeable between the DT 42 and DT 44, also between the Waugh Turbo and 71 Drills. The Clipper, CC 11, NRW 93, and DP 33 require only the standard $\frac{3}{4}$ -in. pipe nipple to connect the air to the machine. None of the swivel-nut heads make an exact fit with the chuck-wrench.

The six air-hose spuds listed are all different. None of the spud-heads are the exact size to fit the large end of the chuck-wrench. That the I.-R. spud has not taper threads to the nut is the only difference between it and Briggs standard $1\frac{1}{2}$ -in. pipe fitting. Parallel threads are necessary on account of excessive wear from frequent use.

Air-Filter

The form of air-filter is a matter of choice. In some of the T-shaped types it is too easy a matter to remove the screen. The T filter with a plug promotes oiling through the hose.

The I.-R. air-filter No. 27631 could be improved by adding a small lug to the casting to prevent the screen from dropping out of place. There are other types of filters which do not require a screen of special shape.

There are a few miscellaneous bolts, nuts, bushings, etc., that, for the sake of uniformity, should be made to fit one of the wrenches on hand.

The stoper-handle nut, to fit the chuck-wrench, needs to be $1\frac{1}{4}$ -in. across flats. The handle nut on the CC 11, 16 V, DT 42, DT 44, and Waugh 71 is the proper size.

Some of the stopers require chuck retaining bolts. The chuck-bolt details on a few of the machines are as follows:

Machine	Size of bolt, inches	Nut	Remarks
Waugh 71.....	$\frac{3}{4}$ by $5\frac{1}{4}$	Hexagon	Nuts on both ends.
16V.....	$\frac{3}{4}$ by 4	Hexagon	
CC 11.....	$\frac{3}{4}$ by $5\frac{1}{2}$	Hexagon	

It appears as if the same size of bolt, with a square nut, can be used for the safety collar and chuck.

TABLE NO. 14

		Swivel-Nut or Bushing					
		Shape and diameter across flats, inches	Threads per inch	Diameter inches	Fitting to machine from hose, size, inches		
DRIFTERS:							
DX 61.....	Hexagon	1 ¹ / ₁₆	14	1 1/2	3/4 Nipple		
Turbo.....	Hexagon	2 ¹ / ₄	16	2	3/4 Pipe (Same as 71)		
18 Leyner.....	Hexagon	1 ³ / ₄	14	1 1/2	1/2 Nipple		
150 D.....	Hexagon	1 ¹¹ / ₁₆	14	1 1/2	3/4 Nipple		
548 Leyner.....	Round	2	12	1 1/8	3/4 Nipple		
STOPPERS:							
CC 11.....	Hexagon	2 ¹ / ₄	16	2	3/4 Nipple		
71.....	Hexagon	2 ¹ / ₄	16	2	3/4 Pipe (Same as Turbo)		
Dt 42 and 44.....	Hexagon	1 ¹ / ₁₆	14	1 3/4	3/4 Nipple		
PLUGGERS:							
DP 33.....	Hexagon	1 ¹ / ₁₆	14	1	3/4 S. Nipple		
NRW 98.....	Hexagon	1 1/2	11	1 1/16	3/4 Nipple Lock-nut		
DCRW 430.....	Hexagon		11		Special thread.		
Clipper.....			11		3/4 Nipple		
						Air-hose spud	
		Hose, Inches	Diameter, Inches	To Nut Threads per inch	Inches across head.		
I-R.....		1, 3/4, 1/2	1 1/16	11 1/2	2		
Waugh.....		3/4	1 1/2	8	1 3/4		
Sullivan.....		1	1 11/16	9	1 1/16		
Sullivan.....		3/4	1 1/2	12	1 1/16		

The cradle clamp-bolts on the Waugh Turbro drill are:

Rear clamp-bolt, $\frac{5}{8}$ by $6\frac{3}{4}$ in., hexagon nut on both ends.
 Front clamp-bolt, $\frac{5}{8}$ by $5\frac{1}{4}$ in., head on one end.

On the 148 and 248 Leyners the valve-head bolt-nut is hexagon in shape and $1\frac{13}{16}$ in. across flats. It fits the large end of the chuck-wrench.

Throttle-Valve Handle

No attempt has been made to standardize the details of the throttle-handle. At present, few of the handles are interchangeable. Table No. 7 calls attention to the varying shape of valve-stems.

Water-Valve

The standard make of $\frac{3}{8}$ -in. brass needle-valve costs materially less than the rock-drill manufacturers' valve. The standard brass valve gives just as satisfactory service as the more expensive product. The threads on the steel valve rust quickly. The valve-stem cap should be $1\frac{1}{4}$ in. across flats, as it is on most of the valves in use in the Copper Queen mines.

If it were not for pipe-scale getting in the valve-seat, it would be an improvement to have the hose-stems fixed to the valve. This would prevent the miner from disconnecting the water-hose at the valve. The hose-stem made out of $\frac{3}{8}$ -in. pipe-nippel is more satisfactory than the more expensive stem with the shoulders. The shoulders too readily permit the use of a wrench to break the water connection at the valve instead of at the spud. The "goose-neck" and valve should at all times stay on the hose, and not on the rock-drill.

The most satisfactory form of water-valve handle would be the one-ended lever shape; that is, similar to the shape of the throttle-valve handle. The cross-bar and wheel forms of handle are too easily caught when dragging the hose.

Conclusions

To standardize drilling machines it is essential that the manufacturers adopt the same specifications in making the fittings used on rock-drills. As nearly as possible the spuds, air-swivel nut, back-head cap, back-head plug, oil-plugs, etc., should be interchangeable between the drifters, stopers, and

plugger-drills. Special threads, bolts, and nuts should be avoided except where they are absolutely necessary. As few sizes of bolts, nuts, and bushings should be used as is practical. Not more than two sizes of guide-shells should be standardized. There should be three lengths of feed-screw, and two lengths of standard rods.

It is important that all bolt-nuts, bushings, and spud-heads subject to severe usage should fit the chuck-wrench. The most important fittings to be handled by the large end of the chuck-wrench are the square nuts on the arm, clamp, and swing-bolts. It is also necessary that the large end of the wrench fit the head of the air-swivel nut, air-spud, and valve-head nut.

Among the parts for the small end of the chuck-wrench to take care of, are the water-connection nut, back-head cap, safety-collar nuts, oil-plugs, water-valve cap, and perhaps the side-rod bolt-head, the slide and clamp-nuts on the plugger-cradle.

To handle the smaller nuts about the machine one other two-ended wrench will be required. If $\frac{1}{2}$ -in. bolts are necessary to the drill construction, this smaller wrench can be made three-ended. In designing this wrench it must be remembered that one end, probably the $\frac{3}{8}$ -in bolt end, will have to be so placed as to allow its handling the back-head plug.

To eliminate the monkey-wrench, a box-wrench will be needed to take care of the drill-steel. This wrench can probably be placed between the jaws of one of the regular wrenches.

In this discussion it has been suggested that to reduce the number of size of bolts, nuts, etc., the parts listed below might be made as follows:

- Size of bolt, $\frac{3}{4}$ by 5 in., square nut;
- Column cross-bar bolts;
- Safety-collar bolts;
- Stoper chuck retaining-bolts;
- Size of bolt, $1\frac{1}{8}$ by $6\frac{1}{4}$ in., possibly bevel head, special nuts;
- Arm-bolts;
- Special square nut for the $\frac{7}{8}$ -in. swing-bolt to be the same distance across flats as arm and clamp-bolts;
- Size of bolt, $\frac{3}{8}$ by 2 in., square nut;
- Throttle handle bolt;
- Crank-bolt;
- 1 in., $\frac{3}{4}$ in., and $\frac{1}{2}$ in. clamp-bolts;
- Size of bolt, $\frac{5}{8}$ by 1 in., hexagon nut;
- Cradle standard rods; and
- Machine side-rods.

On the Ingersoll-Rand cradle, it may be possible to use the same size of bolts for the mounting slide-clamps, cross-head, and feed-screw support.

Having the use of two wrenches, one a chuck-wrench with $1\frac{15}{16}$ and $1\frac{1}{16}$ -in. jaw openings, the other a lighter weight double ended $\frac{3}{8}$ and $\frac{5}{8}$ -in. bolt-wrench, the sizes of bolts, nuts, etc., in Tables 15 and 16 have been suggested.

Drill-Steel

All the drill-steel used in the Copper Queen mines pass through a centrally located surface shop, which is within a few feet of one of the principal shafts. With the exception of the drill-steel used in that division of the mine, it all has to be transferred daily each way by auto-truck between the mines and the sharpening shop. The drill-steel is handled between the shaft-collar and the underground tool-racks by the mine tool nippers.

There are now in use in the Copper Queen mines four different kinds of drill-steel. Among the disadvantages of not having one standard form of drill-steel are:

(1) To permit proper distribution with the various kinds of steel in use, it is necessary that careful sorting and counting be done by both the mine and shop nippers.

(2) The use of several kinds of steel places more labor and responsibility upon the underground tool nippers.

(3) With several kinds of steel in the rack, it is necessary that the drill-runner should be more careful in his selection of the steel for the shift's work. If there were but one kind of steel in use in the mine, the drill-man would have a larger supply from which to choose.

(4) With various kinds of steel to be sharpened, the shop loses more time in frequently having to change dies, dollies, blocks, and formers. The additional supply of tools required means more expense. In the shop it is not only necessary to sort out the various lengths, but the different sizes of steel as well. When different sizes of drill-steel are in use, the lengths of starters, size of bits, and length of change are likely to be different for the various steels.

TABLE NO. 15

Part	Bolt, inches	Nut shape	Nut across flats, inches	Wrench
Air-spud nut.....		Hexagon or lugged		L chuck.
Air-spud head.....		Hexagon	1 $\frac{1}{16}$	L chuck.
Air-swivel nut.....		Hexagon	1 $\frac{1}{4}$ or 1 $\frac{3}{16}$	S or L chuck.
Arm-bolts.....	1 $\frac{1}{2}$ by 6 $\frac{1}{4}$	Square	1 $\frac{3}{16}$	L chuck, (Bevel- head bolt, extra long nut)
Back-head cap.....		Hexagon	1 $\frac{1}{4}$	S chuck
Back-head plug.....			$\frac{5}{8}$	%
Clamp-bolts.....	1 $\frac{1}{2}$ by 6 $\frac{1}{4}$	Square	1 $\frac{3}{16}$	L chuck (Bevel head, extra long nut)
Clamp jaw-bolt.....	$\frac{5}{8}$ by 3 $\frac{3}{4}$	Square	1 $\frac{1}{16}$	$\frac{5}{8}$
Column cross-bar bars.....	$\frac{3}{4}$ by 5	Square	1 $\frac{1}{4}$	S chuck.
Crank-bolt.....	$\frac{3}{8}$ by 2	Square	1 $\frac{1}{16}$	%
Feed lock-nut.....		Hexagon	1 $\frac{1}{16}$	L chuck.
Feed-screw support.....	$\frac{5}{8}$	Square	1 $\frac{1}{16}$	%
Hose clamp-bolts.....	$\frac{3}{8}$ by 2	Square	1 $\frac{1}{16}$	%
Oil-plugs.....	$\frac{7}{8}$	Hexagon	1 $\frac{1}{4}$	S chuck.
Plunger cradle cross-head bolts.....	$\frac{5}{8}$ by 3	Square	1 $\frac{1}{16}$	%
Plunger cradle forward clamp-bolt.....	$\frac{5}{8}$ by 3	Square	1 $\frac{1}{4}$	S chuck (special nut)
Plunger cradle rear clamp-bolt.....	$\frac{5}{8}$ by 5 or 6	Square	1 $\frac{1}{4}$	S chuck (special nut)
Plunger cradle slide-bolt.....	$\frac{3}{4}$ by 5 or 7 $\frac{1}{2}$	Square	1 $\frac{1}{4}$	S chuck.
Plunger-handle bolt.....	$\frac{5}{8}$ by 14	Square	1 $\frac{1}{16}$	%
Safety-collar bolt.....	$\frac{3}{4}$ by 5	Square	1 $\frac{1}{4}$	S chuck.

Side-rods.....	%	Hexagon	1	% (special nut, 1¼ bolt-head)
Side-rods.....	%	Hexagon	5/8	% (special nut)
Stoper chuck retaining-bolt.....	¾ by 5	Square or Hex.	1¼	S chuck.
Stoper handle-nut.....	¾	Square or Hex.	1¼	S chuck (special shape)
Standard rods.....	5/8	Square	1 7/16	%
Swing-nut.....	¾	Square	1 13/16	L chuck (special nut)
Throttle-bolt.....	¾ by 2	Square	1 1/16	%
Turbine box-bolts.....	%	Hexagon	1 1/16	%
Turbine cradle clamps.....	%	Hexagon	1 1/16	%
Valve-chest bolts.....	%	Hexagon	1 1/16	%
Valve-chest bolts.....	%	Hexagon	1 1/16	L chuck.
Valve-head bushing.....		Hexagon	1 1/16	% or %
Needle-valve bushing.....		Round		
Water-spud.....		Hexagon	1¼	S chuck.
Water-spud nut.....		Hexagon	1¼	S chuck.
Water-valve cap.....				

TABLE NO. 16

Number of fittings or machines examined	Part	Different forms now in use	Standardized to
6	Air-spud.....	1	
6	Air-spud nut.....	4	
13	Air-swivel nut.....	4	
7	Arm-bolt.....	8	Same as clamp-bolt Same as clamp-nut.
1	Arm-bolt nut.....	1	
9	Back-head cap.....	1	
9	Back-head plug.....	7	
9	B. H. gland rubber.....	4	
1	Clamp-bolts.....	1	
1	Clamp-nuts.....	5	
1	Clamp jaw-bolt.....	2	1 Same as arm-bolt
1	Column cross-bar bolts.....	1	
9	Crank-bolt.....	1	
9	Cross-head.....	3	Same as collar-bolt
9	Feed-screw.....	5	Same as throttle-bolt
8	Feed lock-nut.....	6	1
8	Feed-screw support.....	6	3
4	Handle bolts, pluggers.....	3	1
6	Hose clamp-bolts.....	5	1
11	Oil-plugs.....	4	1
1	Plugger cradle cross-head bolts.....	1	1
3	Plugger cradle forward clamp-bolt.....	1	1
3	Plugger cradle rear clamp-bolts.....	3	1 (Possibly same as cross-head bolts)
1	Plugger cradle slide-bolt.....	3	1
1	Safety-collar bolt.....	1	1
		1	1

9 Shell casting.....	6	2
15 Side-rods.....	12	3 or 4
3 Stoper chuck-retaining bolt.....	2	1
5 Stoper handle-nut.....	1	1
8 Standard rods.....	5	2
1 Swing-bolt.....	1	1
1 Swing-nut.....	1	1
8 Throttle handle-bolt.....	6	1
2 Turbine-chest bolts.....	2	1 (diameter only)
2 Turbine cradle-clamps.....	2	2
10 Turbine-chest bolts.....	3	2 (diameter only)
1 Valve-head bushings.....	1	1
1 Water-spud.....	2	2 (head only)
6 Water-spud nut.....	6	1

1 Same across flat as arm or clamp.

(5) As the number of any one class of rock-drills in use in the mine will vary from time to time, there will often be an excess or shortage of one or more kinds of drill-steel.

Steel Used in the Copper Queen Mines

The four kinds of steel now in use in the Copper Queen mines are as follows:

- (a) For use in drifting machines:
1 $\frac{1}{4}$ -in. round hollow steel with the regular Leyner shanks.
- (b) For use in wet stopers:
 $\frac{7}{8}$ -in. hexagon hollow steel with a plain shank.
- (c) For use in dry stoping:
1-in. cruciform solid steel with a plain shank.
- (d) For use in plugger machines:
 $\frac{7}{8}$ -in. hexagon hollow steel with the regular Jack-hamer collar-shank.

Table No. 17, page 767 lists the length of change, length of starter-drill, diameter of starter-bit, weight of the steel bar per foot, and the width of the wings of the bit for the various kinds of drill-steel now in use in the Copper Queen mines.

The above figures show the frequency with which the fittings on the mechanical sharpener must be changed. At present, about 1250 pieces of steel pass through the sharpening shop per 24 hours. Of this total, 500 are 1 $\frac{1}{4}$ -in. Leyner steel.

Throughout the Copper Queen mines the ground is very changeable; there is much ground that is either "ravelly" or very soft. Either of these conditions would prohibit the use of plain shanked steel in the drifter and plugger machines. In general, lug-shanked steel would be an improvement over the present form of stoper steel.

During the last few months [to Nov., 1920], tests were made in one division of the mines with the idea of replacing the four kinds of drill-steel now in use by 1-inch round hollow steel with lugged shanks. To give the necessary strength, the lug on the 1-in. steel is 1 in. long, while the lug on the 1 $\frac{1}{4}$ -in. shank is only $\frac{3}{4}$ in. long. If the 1-inch round steel were adopted, the Leyner man would have to handle only steel that

TABLE NO. 17

Shape and size of steel bar, inches	Length of change, inches	Length of starter-feet	Diameter of starter-bit, inches	Weight of bar per foot, lbs.	Width of bit-wing, inches				
					Starter	2nd	3rd	4th	5th
1/4 round hollow.....	18	3	2	3.98	7/8	7/8	7/8	3/4	3/4
3/8 Hexagon hollow.....	15	2 1/2	1 1/16	2.08	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16
1 cruciform, solid.....	15	3	1 1/16	2.23	1 1/16	1 1/16	1 1/16	1 1/16	1 1/16

weighs about $2\frac{1}{2}$ lb. per foot, while the $1\frac{1}{4}$ -in. steel now in use weighs nearly 4 lb. per foot. On the other hand, the stoper and plugger-steel weights would be slightly increased; but the difference would be of no consequence, as a $7\frac{1}{2}$ -ft (5th size) 1-in. drill-steel is not difficult to handle.

TABLE NO. 18

1 In. Round Hollow			$1\frac{1}{4}$ In. Round Hollow		
Drill	Length ft.-in.	Weight, pounds	Drill	Length ft.-in.	Weight, Pounds
Starter.....	2-6	6.2	Starter.....	3-0	11.9
2nd.....	3-9	9.3	2nd.....	4-6	17.9
3rd.....	5-0	12.4	3rd.....	6-0	23.9
4th.....	6-3	15.5	4th.....	7-6	29.8
5th.....	7-6	18.6			
Total.....		62.0	Total.....		83.5
$\frac{7}{8}$ In. Hexagon Hollow			1 In. Cruciform Solid		
Drill	Length ft.-in.	Weight, Pounds	Drill	Length ft.-in.	Weight, Pounds
Starter.....	2-6	5.2	Starter.....	3-0	6.7
2nd.....	3-9	7.8	2nd.....	4-3	9.5
3rd.....	5-0	10.4	3rd.....	5-6	12.3
4th.....	6-3	13.1	4th.....	6-9	15.1
5th.....	7-6	15.6			
Total.....		52.1	Total.....		43.6

Table No. 18 shows that with the adoption of 1-inch round steel there would probably not be a saving in the weight of steel required to supply the mines. The 1-inch round steel would be more easily bent than the $1\frac{1}{4}$ -in. steel, but would be harder to bend than the $\frac{7}{8}$ -in. hexagon steel.

That the round steel with the lugged shank, rather than the plain shank hexagon steel, has been tried is due to the character of the ground in the Copper Queen mines, and that the round section is naturally the stronger one. The plain shank-steel offers the advantage that there is no shank to form, other than grinding and tempering one end of the bar. If it were not for the form of steel retainer required, perhaps the collared shank would give better results than the Leyner shank, as the ring is the first stage of the forging when making the lug. The collared shank-steel could be made to be used with both anvil-block and tappetless machines.

So far, 1-inch round steel has proved satisfactory with all but the "wiggletails."

Shank breakage at either end of the lug is the difficulty encountered with the stopers. The breakage with some of the hand-rotated machines has gone as high as 20%, but with the mechanically-rotated stopers has not exceeded 3%. Though $\frac{7}{8}$ hexagon and 1-in. cruciform steel have been used successfully in the stoper-drills for years, this drill-steel has had only plain shanks. The weakness in the 1-inch round steel seems to develop when upsetting the bar to form the lugs of the Leyner shank.

Careful Heat Treatment

It is thought that this difficulty can be overcome by more careful heat treatment in the shop; not that the 1-inch steel is being treated more carelessly than the $1\frac{1}{4}$ -in. Leyner steel, but that the lighter steel should be given more special attention to make it stand the strain. The shank breakage in the regular run of drill-steel does not go above 0.7%.

The actual practice in the Copper Queen shop is to temper only the striking end of the shank. Some of the entire shanks of the experimental steel have been tempered in fish oil, and these have given better results. The breakage increases with the continued use of the drill-steel.

In much of the 1-inch drill-steel the hole through the bar is distorted in regard to both shape and position. Not in all cases is the distortion due to forging in the sharpening shop, as an examination of many bars has shown this condition not limited to the shank. Any alteration from the round hole means an unnecessary weakness. The position and shape of the hole in hollow drill-steel is an important matter worthy of careful consideration.

Another weakness in the use of lug-shanked steel for stopers is that the Leyner form of chuck does not offer as much support to the drill-steel as does the plain shank-chuck.

Throughout these tests, an air pressure of about 85 lb. per sq. in. was delivered to the stopers. If the air pressure had been reduced 5 or 10 lb., the shank breakage would not have been as high.

Drilling Speed

When using the 1-inch steel in the large drifting machines there did not appear to be any material increase in drilling

speed above the results obtained with the 1¼-in. steel. The bit on the 1-inch round steel is 1¼-in. less in diameter than the corresponding bit in the 1¼-in. steel. In some cases, the 1¼-in. steel out-drills the smaller steel. From these results, it looks as if the large drifting machines were too powerful for the 1-inch experimental steel. Undoubtedly the same inches cut per minute could be obtained with a smaller rock-drill and 1-inch steel. If it is reduced, and though the first cost would be higher, the upkeep expense would be reduced. Most manufacturers make their rock-drills to run most efficiently at 70 lb. of air.

An outline of the progress followed in making the Leyner shank is as follows:

- (1) Heat to about 1800° F.
- (2) Countersink hole in head of drill and forge.
- (3) Re-heat to 1800° F. and upset for ring.
- (4) Re-heat to 1800° F.
- (5) Punch, drive in pin, and form lug complete.
- (6) Let cool in air on shop floor.
- (7) Heat shank for 1½ inches from striking end to 1400 to 1500° F., and draw last ½ inch to blue color.

To form the collared shank:

- (1) Grind striking end of shank.
- (2) Heat to 1800° F., put on collar by upsetting.
- (3) Re-heat to 1800° F., countersink, put in pin and forge shank to proper size.
- (4) Let cool on shop floor.
- (5) Heat shank for 1½ inches from striking end to 1400 to 1500° F., and draw end of shank to blue color.

General Conclusions

From the foregoing it is evident that great economy in both the manufacture and use of drilling machines can be obtained by careful study of the fittings used in the routine operation of air-drills and the adoption of standard specifications for same.

The suggestions made are not offered in any spirit of criticism, but in the belief that joint study of the question by both drill manufacturers and operators cannot fail to result in mutual benefits.

With this in mind, I offer the further suggestion that a joint committee be appointed to consider the question and submit

recommendations to both parties for the adoption of standard specifications.

Furthermore, I do not consider it wise to attempt to standardize the types of drilling machines themselves to be used in mining operations; to do so would seriously handicap the efforts of the designers to improve them. Their past record in the development of drilling machines is sufficient evidence of the value of unrestricted competition in design.

I am in favor of the lightest type of machine in the various classes of work that will stand up with a reasonable cost of maintenance.

In the matter of drill-steel, I believe that material economies will result from the adoption by individual operators of one section of steel and one form of shank for all types of machines used by them, with due regard for the particular conditions encountered in their work.

RELATION OF STANDARDIZATION TO MINE MANAGEMENT

By CHAS. A. MITKE, Chairman of General Committee Standardization,
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It has been well said that "great economies in any business of production result from careful and thoughtful attention to details, and mining is no exception to this rule. On the contrary, successful mining is one of the greatest embodiments of the principle. Just as the difference between the careful manager and the careless one is apt to be the difference between profit and loss, so the difference between standardization and non-standardization is very frequently the difference between good and bad management."

Labor Is 50% of Costs In Mining

Estimates show that in metal mining over 50% of the total cost of production is chargeable to labor; therefore, the proper directing and systematizing of the activities of labor, to eliminate the waste of human efforts, is an important factor in the standardization of mining operations.

In mines where only a few men are employed, and a small tonnage produced, the entire supervision can be accurately directed by one general foreman, and the question of standardization does not enter largely into the daily work. However, where great tonnages must be produced at a low cost, and where the entire supervision of all details by one man is utterly out of the question, but of necessity rests in the hands of a large organization, then the standardization of all operations not only becomes very desirable but absolutely essential.

The need for a scientific investigation of mining practices or mining methods, with a view to alleviating present conditions—as regards high production costs—which have been brought about largely through high cost of supplies, increased advances in wages, and loss of efficiency due to the employment of unskilled or raw labor, has made itself felt throughout the entire mining industry, not only in the United States, but also in Europe.

Wage Increase and Grade of Ore Decrease

In one large center in this country, wages, which in 1914 ran from \$3.75 to \$4.25, now range from \$4.65 to \$5.40 per 8-hour shift. Taxes, supplies, freight rates, etc., are also considerably higher than they were several years ago, with no immediate prospect of reduction. Moreover, inevitably, the grade of the ore in many properties will decrease as time passes. This necessitates the mining of much larger tonnages in order to maintain the ultimate output at the same level.

Therefore, the only remaining alternative for the mine management is to make the workers so efficient as to warrant the continuance of operations under existing conditions. This can only be accomplished in the following manner:

- (1) Americanization, which merely begins with the teaching of the English language.
- (2) Education of employes (from heads of departments right through the entire organization down to miners and shovelers) in the most efficient method of performing the daily task.
- (3) By establishing a standard program for all operations, in order that human efforts may be utilized to the greatest advantage.
- (4) By furnishing the men with standard equipment, in order to facilitate routine work and make their efforts more productive. And
- (5) In order to encourage the miner to put forth his best efforts in attaining maximum production, an incentive, over and above day's pay, should be offered by the management.

Another most important factor in developing a scientific organization is the "setting of standards for work done." A very vital question is, what constitutes a day's work? What was assumed to be a day's work five years ago cannot be adopted as standard today. The wage system, whether contract or bonus, must be based on actual knowledge and justice. Nothing is more discouraging to a workman, or productive of more ill-feeling and discontent, than to have the standard bonus or contract rate cut because he has performed his work

exceptionally well and made a greater footage than the rating engineer ever anticipated could be made under the schedule. Cutting the bonus after it is once established is responsible for the great feeling of distrust which many men show towards working under any system other than day's pay.

Time and Skill Needed In Standardizing At Mines

In order to achieve a universal success, time and thought must be devoted to an intensive study of the details of mining. Each operation must be divided into its component parts, and standardization applied to each unit. Experimentation is also a necessary part of the program, and should be encouraged and fostered by the management. The workers must be trained to perform their tasks efficiently and intelligently. Labor-saving devices and equipment should be substituted for hand labor wherever possible. Unskilled labor should be supplanted as far as possible by mechanical means. This should not be interpreted as meaning a loss of employment to many who are now engaged in this class of work. There is plenty of work for all, and the performance of work by machinery, requiring little or no intelligence, will release thousands of men who can be trained for better paying jobs.

Until recently, the systematization of metal-mining operations was considered impracticable, particularly those operations carried on underground, from which natural circumstances have, to a large extent, excluded the light of publicity. The reserves of many of the larger mines have also been so rich and extensive that economy has not played as important a part, perhaps, as it should. The ever-present possibility of "sweetening the ore," or, in other words, bringing the daily output up to expectations by the addition of higher grade—kept in reserve for such purpose—has often tided over situations which, otherwise, might possibly have disclosed unsystematized methods and careless supervision on the part of underground bosses, to whom quantity plus quality at the moment meant everything, regardless of the disastrous effect their methods might have upon the future life of the mine.

What Happens Underground

Moreover, underground operations are to a large extent shrouded in obscurity, and the intimate details are known only

to a few, whose business it is to make daily visits to the working places. The larger number of the employes are frequently ignorant men, whose main interest in their work is to get out the number of cars required by the boss, and to whom ore and waste are of very little interest, except as they add to the required tonnage.

The needs of the manufacturing industry, and the keen competition encountered, have developed a host of experts, and production engineers, who have delved into the intricacies of the different branches and brought to light innumerable operations which lend themselves well to the adoption of standard methods.

Unfortunately, in the mining industry, no sweeping changes can be effected, which, in the course of a short period of time, might be expected to revolutionize the industry at large, and produce the same gratifying results as have been obtained in industrial plants. This fact, in itself, has acted as a deterrent in the systematization of mining operations, and while, in individual cases, alert, wide-awake operators have made considerable progress along these lines, the industry as a whole does not reflect the same systematization of operations that may be found in manufacturing plants.

Mining Practice Less Studied Than Metallurgy

It is generally conceded that mining is a profession that should require a highly specialized training, but as a rule sufficient emphasis is not placed upon the practical application of such technical knowledge. Too much dependency is placed upon practical experience alone, and too little on scientific principles. Far be it from the writer to discredit practical knowledge. The mining industry in the past owes much to its practical men, but what it now requires is practical knowledge superimposed on a scientific basis, or, in other words, the attention of men who have added years of practical experience to their specialized or scientific training.

The metallurgical branch of the profession has been the subject of much thought and study, and considerable research is continually being carried on in this branch of the profession. Contributions have also been made to the mining branch, but in the main these have consisted rather of descriptions of prac-

tices already in use in certain localities, than in the nature of original research work.

An X-ray analysis of mining operations as a whole, frequently discloses out-of-date methods which would not for an instant be tolerated in surface plants. What large factory owner, for instance, would permit one of his operators to spend two-thirds of his day away from his machine, hunting parts, supplies, lubricating oils, etc.? There, the output is based on machine production for each man, and the amount he can turn out is calculated to a nicety, and it is the imperative duty of the shop foreman to see that everything required is present and the machine in good order before the man starts to work.

Comparison of Work of Miners and Factory Workers

It is, however, a common occurrence underground for a first-class machine-drill operator to spend a large portion of his time walking through drifts and tunnels in search of sharp steel, or the right kind of steel to fit his machine, repair parts, oil-cans, or returning defective machines to the tool-house and carrying new ones to take their place.

In the factory, fatigue studies have been made, covering every action from the steps taken in performing certain duties, to the movements made by each hand of the individual worker in handling manufactured parts. In mining, however, it has come to be an unwritten law that so long as the machine-man drills a round of holes—special allowance being made for unusually hard ground—he has performed his daily task, regardless of the fact that—like Taylor's handler of pig-iron—providing his operations are studied and systematized, he might be made to double his performance with comparatively little additional effort to himself. This has been demonstrated in a number of instances; yet, as a whole, it still continues to be the general practice to consider one round of holes a day's work. The responsibility for this lies largely with the mine management. Formerly, in a great many instances, atmospheric conditions of working places were such that men could not work consistently during an 8-hour shift; and in many cases it grew to be the practice for men to work a certain period and then seek a better atmosphere in the mine, where they cooled off and rested for an equal period of time. Also,

in years past, the ventilation of mines was so bad that no blasting could be allowed during the shift, and consequently after the miner drilled his round of holes he would merely while away the remainder of the shift until quitting time, and fire the shots when leaving the mine. With the improvement that has already been made in metal-mine ventilation, it has been proved in exceptionally well-ventilated mines that shots can be fired at any time during the shift without inconveniencing the men. As a matter of fact, in one large mine, which is well ventilated, there is a shot fired every minute during the shift, with little or no resulting delay to the underground force. Now that every effort is being made to attain underground working atmospheres as nearly as possible approximating those on surface, this custom of considering one round of holes a shift's work—regardless of its depth—which is really nothing more than habit, must be overcome if mining operations are to be placed on an equal footing with those on surface.

Other Departments at Mines Capable of Improvement

This is but one example of the lack of systematization in mining operations. Much benefit could also be obtained from careful study of explosives, their use and handling; the correct placing of machine-drill holes; handling of timber, both underground and on surface, where much unnecessary labor is involved in handling and re-handling each piece as it comes from the cars, the writer having observed as many as 12 men employed at the same time in handling one stick of timber.

The distribution and care of underground supplies is another subject which would react most favorably to research.

The standardization of equipment and supplies is closely linked with the systematization of operations, and of necessity the one must be studied along with the other.

Too Many Different Drills

The industry at the present time is burdened with a multiplicity of machine-drills of varying types, sizes and weights, the difference in weight in some instances not being more than 1 to 2 lb. The production of these machines follows each other with such rapidity that in an effort to stock up with the best equipment available on the market many machines in

good condition must be scrapped, and as parts are not interchangeable, a considerable investment in such supplies must continually be charged off to profit and loss. The development of these machines is, of course, carried on by the manufacturer to meet the needs of the industry; but, unfortunately, these needs are often the individual ideas of various operators rather than the combined views of the majority. What may appeal to one does not appeal to the other, and consequently the necessity for purchasing and trying out this variety of types becomes an ever-increasing burden on the operator.

During the past seven years the necessity for a drifting machine, permitting the use of water and air through machine and steel, became so evident to practically every purchaser of rock-drills that, as a result, the manufacturers evolved the water-Leyner. The self-rotating water-stoper, which is now nearing perfection, is also the result of the combined needs of the mining industry. Many other improvements in drilling machines are possible, providing some research work is devoted to the subject of finding out just what specifications would meet the needs of the majority for the different types of machines, such as jackhamers, drifters, and stopers.

The chucks on all machines must become standard, so as to permit the inter-change of different makes of steel. The lack in efficiency and the loss of time incurred at present through miners supplying themselves with steel which does not fit the machine they are using at the time, is such that this change has become an absolute necessity.

Sizes of Drill-Steel

The size and types of steel should also receive attention. There are individual cases, where companies have standardized on the $\frac{1}{4}$ hollow octagon for all stoping and raising, and find this type of steel satisfactory for all their needs. Other companies are achieving excellent results with the 1-inch hollow round. Research would bring to light many facts that might tend to prove that one of the other of these two was the more satisfactory. The same is true of hose fittings, and various parts and supplies for machines.

Underground power shovels to supplant manual labor in shoveling should receive attention, in order to avoid the creation of the multiplicity of slightly varying types, similar to that at present existing among rock-drills. It is inevitable that mechanical equipment must supersede hand labor underground to a large extent, if we are to overcome the scarcity of labor, both skilled and unskilled, and increase the tonnage per man shift, at the same time maintaining the normal grade of the ore, which is the principal means of combating the present high cost of production. Shoveling is one of the most important items in underground operations.

Underground Transportation and Ventilation

Care and attention might profitably be devoted to underground transportation, the grade of tracks, weight of rail, etc. Also, the possibility of standardizing on a few sizes and types of mine cars, rather than on the unusually large number now on the market, and the various methods of haulage, compressed air, electric, and steam.

The ventilation of metal mines is a subject of the utmost importance. Without good air no man can live, much less work, and upon the condition of the working place depends very largely the efficiency of the worker. Much of the trouble resulting from bad air in metal mines at the present day comes from the deficiency of ventilation in dead ends in drifts and stopes. The ventilation of such working places can greatly be improved by resorting to systematized methods in regard to the use of certain types of small blowers and ventilating pipe, care and attention being devoted to the manner in which these are located and operated. The prevention of dust in mines necessitating frequent blasting during the shift is another means of raising the efficiency of the miners. In the past, bad air, rock dust, and heated atmospheres were looked upon as necessary evils which could not be overcome, and the man who could not put up with a certain amount of such discomfort was rather contemptuously referred to as one who "could not stand the gaff." Today, such conditions are unnecessary, and the adoption and use of standard equipment and standard methods will provide the men with a working atmosphere in which they can put forth their best efforts without discomfort to themselves. The systematic testing of mine

air and the adoption of a standard atmosphere is one of the pressing needs of the industry.

Fires in Mines

Fire-fighting equipment and systematized rules for combating outbreaks in the mine are also of the utmost importance, as the profit and loss accounts of many companies show large sums charged off to disasters of this kind, which might possibly have been averted through the keeping in stock of a standard line of fire-fighting apparatus.

There are many other subjects in the mining industry to which standardization can be applied, such for instance as cost accounting. Frequent discrepancies in the manner of keeping costs are encountered, even in properties owned by the same company. For instance, one mine will charge off the work of preparing an orebody for stoping to development work or to a separate fund which has been laid aside for such purpose. Their production costs may then appear quite low, for the reason that this large sum which should necessarily be added to the stoping cost, as it all goes against the ultimate profits, is omitted, while other companies include development costs, but exclude overhead and supervision, and so forth.

Ore Reserves and Taxation

The estimation of ore reserves is another matter for research; equitable taxation, and many other items, all come under the head of subjects to which standardization might be applied.

An objection frequently raised against standardization is that it retards progress, and that having once decided on a standard, there is no possibility of change and old standards must be adhered to even though newer methods have been developed which have outclassed the old. In this connection it may be well to quote from an authority* on this subject, who well describes the functions of a standard, in the following words:

“A standard is simply a carefully thought-out method of performing a function, or carefully drawn specifications covering an implement, or some article of stores, or of products. The

Morris L. Cooke. Bull. No. 5, Carnegie Foundation Series.

idea of perfection is not involved in Standardization. The standard method of doing anything is simply the best method that can be devised at the time the standard is drawn. * * * Improvements in standards are wanted and adopted whenever and wherever they are found. There is absolutely nothing in standardization to preclude innovation. But to protect standards from changes which are not in the direction of improvements, certain safeguards are erected. These safeguards protect standards from change for the sake of change. All that is demanded * * * is that a proposed change in a standard must be scrutinized as carefully as the standard was scrutinized prior to its adoption. Standards adopted and protected in this way produce the best that is known at any one time. Standardization practiced in this way is a constant invitation to experimentation and improvement."

Standardization of Great Importance to Mines

The standardization of mine equipment and mine operations in the various branches are of vital interest to the mine manager who is responsible for the ultimate cost of the product. In order to work out these problems, to accumulate the correct data upon which to base conclusions, and finally to introduce standard methods, it is absolutely necessary that the mine manager effect this change through the medium of his organization, composed of heads of departments, foremen, bosses, and engineers. Their intelligent co-operation is therefore an essential part of the program. These are the men who represent the company, or mine management, and interpret the policies and desires of the company to the great mass of employes. They are also intimately acquainted and associated with the multiplicity of operations which, combined, form the activities of the mine. If their interest and enthusiasm is directed towards a study and systematization of the details which form the various groups of operations, then through the standardization of many small tasks, which by themselves may not appear important, under the careful supervision of the mine management, larger economies will result, which, in turn, will ultimately have the desired effect of reducing production costs.

STANDARDIZATION WORK OF THE UNITED STATES BUREAU OF MINES

By F. G. COTTRELL

In attempting to standardize mine equipment, the current best practice can be crystallized into the form of a code or set of rules and regulations; but in any such attempt there are always items about which there is a lack of proper information; so that there is doubt whether such items should be crystallized into a code or passed over with as little attention as possible. There are frequently matters that yield to laboratory investigation, facilities for which are rarely available to the mine operator. These rather difficult points are rarely comprehensive enough to form the basis for a code covering any considerable portion of a field, and yet they may themselves form a standard of good practice. This can be illustrated by the Bureau of Mines' permissible explosives or the miners' cap-lamps, or possibly the Bureau's rules for installing and using electrical equipment in bituminous coal mines.

Besides the results of laboratory work and special investigation, there is also that type of work which is the result of conferences of men of prominent standing in their profession and who are regarded as authorities in their own field, and who write their opinion of current best practice in the form of rules and regulations. This type of work is illustrated by the 'Rules and Regulations for Metal Mines,' compiled by mining engineers of standing, and 'Proposed Regulations for the Drilling of Gas and Oil Wells through Coal Beds.'

Approval System As Basis for Standards

While not directed toward the production of standards for mining equipment, still the Bureau's approval system furnishes material that may well form the basis of standards for certain equipment. It is frequently the case that in the commercial development of a really good idea, the early productions are foredoomed to failure because of lack of information and a proper ideal in designing the apparatus. In safety matters this is of particular interest to the Bureau of Mines. In the development of electric machinery for use in gaseous mines,

questions arise as to the proper protection of the device so that sparks may not ignite gas, if perchance the apparatus is in a gaseous atmosphere. Some kinds of sparks readily ignite gas, while others will not. Certain kinds of protective devices will prevent ignition from extending into the surrounding space. If the apparatus is designed in a manner ignoring these facts, the business can develop only through dangerous and disastrous experience and loss of life. After an investigation, the Bureau draws a minimum specification for such devices, and allows those companies which meet this minimum specification to mark their devices as approved by the Bureau of Mines. This minimum specification allows ample room for individual initiative and development beyond the line of necessary safety. This work forms the basis of standardization for such devices in order that they shall be safe in gaseous mines.

With these illustrations of the purpose of the Bureau, a catalogue of its publications along these lines is sufficient to indicate the field already entered by the Department. For this purpose of special investigation, the Bureau has a large laboratory at Pittsburgh and the facilities afforded by eleven other stations in various parts of the country.

The Bureau attempts to crack the hard nuts in the several fields of safe equipment as rapidly as its funds allow, and it is hoped that the future will afford increased facilities for work of this kind.

Publications Available

A list of the Bureau's publications on this subject follows:

Schedule 1.—'Conditions and Requirements Under which Explosives are Tested.'

Schedule 2A.—'Procedure for Establishing a List of Permissible Explosion-Proof Electric Motors for Mines.'

Schedule 6A.—'Procedure for Establishing a List of Permissible Portable Electric Mine Lamps.'

Schedule 7.—'Procedure for Establishing a List of Permissible Miners' Safety Lamps.'

Schedule 12.—'Procedure for Establishing a List of Permissible Single-Shot Blasting Units.'

Schedule 13.—'Procedure for Establishing a List of Permissible Self-Contained Mine-Rescue Breathing Apparatus.'

Schedule 14.—'Procedure for Establishing a List of Permissible Gas Masks.'

Schedule 15.—'Procedure for Establishing a List of Permissible Storage-Battery Locomotives for Use in Gaseous Mines.'

Schedule 16.—'Procedure for Establishing a List of Permissible Multiple-Shot Blasting Machines.'

Technical Paper 22.—'Electrical Symbols for Mine Maps.'

Technical Paper 53.—'Proposed Regulations for the Drilling of Gas and Oil Wells with Comments thereon.'

Technical Paper 79.—'Electric Lights for Use about Oil and Gas Wells.'

Technical Paper 138.—'Suggested Safety Rules for Installing and Using Electrical Equipment in Bituminous Coal Mines.'

Technical Paper 214.—'Motor Gasoline Properties, Laboratory Methods of Testing, and Practical Specifications.'

Bulletin 49.—'Smoke Abatement and City Smoke Ordinances.'

Bulletin 75.—'Rules and Regulations for Metal Mines.'

Bulletin 116.—'Methods of Sampling Delivered Coal.'

'Advanced First-Aid Instructions for Miners.'

'Rescue and Recovery Operations in Mines after Fires and Explosions.'

The last two are pocket-books issued in 1917 and 1916, respectively.

NATIONAL AND INTERNATIONAL STANDARDIZATION

By P. G. AGNEW, Secretary American Engineering Standards Committee

During or since the war, national engineering standardizing bodies have been organized in Austria, Belgium, Canada, France, Germany, Holland, Italy, Sweden, Switzerland, and the United States, and one is in process of formation in Japan. All of these are similar in form of organization and method of operation to the British Engineering Standards Association, which, organized in 1902, has been a most significant factor in the development of British industry.

Our own society—the American Engineering Standards Committee—was started in October, 1918, and has been actively at work for about a year. At first it consisted of representatives of the American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, and American Society for Testing Materials. Upon invitation, three Government departments—War, Navy, and Commerce—joined in the movement, and appointed representatives; and later, provision was made for representation upon the main Committee of other bodies of national scope interested in standardization. At the time the Committee was organized there were more than 100 American societies actively engaged in standardization work; but there were no systematic, unified methods of co-operation, and there had been a widespread recognition of the need of some central agency for the purpose.

The functions of the Committee are: to unify methods of arriving at engineering standards; to secure co-operation between various interested organizations, in order to prevent duplication of work and promulgation of conflicting standards; to act as an authoritative channel of co-operation in international engineering standardization; to promote in foreign countries the knowledge of recognized American standards; to collect and classify data on standards; and to act as a bureau of information regarding standardization.

Scope of the Work

The scope of the work which is being carried out under the auspices and rules of procedure of the Committee is very broad. The following types of work are found among the standardization projects which are now under way:

1. Definitions of technical terms used in engineering work, specifications, and contracts.
2. Specifications for materials.
3. Methods of tests, especially acceptance tests for materials and apparatus.
4. Dimensional standardization to secure interchangeability of supplies—for example, screws, nuts, and bolts.
5. Dimensional standardization to secure the inter-working of parts, and of inter-related apparatus, made or assembled by different manufacturers, such as shafts, pulleys, etc.
6. Safety codes, to secure uniformity in requirements for safety in apparatus and equipment, and in industrial processes.
7. The limitation of the number of types, sizes and grades of manufactured products—an exceedingly important and far-reaching subject.

Specific Examples

It may be well to mention two or three specific projects:

The British Engineering Standards Association suggested Anglo-American agreement on a standard series of cross-sectional shapes for structural steel. A committee was organized on which are representatives of organizations interested in the question. Among them are the Association of American Steel Manufacturers, American Society of Civil Engineers, Society of Naval Architects and Marine Engineers, American Bureau of Shipping, U. S. Navy, and the Railway Car Manufacturers' Association. Considerable progress has been made, and a representative of the committee was abroad during the early summer to confer with the British.

Another example arises also from an international proposal, this time from Belgium, that there be international standardization for the non-ferrous metals. They outlined in detail what they thought should be done on the question of zinc—the methods of sampling zinc ore, methods of analysis, allowances for moisture content, etc. A committee is being organized for the work on zinc, under the leadership—technically called sponsorship—of the American Zinc Institute and the American Society for Testing Materials. On this committee all the societies that are concerned in the subject will be represented.

Passenger and freight elevators for buildings are built to a large extent to special order. On account of lack of recognized standards, adequate provision is not made in the architect's plans, and steel work is often up before fundamental decisions on elevators are made, and more or less confused and wasteful conditions result. At the joint request of the Elevator Manufacturers' Association and the American Institute of Architects, a conference was called. There were 14 interested organizations that were represented. The action taken was enthusiastic and unanimous that a standardization of elevators, based on fundamental considerations, should be undertaken. Arrangements are being made for a thoroughly representative sectional committee to carry out the detailed technical work.

Another illustration, which is typically American, is the matter of safety codes. There have been in the past at least 100 organizations formulating safety-codes. Nearly all of the 48 States have bodies that have the authority to promulgate safety-codes. At a conference in Washington in January, 1920, where more than 100 organizations were represented, it was unanimously voted that a comprehensive program of safety-codes should be undertaken, and that it should be handled under the auspices and rules of procedure of the American Engineering Standards Committee, in order that there be proper co-ordination, elimination of overlap, etc. Active work is now in progress on about 30 such codes. State commissions, which are the bodies responsible for the legal adoption and enforcement of safety-codes, associations of insurance companies, national engineering societies, manufacturers' and industrial associations, labor and civic organiza-

tions, and technical bureaus of the Federal Government are all heartily co-operating in the work. The committees responsible for the formulation of each of the codes are made up of representatives of such of these bodies as are interested in the particular code in question.

Economic and Industrial Significance

If standardization is carried out on a sound engineering basis:

1. It enables buyer and seller to speak the same language, and makes it possible to compel competitive sellers to do likewise.
2. In thus putting tenders on an easily comparable basis, it promotes fairness in competition, both in domestic and in foreign trade.
3. It lowers unit-costs to the public, by making mass production possible, as has been so strikingly shown in the unification of incandescent lamps and automobiles.
4. By simplifying the carrying of stocks it makes deliveries quicker and prices lower.
5. It decreases litigation and other factors tending to disorganize industry, the burden of which ultimately falls upon the public.
6. It eliminates indecision both in production and utilization—a prolific cause of inefficiency and waste.
7. By focusing on essentials, it decreases selling expense, one of the serious problems of our economic system.
8. By concentrating on fewer lines, it enables more thought and energy to be put into designs, so that they will be more efficient and economical.
9. It stimulates research, to which it is closely allied.
10. It is one of the principal means of getting the results of research and development into actual use in the industries.
11. It helps to eliminate practices that are merely the result of accidental or tradition, which impede development.

12. By concentration on essentials, and the consequent suppression of confusing elements intended merely for sales effect, it helps to base competition squarely upon efficiency in production and distribution and upon intrinsic merit of product.

A stock argument often used against standardization is the claim that it results in crystallization and the throttling of development. Quite the contrary is true if the work is carried out on a sound basis. Crystallization, when it occurs, results from mental attitude, and not from sound engineering standardization. As just stated, standardization in itself is a powerful incentive to research, and is one of the chief means of getting the results of research actually utilized. In attempting to arrive at standards agreement is frequently prevented by a lack of facts, and this leads to the getting of those facts.

Benefits of Research.

Dr. W. R. Whitney, the director of one of our great industrial research laboratories, has said that the benefits of research and development work to the public are far greater than to the manufacturer; that while a series of investigations may benefit the manufacturer to the extent of millions, the ultimate benefit to the public will be in hundreds of millions. A striking example that Dr. Whitney had in mind was the incandescent electric lamp. It is doubtful if there is another article in any of our industries that represents more research work either in quantity or in quality. The benefits that have accrued to the manufacturer and to the public could not have been realized had the research work not been supplemented by thorough-going standardization.

Organization and Methods

The American Engineering Standards Committee itself, usually referred to as the Main Committee, is composed at present of 47 members, representing 17 member-bodies, which are as follows:

American Electric Railway Association.

American Institute of Electrical Engineers.

American Institute of Mining and Metallurgical Engineers.

American Society of Civil Engineers.

American Society of Mechanical Engineers.

American Society for Testing Materials.

Electrical Manufacturers' Council—

Associated Manufacturers of Electrical Supplies,

Electric Power Club,

Electrical Manufacturers' Club.

Fire Protection Group—

Associated Factory Mutual Fire Insurance Companies,

National Board of Fire Underwriters,

National Fire Protection Association,

Underwriters' Laboratories.

Gas Group—

American Gas Association,

Compressed Gas Manufacturers' Association,

International Acetylene Association.

National Electric Light Association.

National Safety Council.

Society of Automotive Engineers.

U. S. Department of Agriculture.

U. S. Department of Commerce.

U. S. Department of the Interior.

U. S. Navy Department.

U. S. War Department.

The Committee does not duplicate the work of other organizations. On the contrary, in acting as a clearing-house for standardization, it eliminates duplication, as very substantial results have already shown.

The Main Committee is solely an administrative and policy-forming body, and does not pass upon the technical details of standards. The formulation of a standard is in the hands of a working committee, technically called a "sectional committee," made up of representatives designated by the various bodies interested. The Main Committee must approve the personnel of each sectional committee, as being authoritative and adequately representative of the various interests concerned. Producers, consumers, and general interests, are to be represented on every sectional committee dealing with standards of a commercial character.

Sponsor Bodies

In one important particular the method of work of the American Engineering Standards Committee differs from that of the other national bodies. This is the use of what are termed "sponsor" bodies. When the Committee was formed there were already a large number of organizations doing standardization work, some of whom had accomplished, and were engaged in, very important work. This led to a policy of decentralization. Each sectional committee is organized by, and under the leadership of, one or more of the principal bodies interested and known as sponsor.

Special provision is made for the approval of important standards in existence prior to 1920, without going through the full formal machinery of a sectional committee.

It is to be noted that each industry, or branch of industry, is wholly autonomous in its standardization work, the Main Committee not dealing with the technical matters in any way, but merely assuring that each body or group concerned in a standard shall have the opportunity to participate in its formulation, and providing systematic means of co-operation in the work.

The Committee has decided that "if it is the desire of any industry to have a general committee, representative of the industry as a whole, as a means of developing and correlating the standardization work of the industry, the arrangement will be eminently satisfactory to the American Engineering Standards Committee." Such a general correlating committee for mining standardization has been formed, the nucleus being two representatives from each of five leading mining bodies—the American Mining Congress, the American Institute of Mining and Metallurgical Engineers, the U. S. Bureau of Mines, the Mining and Metallurgical Society of America, and the National Safety Council.

If requested to do so by a responsible organization, the Main Committee calls a conference of the interested bodies to decide whether it is desirable that a given piece of standardization work shall be undertaken, and if so, what its scope shall be. In this, and in its work generally, the Committee is not an initiating body. Consideration will show that this policy is

very conducive, if not necessary, to cordial co-operative work. For example, if the Committee were to call such a conference on its own initiative, its action in doing so might be misunderstood and resented as an attempt to dominate, while by not taking the initiative it becomes perfectly clear that the purpose is to serve.

Machinery for International Standardization

The American Engineering Standards Committee is in touch with all the other national standardizing bodies, and is actively co-operating with several of them.

There are at present three international standardizing bodies—the International Electrotechnical Commission, the International Commission on Illumination, and the International Aircraft Standards Commission. Each of these commissions is composed of national committees in the different countries. The International Aircraft Standards Commission has a quasi-governmental status.

In the other fields there is as yet no machinery for general international standardization. Each national body deals directly and independently with any of the other national bodies with which it wishes to co-operate on any specific project. Plans are now being made in Europe for a conference in the spring of 1921 to further international standardization, and to take first steps toward systematizing methods of co-operation between the different national bodies.

European Activity

Early in 1920 I had the opportunity of visiting the national standardizing bodies of Belgium, France, Great Britain, and Holland. It is surprising to see the amount and the intensity of standardization work being undertaken in Europe. One continually heard the term "mass production," and the statement that the extensive introduction of it into industry through standardization is an economic necessity for Europe today. Dimensional standardization is being carried much further than has been attempted in America, and standardization on a national scale is being woven into industrial fabric much more intimately than it is here.

These conditions prevail to an extraordinary extent in Germany, where the economic pressure is so great. It is being

carried further than would generally be thought desirable in America. Considerable work is being done in the standardization of design, and in some cases uniform design of complete apparatus is proposed for the entire German industry. It is urged that a great increase in efficiency and economy in production and utilization will result from pooling experience and skilled in design, and that it will be of great value in foreign trade, for example, in maintaining service stations.

The standardization movement is one of co-operation throughout each branch of industry, and between the different branches of industry whose interests touch or overlap, and will inevitably lead to a large measure of international standardization.

For years there has been a growing feeling among leaders in industry, which was heightened by the experiences of the war, that our industries function too much as independent units, and not enough as articulated parts of a national whole. It is not too much to say that standardization offers a major opportunity toward the integration of our industries on a national scale, so that they may function in a truly national way.

STANDARDIZATION AT THE UNITED STATES BUREAU OF STANDARDS

By G. K. BURGESS

The Bureau of Standards welcomes the opportunity of participating in these first annual conferences of the American Mining Congress on standardization, and the director, Dr. S. W. Stratton, regrets he was not able to be present in person to take part in the discussions and present a statement of the work that the Bureau is doing in the field of standardization.

This Bureau was founded in 1901. At the present time it has a personnel of about 850, and is located in a 200-acre tract just outside of the city of Washington, D. C. In 10 permanent and several temporary structures the plant represents a capital expenditure of \$4,000,000. The budget for 1920 is \$1,200,000.

How the Bureau Works

The scientific and technical work of the Bureau is grouped in nine administrative divisions, which are arranged according to the subject-matter coming under the jurisdiction of the Bureau. These divisions are: Weights and Measures, Electricity, Heat, Optics, Chemistry, Engineering, Physics, Structural and Miscellaneous Materials, Metallurgy, and Ceramics. These lines of work were not all developed at once, but the Bureau has had a systematic and healthy growth directed largely by the same men who were associated with Dr. Stratton at the time of the Bureau's foundation. This has made for continuity of policy, and a rational, systematic, development along lines laid down in advance and carried out as opportunity offered.

At the time of the establishment of the Bureau, it was necessary, in the hearings before the Congressional Committee, to call in witnesses from many fields of work to demonstrate the advisability or even the desirability of the establishment of a Bureau concerned with standards. At that time there was no National, State, or Municipal body concerning itself with and responsible for standards of measurement on any comprehensive scale. In the field of materials there was the

American Society for Testing Materials, founded in 1898, which, from the start, had been concerning itself with the promotion of knowledge of the materials of engineering and the standardization of specifications and the methods of testing. The membership of this Society at the time of the foundation of the Bureau of Standards was less than 200, whereas now, as an evidence of the growth of the standards idea in the field of engineering materials, membership of the American Society for Testing Materials is some 2900 persons. About the time of the establishment of the Bureau, the large engineering societies began to interest themselves with the various aspects of the standardization field. This interest in standards culminated in the formation of the American Engineering Standards Committee in October, 1918, which after a year largely devoted to questions concerned with scope, organization, and methods of functioning is now well launched on a firm basis with a very rapidly expanding program. A list of the technical organizations of the country drawn up last year showed there were over 260 of such that are actively interested in one way or another in the subject of standards.

Co-operation Between Government Departments

In the Government Departments, during these 20 years, closer relations and interchange of experience in the formulation of specifications and standards has been developing, although some of the Departments have been and still are handicapped by an inadequately equipped personnel for handling such questions with entire satisfaction to themselves. The question may be asked, "What attitude does the Bureau of Standards take toward other organizations, Governmental, and especially non-Governmental, in the field of standardization?" This may perhaps best be answered by considering the relations in the past between the Bureau of Standards and such bodies. Let us take first the Government Departments: In the hearings preceding the establishment of the Bureau, representatives of the various Departments were asked to testify as to what help such a Bureau would be to their Department. In the light of future developments this testimony today makes very interesting reading. Representatives of one of the largest Departments requiring a great deal of high-class technical work testified that such a Bureau would render

no service to their Department. It is a matter of record, however, that this particular Department has called for the services of the Bureau more than has any other, and largely for the very reason that it has so many highly technical questions involving specifications, standards, and properties of materials and performance of equipment, that in the very nature of things it was inevitable that the existence of such an organization as the Bureau of Standards equipped for experimental work on fundamental constants, properties of material, and methods of measurement, would have to be used by such a department.

The Bureau has acted in an advisory or consulting capacity to many of the Government Departments on questions involving specifications and standards, and has carried out many investigations at the instigation of these Departments on matters primarily of interest to them.

Other Standardization Societies Desirable

We may state it as an axiom, that the Bureau of Standards encourages the formation and growth of any other organization, whether it be public or private, which has among its objects the progress or improvement in the standardization field and in the dissemination of knowledge concerning standards. The standardization field is one of practically unlimited extent, and each one of the numerous organizations in the country that are concerned with the subject has some particular phase of it that it wishes to cultivate. In so far as its facilities admit, the Bureau of Standards is ready at all times to work in harmony with, and when desired in co-operation with, all movements looking toward the improvement of standards and the methods of standardization. There are few, if any, aspects of the development of standards and specifications, at least concerning matters relating in whole or part to various branches of engineering, in which the Bureau of Standards can not be of some use. To refer again, as an example, to the work of the American Society for Testing Materials, it has been mutually advantageous to the Society and to the Bureau to work in close harmony in the preparation of specifications for engineering materials. A great deal of the experimental work outlined by the several committees of this Society has been carried out in the Bureau laboratories, and members of

the Bureau are represented on many of the Society's committees. We believe, and in this I can speak both for the Bureau of Standards and the American Society for Testing Materials, that this close co-operation and co-ordination of effort has worked to the very great benefit of the engineering public.

Again, the Bureau of Standards welcomed the founding of the American Engineering Standards Committee, on which Committee the Bureau has three representatives. It will be remembered that in the preparation of standards which are to be reported to the Standards Committee there is a "sectional committee" appointed to formulate a given standard, and there is one or more especially interested organizations named "sponsor" to push actively the constructive work on the standard. The Bureau of Standards has been designated as sponsor in the preparation of a considerable number of standards, including, for example, several in connection with the preparation of industrial safety-codes as follows: Electrical Safety Code, Gas Safety Code, Head and Eye Protection, Lightning Protection, Logging and Saw-Mill Machinery, among a list of 37 codes which are in various stages of completion.

A Wide Field in Standardization

The Bureau of Standards recognizes that the field of standardization is an extensive one; and the functions of the Bureau may be briefly stated as the development, construction, custody, and maintenance of reference and working standard and their inter-comparison, improvement, and application, in science, engineering, industry and commerce. For convenience, the Bureau groups standards into five classes: (1) "Standards of Measurement," which includes reference and working standards for measurements of all kinds for expressing the quantitative aspects of space, time, matter, energy, motion, and their inter-relations as illustrated by length, area, volume, mass, density, pressure, thermal, electrical, and other physical measurements, which have for their purpose to aid accuracy in industry, assist commerce in size standards, promote justice in daily trade, and facilitate precision in science and technologic research. (2) "Standard Constants." or what we may call natural constant or the measured numerical data rep-

resented by fixed physical constants, such as mechanical equivalent of heat, melting and boiling points, heats of combustion, electro-chemical, and atomic weights, and the like, which we have as an exact basis for study, experiment, computation, and design, furnish an efficient control for industrial processes in securing reproducible and uniformly high quality and output, to secure uniformity of practice in instruments and tables and aid laboratory research by reducing errors and uncertainty caused by the use of data of doubtful accuracy. (3) "Standards of Quality," which are illustrated by specifications for materials used in engineering, which fix in measurable terms a property or group of properties for determining the quality in question, securing high utility in the products of industry by stabilizing the standard of quality, furnishing a scientific basis for fair dealing, avoiding disputes or providing means to settle questions, promoting truthful branding and advertising as well as precision and the avoidance of waste. (4) "Standards of Performance," or specifications of operative efficiency or action for machines and devices. (5) "Standards of Practice," such as codes and regulations impartially analyzed and formulated after study and experiment into standards of practice for technical regulation of construction, installation, operation, and based upon standards of measurement, quality and performance; such, for example, are the safety codes above mentioned.

Specific Examples of the Bureau's Work

To give a complete account of the standardization work of the Bureau would surely take us far afield, but it may not be without interest to give a summary of certain of the standardization activities as illustrative of the methods of procedure, and emphasis will be placed on those cases showing our methods of co-operation with other bodies. In the field of fundamental standards of measurement and the determination of standard constants the Bureau considers itself the final authority for the country, but in the development of standards of quality, and more particularly in the establishment of standards of practice, the Bureau considers it does its most effective work in co-operation with the interested bodies.

Screw-Threads

Let us first consider briefly the work of the National Screw Thread Commission established by Congress on July 18, 1918, made up of representatives of the Government, the Society of Mechanical Engineers and the Society of Automotive Engineers and of which the Director of the Bureau of Standards is chairman. The task of this Commission is the establishment of screw-thread standardization from the standpoint of interchangeable manufacture, and includes the setting up of a series or system of threads with definite specifications as to form and dimensions expressed in measurable terms. The Commission has decided that the thread form should be that known as the "U. S. form"—there should be two series of threads, a coarse and a fine, and there should be four classes of fit provided for, loose, medium or standard, close, and wrench fit. There have been established a set of pitches and tolerances for each class, and the Commission still has to formulate a considerable number of rules regarding threads, tubes, taps, bar stock, and dimensions of bolt heads and nuts. The experimental work for the Commission has been carried out largely at the Bureau of Standards.

Research in Electrolysis

As an example of the co-operative method adopted by the Bureau in questions involving engineering practice on a considerable scale in various communities, there may be mentioned that of electrolysis survey and prevention. This is a problem that has been studied more particularly in its relation to conditions in cities and in some cases to inter-urban transmission, but nevertheless may have its applications in certain cases to the mining industry. The method of carrying out these investigations is, however, typical of the way the Bureau would take up problems falling in its field which might be desired by the mining industry. Briefly, our methods in electrolysis investigations have been the following: Field surveys are carried out on the actual conditions in the districts to be studied. This often requires, for example, modified forms of apparatus for measuring current flow in pipes and leakage flow from pipes. In fact, the electrolysis problem has required the development of a whole series of modified apparatus for

the purpose. There arise special problems such, for example, as the actual facts concerning the phenomena of corrosion of lead, and as what may be expected under the conditions of alternating current and of direct current. This requires laboratory as well as field research. From its surveys and experimental studies, the Bureau has been able in many cases to recommend modifications that have eliminated or greatly reduced the very harmful effects of electrolysis in cities. A not unimportant function of the Bureau has been its position of an impartial technical advisor as between the diverse interests.

There is also in existence an American Committee on Electrolysis, which represents all of the great national associations of utilities companies, and is co-operating with the Bureau in conducting extensive research in the field of electrolysis mitigation. The research program was formulated by the Bureau and approved by the Committee, and this research work will be carried out jointly. Some of the work under way is the effect of pipe drainage on underground systems, especial attention being given to the possibility of joint electrolysis on high resistance joints and interchange of current between drained systems. It will be seen from this brief statement that several aspects of this electrolysis branch of research by the Bureau may have direct application in the mining industry.

Standardizing Coal-Mine Scales

Another item that may be of particular interest to the American Mining Congress is the Bureau's work on investigation of mine-scales. In August, 1917, it was brought to the attention of the Bureau that a serious condition of affairs existed in the coal-fields of Allegany county, Maryland, as a result of disputes continually occurring between the miners and operators in regard to the condition of the scales and methods used in weighing the coal mined by the workers, upon which their wages depended. The miners distrusted the weighings obtained from the scales in use, and believed that they were not receiving the full amount of pay to which they were entitled. No method of remedying the situation had been found, and it had become so acute that a general strike was impending, and would certainly have occurred had not the Bureau promptly intervened and obtained a postponement of this action while an investigation was conducted. This

matter was considered to be of the greatest importance on account of the special necessity for continued production of coal at this time, when it is so vitally needed.

No attempt was made to test all the scales in the region, those being selected for test at mines where the friction between operators and employees was most pronounced. As a corollary to the test of scales, an investigation was conducted into the matter of average tare weights and other matters closely related to the accuracy of the weights obtained.

It was demonstrated that the grievances of the miners were in many cases well-founded. The scales had in many instances been improperly installed; no proper attention to their maintenance had been given throughout long periods of service; and, in at least one instance fraud in weighing was very strongly indicated. The result of all these conditions was that very serious errors of use were common—not a single scale examined being within the tolerance allowable in such work; moreover, important errors were in every case in favor of the operator.

This work is being continued with additional portable equipment, and the investigation extended into new mining regions including the bituminous fields of Kentucky, Tennessee, Ohio, West Virginia, and Georgia. In general, it may be said that the tests made were found to have a very desirable effect on the regular production of coal. In those cases where the scales were found accurate, distrust and suspicions in the minds of the workers were allayed, and operations continued with better feelings on both sides; in other cases where scales were found to be inaccurate, corrected measures were applied, and both parties to controversies were satisfied.

Sulphur and Phosphorous in Steel

Still another type of co-operative work to which reference may be made is the metallurgical investigation under the auspices of a Joint Committee representing all interested parties including Government, manufacturers, specification making bodies, and large users of steel, to determine from a series of experiments carried out on a large scale both in the plants and in the laboratory of the effect of sulphur and phosphorous on steel, for the purpose of arriving at fair limits of these deleterious elements in the specifications for steel.

From the above illustrations I trust to have made it evident that the Bureau of Standards in its standardization work takes the position that it can be most effective in co-operating with those organizations both public and private who are interested in developing standards in any particular field. It is undoubtedly the case that the mining industry will find it to its advantage to call on the Bureau not only for experimental work in determining fundamental questions of fact regarding measurement and the quality of material entering into mining equipment and accessories, but also I trust that you will find it beneficial to take advantage of the experience that the Bureau of Standards has had in the past in developing standards in other lines, and I am instructed to say by the Director that the Bureau of Standards is at your disposal for this purpose.

Permit me to express my admiration for the spirit shown in these Standardization Conferences, and my astonishment at the surprising amount of progress already made in the standardization field as related to the mining industry. It is hardly necessary for me to emphasize again as so many speakers have done, the economic and far-reaching benefits of standardization which has abundantly been proved to be worth many times the cost in not only money, but in time and thought and energy spent upon it. On behalf of the Bureau of Standards, therefore, I extend to this Standardization Conference our most hearty congratulations and best wishes for continued prosperity in the standardization field.

MINE ACCOUNTING*

By LAWRENCE K. DIFFENDERFER, Treasurer, Vanadium Corporation of America, New York

Each mining company seems to use a different system of accounting. Because of this, and because mines are frequently in undesirable regions, companies experience great difficulty in securing competent mine accountants. Recognizing the necessity of a uniform system of accounting, this paper is submitted, being the result of 12 years of actual experience as a mine accountant. It is not intended to cover the technical part of mine accounting, but the practical side; and is for operating heads.

Too much care cannot be exercised in the selection of the mine accountant. He is an invaluable asset. He must be more than a bookkeeper, and should understand all operations about a mine.

Mine accounting should be divided into three general divisions, namely: (1) "Operating Expense"; (2) "Capital Account"; and (3) "Deferred Charges."

Operating Expense

This account should cover all expenditures incidental to producing the product, including items of repairs and maintenance, as well as reserves for depreciation, depletion, obsolescence and development.

Capital Account

This account should include all expenditures incidental to the creating of a permanent or fixed asset; and proper reserve for depreciation, obsolescence and depletion should be set up and charged to operating expenses concurrently.

Deferred Charges

Unless the general balance-sheet reflects the true financial condition of a company, it is worthless. The true current position of a company is the most important for all financial purposes. The cost sheet is also worthless unless true cost is shown, and the greatest care should be exercised to keep the costs absolutely correct and uniform.

*An abstract.

Wherever the shrinkage or overhead stoping system is in use, generally one-third of the ore broken in any given period is hoisted, and the remaining two-thirds held in the stopes until the level is stoped out.

In one instance, where 500,000 tons of ore had been left in stopes, which at a breaking cost of 44 cents per ton, represents current assets amounting to \$220,000, this was not reflected in the current position of the company on the general balance sheet. It therefore follows that wherever more ore is broken in any given period than is hoisted, credit should be given for the same to operating expense and charged to the proper asset account in the current position of the company; and whenever more ore is hoisted than is broken, operating expense should be charged for the same and this same account credited.

It is sometimes stated that this asset is questionable on account of the hazardous operation, but it should be conceded that the main shaft should be of a permanent nature, otherwise all operations in the mine are jeopardized, and should the walls cave and the ore which is broken in stopes be lost, it is a direct charge to income and should not be taken through the current costs.

If prospecting for ore proves its existence, then the expense of exploration should be considered as a deferred charge; if it does not prove ore, then the cost should be charged direct to income or profit and loss.

Development is a deferred charge and should be so considered. The main-shaft station, grizzly, and loading pockets are capital expenditures, and should be capitalized and depreciated. This can be done on the basis of number of tons hoisted, or on a percentage basis.

Drifts and crosscuts are usually considered as development; and raises and chute holes to a point of coning out are included under this head. Ore is usually recovered in development. It is reasonable to assume that the cost of tramming, hoisting, and milling ore received from development is the same as ore which comes from stopes, as the ore from the former and that from the latter cannot be kept separate, and therefore becomes mixed. So instead of keeping these costs separate—which costs are always an estimate based upon percentages—it is better to credit development ore at the breaking cost of the ore in the stopes.

Depletion

Generous reserves for depletion should be set up and credited to reserve for depletion, and charged to operating expense, and so shown on the cost sheet. The simplest and best method is to take the number of tons of ore that is in reserve, as calculated by a disinterested engineer, and divide the same into the cost of the property, exclusive of the amount expended for development, or for buildings and machinery. It is wise to be conservative in this matter, and not let the reserve be stated higher than that can be justified.

Retirements

Whenever a unit of equipment or building becomes obsolete or useless, and is retired, the proper account should be credited with same at cost. If the unit is sold, then the purchaser's account—accounts receivable—should be charged at the sales price. Reserve for depreciation should be charged for the depreciation set up on said unit of equipment, and operating expense either debited or credited for the loss or profit on the same. Sometimes it is advisable to create an account on the cost sheet, entitled 'retirements,' in order to keep this expense separate.

Depreciation and Obsolescence

Generous reserve should be set up for depreciation and obsolescence, based upon past experience. The Revenue Law allows the setting up of depreciation reserves based upon the theory that if the unit of equipment or building has been repaired, then it has not depreciated by that amount which was expended for repairs and maintenance in said period. Therefore, the depreciation rate should take this fact into consideration at the time of creating said rate, and the repairs and maintenance should be deducted in setting up the reserve.

There are only six sub-divisions of accounting necessary at a plant; these are: (1) 'Working Fund'; (2) 'Payroll'; (3) 'Stores (materials and supplies)'; (4) 'Shipping (product and miscellaneous)'; (5) 'Production Records'; and (6) 'Depreciation Ledger.'

[Mr. Diffenderfer's paper, of which the above is an abstract, included 13 forms of reports applying to these sub-divisions, but as it is impracticable to reproduce them, they are omitted.]

STANDARDIZATION OF METAL-MINING ACCOUNTING

By T. O. McGRATH, Bisbee, Ariz.

Even though a mining property be equipped with the best mechanical appliances, has an organization of high ability, and has employes imbued with the spirit of co-operation, the business cannot be intelligently managed without a knowledge of the results of operation and the condition of the business for each operating period, for each department, and for the business as a whole. Such information is obtained by proper accounting.

Accounting for metal mines consists of three main groups, namely, (1) General Accounting; (2) Cost Accounting and Statistics; and (3) Economic Accounting.

General accounting determines the condition of the business, and the profit and loss for each operating period. Cost accounting determines the profit and loss, and the variation in the cost of each department for each period of operation. Economic accounting determines which of several methods of operation is most profitable under different market prices of metal.

General accounting and cost accounting for metal mining have been fairly well developed during the past 10 years, but mostly along individual lines. So far, little has been done in economic accounting, although great savings could be made by it, especially during periods when there are wide fluctuations in metal prices.

This discussion will be limited to the fundamental principles of general accounting, and to recommendations for a standard system of accounting for metal mines.

General Accounting

I am well aware of the fact that no standard system of accounts can be devised that would be applicable to each separate department, due to different mining and metallurgical methods. However, there are certain basic principles that can be followed, upon which the accounting and cost structure can be built to obtain uniformity in the accounting and cost data for each operating unit having similar problems.

Chart I shows the fundamentals of the business of mining in the natural order that must be accounted for in any complete and correct system of mine accounts. The business begins with the capital investment. Production operations start with the disbursements of working capital, which are made in order that production may be obtained. This is followed by sales of the production in order that receipts may be created by delivery of the sold product to transportation agents, which in turn is liquidated by cash payments from customers, and this cash is used with which to meet new disbursements, and so forth. The business of operation continues to rotate through these five stages as long as there is production. At the end of each period, results of operations are shown in profit and loss, dividends and surplus, and the condition of the business is shown by a balance-sheet.

These accounting and business principles are uniform for all metal mines and the general accounting for metal mines could be standardized with the exception of the expense accounts, which would vary to conform with the different methods of mining and treatment.

Accrued or Cash Basis

In working out a system of accounts, the first matter that must be decided is whether the accounting shall be kept upon an accrued or cash basis. At the present time, most of the large corporations keep their accounts upon an accrued basis, which is necessary to obtain a complete and correct system of costs. Therefore we may safely state that the accrued basis of accounting has been accepted as standard in metal mining.

Standard Statements of Profits and Loss, and of Balance-Sheet

There are two accounting statements that are of vital interest to the officers, stockholders, and directors of each company; also to other units, and to the investing public. These are the income, or profit and loss statement, for the month and year, and the balance-sheet or statement of the condition of the business at the end of such periods.

There is no reason, except lack of interest, for not having these two statements uniform for all units. Some companies publish clear and complete statements of profit, and of the condition of their business properly grouped and arranged;

while the reports of others are so drawn and arranged that it is practically impossible, even for the officers, to obtain a satisfactory analysis therefrom. While there has been a great improvement in the form and nature of these two statements since the enactment of the income and excess-profit tax laws, there is no reason why these should not be further improved and made uniform for the whole industry. This could easily be accomplished by agreeing upon uniform grouping of the profit and loss statement, and balance-sheet.

If this were obtained, the results and conditions of each operating company could easily be compared with that of other units, and would be of great value to all concerned. In the past, the result of improper and incomplete statements of earnings has furnished the labor agitator with good argument with which to convince workmen that the organization by which they were employed could well afford to make unreasonable concessions, as well as leading the taxing commissions to believe that such mines should pay excessive taxes. Also one of the reasons for the lack of interest in copper has been attributed to the lack of proper presentation to the general public of the facts of the industry and its possibilities. To give the consuming and general public clear and concise facts would without doubt be of general benefit to the industry.

Cost Accounting

I do not believe that it is necessary to emphasize the need of proper costing; that is self-evident.

At the present time, metal mining includes mines, mills, smelters, and refineries, principally large units, employing hundreds, and in some cases, thousands of men. The saving or loss of a few cents per man per day in the use of powder, tools, and other supplies, and in 'dead' time of labor, or effort improperly expended, results in some cases in the difference between profit and loss, especially during times of low prices for metals.

Cost accounting in itself cannot obtain efficiency, but once efficient standards have been obtained in the different departments of the organization, proper accounting and costing will then show the variations from these standards and the source of the variation, enabling the manager, department heads, and

Principles of Mining Accounting

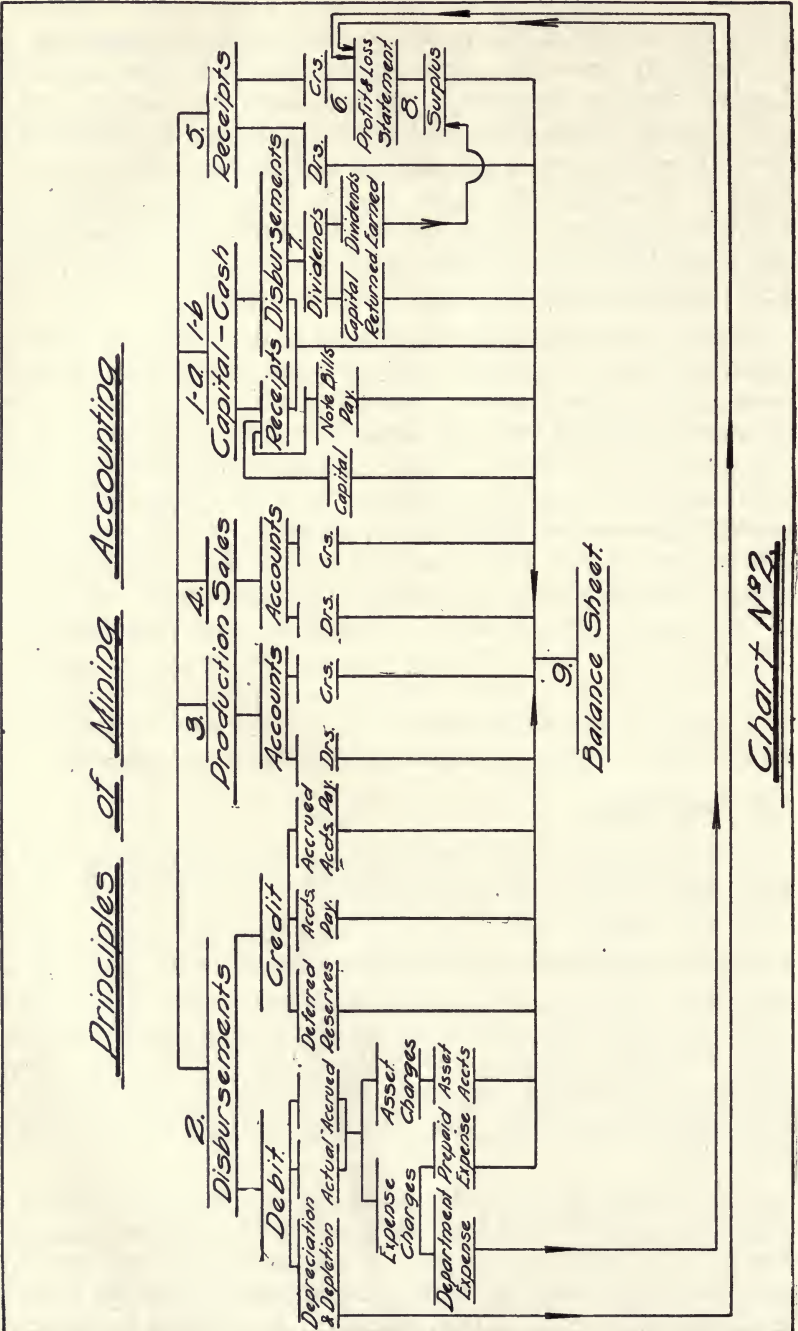


Chart No. 2.

others to correct immediately any deficiency or waste before that unit has become unprofitable.

I do not believe that it is necessary to emphasize the need of uniformity in compiling the accounts and costs by each company in metal mining. If each one compiled these in a uniform and correct manner, results in the various mines and plants having like methods and problems could be compared, and proper standards of achievement could be easier and more quickly determined. Such uniformity would tend to broaden the view and interest, and increase the co-operation among the different units of the industry, as well as to minimize personality and prejudice, not only among the superintendents of labor, but among the workmen themselves, who become prejudiced by the lack of uniformity in different mines or even in different divisions of the same mine.

Analyzing the Disbursements

Costing is concerned with analyzing disbursements and production. In order that the former may be correct and uniform, disbursements should be segregated into the different groups of expense, prepaid expense, and assets. The expense should then be segregated to each department, sub-department, and departmental unit. Production should also be segregated to each department and unit, so as to allow of the determining of the cost per unit of production or of operation.

In Chart II, entitled 'Operating Disbursement Accounts,' are all the disbursements segregated into expense and assets that are involved in the operation of a mine producing smelting ores. This chart does not show the administrative disbursements for expense and investments, as these are not generally under the direction of the manager.

This chart shows a complete record of all disbursements whether current or actual, accrued, and deferred. It is best to make up such a chart of disbursement accounts in order to insure that all disbursements are being recorded each month in proper manner. Also, such a chart fixes the matter more clearly in the mind, and acts as a guide and reference for those who perform the work of compiling and segregating disbursements.

Principal Costs

The present practice is to keep four kinds of costs, such as:

(1) Production; (2) Departmental Production; (3) Unit Operating; (4) Unit Construction and Equipment Costs.

Of course there are the estimated costs that are made up by the engineering department in connection with proposed new construction and equipment, against which the actual costs are checked. The production cost is obtained by dividing the total production into the items of expense appearing in the profit and loss account. In determining the departmental production cost, each department such as ore extraction, or mining, milling, smelting, etc., should be divided into sub-departments to conform to the actual organization and work in each of the departments. Then the expense of the department should be segregated to each of these sub-departments, and the expense for each of the sub-departments further segregated into at least six elements, namely, (1) Labor; (2) Supplies; (3) Power; (4) Repairs; (5) Replacements; and (6) Indirect expense.

By adding the amount of the expense of each element for each sub-department, the total expense for the department and for each element is obtained, and the dividing of the production of the department into the amount of expense gives the cost for each element for each sub-department, and for the department as a whole. By segregating the expense into these six elements, it is possible to trace the variations in costs from month to month, and informs the department head where and what to investigate. This method of determining the departmental production costs is already in general practice by several groups of mines. The differences are in the naming of the accounts for the different sub-departments, and in the dividing of the sub-departments; but these are matters that could be easily remedied.

The same method should be followed in determining unit operating costs except that the elements of labor, supplies, repairs, replacements, and indirect expense should be detailed into as many items as it is found necessary to enable the tracing of all fluctuations.

The unit operating cost is the cost kept on each operating

unit or sub-department, as for instance the cost of steam, air, electricity, cost of sinking, stations, drifting, raising, stopping, etc., and are figured upon the operating unit instead of upon the production unit for the department. It would be of great advantage to have such costs obtained uniformly by all mining units.

Methods of Determining Costs

There are two principal methods of determining departmental and unit costs: First, the Departmental Unit Method; and second, the Departmental Pro-rated Method.

The former is the dividing of each department into sub-departments, and these into units regardless of whether or not they are productive or overhead departments, and the segregating of the expense into the proper elements and the distributing of the expense to each sub-department and unit which is kept intact.

The second method segregates the departments and expense in a like manner, but further divides the sub-departments into productive and overhead and pro-rates the expense of the overhead departments to the productive departments.

This latter method is the one used by manufacturing concerns making more than one article for sale, when it is necessary to get the exact production cost for each article in order to determine the proper selling price. However, in mining, where there is only one principal product, with sometimes a by-product which is treated as a credit, the pro-rated method is not necessary, and only increases the amount of bookkeeping and segregating, and makes the costs more complicated and difficult to comprehend and analyze. The Departmental Unit Method should be the one adopted as standard.

Uniformity of Cost Determinations

While it is not probable that all unit and departmental production costs of metal mining will be standardized, nevertheless the industry could be divided into the several groups that mine and treat ores in a similar manner, and the cost for each of these groups could be standardized and determined uniformly.

At the present time there are possibilities of large savings in

fuel and power at most properties. It is only occasionally that the power costs are accurately determined. There are usually large wastes in the use of supplies and in the purchasing of improper supplies, which could be limited by correct cost methods properly presented.

The determining of boiler horse-power, the amount of compressed air, and of all power and other unit costs should be and could be made uniform. In some cases the drifting cost in one mine will be based upon the actual expense at the face of the drift, while in another mine in the same district this cost will include the pro-rated cost of overhead. This destroys the possibility of comparison and applies to all costs when compiled by different methods.

Uniformity in Compiling Efficiency Factors

Not only should the cost data of expense and production be compiled in a uniform manner, but the production factors necessary to determine efficiency should be uniformly kept. For instance, the shifts of men employed in a certain department or in a certain unit should be compiled in like manner each month, and for each unit of the industry, so that if there is any variation in the output the compilation will show the facts. The feet advanced per man-shift in drifts and raises, and tons obtained per man-shift in stopes, etc., as well as the methods of determining mill and smelter recoveries and losses, should be compiled by all companies in the same manner. This would enable one mine, mill, or smelter to determine quickly whether or not the efficiency of the men in its plant was equal to that of the employees in another plant, working with the same equipment and under the same conditions, and would enable the department heads and supervisors to ascertain whether or not better results obtained elsewhere are due to better methods, equipment, or efficiency.

During times of rapid advances in wages that are based on a sliding scale, as well as rapid advances in prices of supplies, the cost for one period may show a decline over a previous period, in spite of increase in wages and supplies, due to an increase of efficiency in the workmen. Also, during declining prices and wages the cost may show an advance in spite of the decline due to a loss in efficiency. Therefore, in order to know

positively the reason for increase or decrease in the cost for each period, the necessary production factors should be compiled, as well as the cost in dollars. This data should be and could be ascertained in a uniform manner by all units of the metal industry.

Necessity of Departmental Co-operation

Most of the metal produced comes from mines of large organizations. It is the tendency for each department of such companies to isolate itself from the others and to become prejudiced and indifferent as to the work of the other departments, and the business as a whole. When such a condition exists, it is difficult to obtain correct accounting and cost data, and to present in proper form the accounting and cost results for each department, and of the business generally.

Close association between the heads of different departments leads each to a broader knowledge of the business, and to value the viewpoint and to profit from the knowledge and experience of the others, as well as tending to eliminate friction and misunderstanding, and to develop breadth, consideration, tact, judgment, and the ability to co-operate and manage, to the benefit of the whole organization, as well as for each department.

Of course, it is the duty of the manager to co-ordinate the work of each of the departments, and to correct the extremes resulting from isolation. However, this is difficult to accomplish when there is not a close working contact between the departments, or when the manager has obtained his preliminary knowledge of the business as the head of an isolated department. The better the organization and working contact, the greater the benefit that can be obtained from accounting and costing.

In the mining business, as in other lines of industry, the matter of first importance in connection with an expenditure is whether it is profitable. This point is lost sight of more often than is usually realized, due principally to departmental isolation.

In some large organizations, thousands of dollars are expended each month in compiling accounting and cost data that

are never used except for a record, due to the fact that they are ready at such a late date, or in such a manner, as to be valueless to the heads of operating departments. This waste could be turned into a profit by correct presentation of costs and a closer working agreement between the different departments.

Uniform Determination of Sales Price

There is no uniformity at present in the recording of sales prices received for metals. For instance, in copper and lead mining, some small producers will show the price received for metal at the net figure received from the custom smelter; while some of the large producers will give as the price received the net price f. o. b. New York; and again others give the New York price less commissions; while others will show as the sales price the actual delivery price. This makes it practically impossible to compile accurate statistics of prices received for metals, and in some cases where the deductions of smelters or sales agents are ignored, the costs are incomplete and show at less than actual. This could be easily remedied by adopting the gross settlement price as standard.

Summary

A brief of the principal points of this discussion shows that there should be an earnest endeavor to obtain in metal mining the following:

- (1) A condensed standard form of profit and loss statement in correct order giving the actual results of operations.
- (2) A standard form of balance-sheet arranged in proper groups and in order showing the true condition of the business at the end of each period.
- (3) A standard system of expense accounts based upon the unit or control system, for each group of the industry.
- (4) Uniformity in the determination and compiling of production and operating factors, and of recoveries and losses for use in obtaining costs and efficiency.
- (5) A uniform method of recording sale prices received for metals.

In working to obtain standardization as above set forth, we should begin at the top and work down as far as practicable to carry out standardization of procedure without interfering with individual requirements, and then confine efforts to obtaining uniformity in determining production and operating factors used for costing or measuring efficiency.

I have tried to set forth the principal advantages that would accrue from such standardization. The reward of such an achievement is certainly great enough to justify our best efforts.

A STANDARD SYSTEM OF ACCOUNTING AND ANALYSIS OF COST OF PRODUCTION

Presented by T. T. BREWSTER, of the National Coal Association

The object of the National Coal Association Committee's* work is to propose a standard system of accounting under which all coal operators, so far as the particular circumstances of each case will permit, will classify their operating expenses for labor and material in the same way, to the end that true, detailed, and comparable statements of cost of production may be readily obtained; also that all operators shall make the same distinctions between capital and operating expenditures, so that the vital matters of depreciation and depletion and obsolescence may be treated with uniform consistency in accordance with law.

Preliminary Considerations

Before discussing the details of an accounting system, it is useful to emphasize the fundamental truth that every coal mine consists of: owned or leased coal deposits, plant, equipment, and development.

They all depreciate together as the coal is exhausted, for when the coal is gone, or the right to the coal has elapsed, the plant and equipment have little or no value and the development is lost.

Capital investment in a coal mine is not a permanent asset; it is only an outlay preliminary to the extraction of the coal; it is merely an advanced or deferred charge upon future income, which capital, if recovered, must be recovered with the current expenses of operation out of the proceeds of coal sold.

In coal mining, the exact unit for the measurement of work done is the ton of coal mined. It is also the exact unit for measuring depletion of mineral, wear and tear from use of equipment, and exhaustion of development. Development is a mere easement, the value of which disappears when the coal is gone.

*The Committee consisted of C. E. Backus, T. T. Brewster, W. M. Henderson, J. C. Osgood, and Erskine Ramsey, with W. B. Reed as secretary.

A coal mine being, as emphasized, made up of several elements, all depreciating as the coal is mined, such depreciation is composite, accruing at a rate concurrent with the rate of extraction. The necessary rate per ton being determined, the aggregate depreciation for any accounting period should, of course, as far as practical, be distributed among the various elements in proportion to their respective costs or value.

The doctrine that measures depreciation of coal mining plant and equipment in terms of time—excepting of course, some leasehold propositions—is fallacious, as tested by the further assertion that a completely equipped mine could be maintained indefinitely without depletion or wear and tear if no coal were mined, by minor repairs. Therefore, we insist, as a general rule—excepting some leaseholds—that the correct measure of the depletion and depreciation experienced in mining coal is the ton of coal mined.

After a coal mine has been developed and equipped to its planned output capacity, charges to its Capital Account should cease, and thereafter there will be few if any permissible charges to that account.

At the end of each month, Operating Account should be charged, and Depreciation and Depletion credited with an amount equivalent to the depreciation rate multiplied by the number of tons mined during the month. At the end of the year, Depreciation should be charged with the year's accumulation, and the respective elements of the mine written off in proper proportions. If, however, the operator prefers to allow total Depreciation to stand as a credit on the ledger, it should be exhibited in the Balance Sheet as a deduction from the cost of property. Irrespective of which way it is handled on the general ledger, the proper reducing entries should be made against each element of the property in the plant ledger.

In the case of mines operated under lease, if the leasehold rights run longer than the probable period required to exhaust the estimated available coal, the same factor of Depreciation applies; but if the life of the lease is shorter than the probable period required to get all the coal, the monthly charge to Operating Account and corresponding credit to Depreciation should be such proportion of the cost of the mine as one month is of the remaining term of the lease.

Funds representing Depreciation accumulations, if not periodically applied to the retirement of outstanding securities or obligations, should be kept liquid for that purpose or invested in assets distinct from the depreciating property.

Before any profit or net income can be realized, current expenses for labor and for material consumed, current repairs, replacements, and depreciation must be made good out of gross income. Hence, sound consideration of the nature of investment in coal mining or any other wasting industry dictates that all outlay must be classified and dealt with as follows:

(a) The initial cost of the mine in its entirety, chargeable to Capital Account—which must be redeemed by periodically setting aside, from current gross income, sufficient amounts to replace such investment within the life of the mine. It is obvious that the fund thus derived must be held inviolate for ultimate capital redemption, and if not applied immediately to the retirement of outstanding securities, invested in assets separate from the depreciating property or kept liquid in the business.

(b) The cost of additions and betterments, so large that such costs should be capitalized, must likewise be redeemed by setting aside from gross income adequate provision for reimbursing such cost during the life of the mine.

(c) To ordinary Operating Expense should be charged the cost of repairs and replacements of plant and equipment, and also cost of additional equipment necessary because of the extension of workings to maintain the normal output.

Distinction Between Capital and Operating Expenditures

The drawing of distinctions between capital and operating expenditures, in the accounting involved in permanent enterprises, is a favorite field for discussion among accountants, but in the case of coal mining or other wasting enterprises, experience teaches that the field for discussion, if indeed there be any, is extremely limited.

After a coal mine has been developed and equipped to its contemplated or possible capacity, it is a constant consumer of material and supplies and equipment, which, though nominally of a durable nature, are subject to destructive wear and tear,

by reason of the uses to which they are put, and all these appliances must be kept in repair to do their work or the output can not be maintained.

Mules and pit cars are constantly worn out, and have to be replaced, and as the working faces advance with the exhaustion of the coal, the length of haul, and consequent time of circulation of pit cars between the working face and dump increases, more motors, mules, and pit cars have to be supplied to maintain the output, and the more of these in the mine, the greater expense for replacements and repairs.

Also, with the advance of workings, more rails have to be laid and more copper wire or other conductors put up to carry power to the working forces to maintain the output. They remain in place until the mine is exhausted, and when they are recovered have but little net scrap value. In fact, any net salvage is relatively very small.

The fact that these expenses are continually recurrent and practically a fixed factor in the cost of production per ton from year to year, prove that they constitute an operating rather than a capitalizable expense.

Obsolescence

In addition to the provisions for depreciation and depletion to replace the capital sum invested in depreciable property and charges for ordinary working expenses, Operating Account should be charged with the residual value of property (after deducting depreciation, which has been or should have been charged, and insurance) that may be destroyed by catastrophe; also Operating Account should be charged with the residual value over accrued depreciation and salvage of any property discarded or that has become useless or obsolete before the end of the natural period of its usefulness.

Necessity of Detailed Analysis

If the only object of an operator's periodical statements were to exhibit the financial results of the period covered, or to contribute to general statistics, a short form with a few sub-totals and their extensions would be all required; but the successful solution of the problems facing the industry demands intensive management and economy, and as intensive

management means careful and intelligent attention to detail, analytical accounting is necessary.

The operating executive should have a report from each mine, which, read in the light of his knowledge of the property, will be a comprehensive narrative of what has been done, and reflect the physical conditions met with during the period covered by the report, and exhibit a clear statement of the cost of labor and material expended, classified in accordance with the natural sub-divisions of the work that has to be done in and about a mine, so that the economy and efficiency with which each thing has been done can be studied critically.

In the majority of cases, the natural sub-divisions of the work in and around a coal mine are as follows:

- | | |
|---------------------|--|
| 1. Mine office. | 10. Haulage and hoisting. |
| 2. Superintendence. | 11. Dumping and tallying. |
| 3. Engineering. | 12. Preparation. |
| 4. Mining. | 13. Railroad car loading and yard expense. |
| 5. Timbering. | 14. Power. |
| 6. Deadwork. | 15. Repairs to buildings and permanent structures. |
| 7. Tracklaying. | 16. Sundries. |
| 8. Drainage. | |
| 9. Ventilation. | |

To these sub-divisions should be distributed the items below:

Mine Office Expense—Clerk, bookkeepers, janitors, books of account, stationery, office furniture and supplies, telephone, light, heat, etc.

Superintendence—Wages of superintendents, bosses, mine examiners, watchmen, and all other direction and caring for the property in a supervisory capacity. Safety lamps, mine telephone, etc.

Engineering—Mining engineer, helper, engineering instruments and supplies, maps, blueprints, etc.

Mining—(a) Hand mining. Miners, helpers, shot-firers, etc. (b) Machine mining. In machine mines this item should be sub-divided into undercutting and pit-car loading. Undercutting should be charged with

- (a) Generation and transmission of power, that is, the proportionate share of cost of power generated and its transmission to machines (see note on power below).
- (b) Maintenance of machines, that is, repair parts, machine picks, cable for electric machine, and air-hose for air machines. Shop and repair-men employed on machines and labor of blacksmiths sharpening or making bits and such part of the time of head electrician spent in maintenance of machines.
- (c) Operating machines: To this sub-division should be charged the wages of machine runners and helpers, bit carriers, oil, grease and waste, oil-cans, hand picks, pick handles, jacks, machine-shovels, etc. If machines are not equipped with self-propelling trucks and the machines are moved about their sections by mule haulage, such haulage should be charged to operating machines.
Pit-car loading needs no comment.

Timbering—Though timbering is imposed by physical conditions and is closely incident to work at the face, it is a significant item, and should stand by itself. To this sub-division should be distributed wages of timbermen and helpers, the cost of props, cap-pieces, cross-bars and other timber used in advancing work, such cost including freight and the cost of unloading and handling at the mine, with the expense of preparing and delivering to the working face.

Deadwork—As every mine presents physical conditions peculiar to itself, no two mines being alike, and as the physical conditions fluctuate as the work progresses, in order to work out comparable statements and records, deadwork should be classified in accordance with its nature, such as yardage, premium for narrow work, shooting rock, lifting bottom, taking down top, stowing and dumping gob, cleaning up falls and re-timbering after them, handling squeezes, mine fires, or any other work imposed by adverse physical conditions.

Tracklaying—While track is immediately connected with and necessary for the transportation of coal to the shaft bot-

tom, and hence a necessary item incident to haulage, it has long been regarded as a significant item in the cost sheet, and should stand by itself.

To this account should be charged rails, ties, spikes, and fastenings, and the labor of grading roads and tracklaying in advancing work. Repairs to track should be charged to Haulage and Hoisting, under maintenance of way.

Purchases of track material should be charged to track material account, and as the material is taken into the mine it should be credited and charged Tracklaying.

Drainage—To this sub-division should be charged the cost of labor employed in connection with the ordinary removal of water from the workings of the mine, with the expense of repairs and maintenance of pumps, pipe-lines, drains; also the proper proportion of power used. In some regions and in deep mines the tonnage of water handled and consequent consumption of power is very heavy.

In the event of a flood or extraordinary inflow of water, the expense of recovering the mine or flooded workings should be shown as a special and separate charge to Operating Account.

Ventilation—To ventilation should be charged proper proportion of Power expense to represent power used in driving fans. If cross-cuts are driven narrow because of physical conditions, the yardage should be charged under Deadwork.

Labor and material used in closing cross-cuts, constructing overcasts, mine doors, curtains and brattice, should be charged to Ventilation; also expense of cleaning and repairing air-courses. Repairs and lubrication of fan and fan engine, pressure gauges, etc., should be charged to Ventilation.

While trappers are rendered necessary in connection with ventilating doors, their work is incident to haulage of coal, and their wages should be charged to Hauling and Hoisting under conducting transportation.

Haulage and Hoisting should be separated into

1. Generation and Transmission of Power; that is, the proportion of expense of generating power and the construction and keeping up of transmission-lines and haulage circuits.

2. Care and Maintenance of Equipment—(a) Hoisting and haulage engine repair parts, lubricants, packing and waste, and wages of hoisting engine-man and mechanics employed in care and repair. Hoisting and haulage ropes, cage repairs, and replacement; safety devices, guides, and sheaves.

(b) Care and maintenance of motors. When motor haulage is used, repair parts, and labor of care and repair.

(c) Care and maintenance of pit cars. Labor and material used in keeping pit cars in repair. New cars replacing wrecked or worn-out cars, also additional cars necessary to maintain output by reason of increasing length of haul after mine has reached its contemplated output capacity.

(d) Care and maintenance of livestock; such as harness and stable supplies. Grain and hay, and wages of stable-men and veterinary, clipping and shoeing, etc. New mules replacing killed or worn-out animals should be charged to maintenance of livestock.

3. Conducting transportation. Drivers, boss drivers, motormen, trip riders, couplers, cagers and pushers, oilers (oil and grease) trappers and switch-throwers, jackmen, and that part of hoisting engine-man's wages not charged to maintenance and repairs.

4. Maintenance of way; that is, repairs to roads, cleaning roads, relaying track, new ties, rollers for rope haulage, etc.

Dumping and Tallying—Top cagers, pushers and dumpers, weigh boss, check puller and track weighman.

Preparation—The proportion of power used in operating screens, crushers, elevators, conveyors, picking-tables, spiralizers, loading booms, etc., and the cost of the labor of attendants thereon, such as inspectors, dock bosses, sulphur and slate-pickers, and the labor of disposing of waste, all material and labor involved in the maintenance of repairs and replacements of such apparatus as is used in the preparation of coal.

If a washer is operated, such investment and its operation should stand by itself. The washer should be charged with the expense of operation, repairs, maintenance, insurance, and its proper depreciation, with the value of the raw coal passed through it, either at cost of production, or, preferably,

at the market value obtainable for raw coal, and credited with the out-turn of washed product.

If the result is a credit balance, it should be taken into operating income as net income from washer; if it results in a debit balance, it should be deducted from operating income as loss on washer operations.

Railroad Car Loading and Yard Expense—To this sub-division should be charged wages, of yard boss, car cleaners, trimmers, car riders, car haulers, brakemen, and all material and supplies used by them.

The expense of maintaining and operating mine tracks, if a switch engine is employed, or if switching is done by the railroad for which a special charge is made, distinct from the freight rate, the expense thereof should be charged to this sub-division.

Power—The generation and transmission of power is about the only expense about a coal mine that is not in total directly chargeable to some one sub-division of operating work. To it should be charged the wages of firemen, fuel-men, ash-haulers, water-men, pump-men, generator and compressor attendants, and such part of hoisting engine-man's and electrician's time, or other labor and material, as may be employed in the care, repair and maintenance of boilers, pumps, engines, generators, air-compressors or other power-generating machinery; wire and pipe used in transmission-lines, cost of water supply and all coal consumed, preferably at its market-value. The cost of coal to the operator for his own consumption is what he could get for it in the market. If an unmerchantable product is used under the boilers, it should be charged at its cost of production. If cost of fuel is not included in cost of power, the accounts do not exhibit true cost. The true cost should be before the operate to induce him to estimate the possibilities of effecting savings by improving his plant or boiler room practice; also to estimate the possibility of effecting economy by purchasing power of outside service companies, or through establishing central power plants. The tonnage consumed per annum under new boilers by large producers is very large, and the cost thereof should be clearly shown.

If outside power is purchased, it should be charged to Power.

Distribution of Power Costs

The expense of power should then be distributed to the different sub-divisions of Operating Expense, in accordance with the proportion of power employed in each section of the work.

Mining, under the sub-division Undercutting, should be charged with the proportion of power applied to machine operation.

Haulage and Hoisting should be charged under Generation and Transmission of Power, with its proportion of power-house expense, as represents the power used by hoisting engines and haulage engines and motors.

Under the sub-division Preparation should be charged the power used for shaker-screens, picking tables, etc.

Ventilation should be charged with the share of expense of power-house, in accordance with the power used for driving fans.

Drainage, with the proper proportion of power used in pumping water from the mine.

The above suggestion that the expense of power should be distributed to the various sub-divisions of the work may appear difficult to the accountant, and in small operations such distribution may be a needless refinement; and in such cases power may well be shown as an undistributed item of operating expense.

However, in large operations, the cost of power is a large item, and the making up of a heat and steam balance will not be difficult to the well-informed engineer or electrician.

The measurement of fuel and water and steam generation compared with the useful work being done, will prove fruitful in results. Such time and effort is well spent, as it leads to the detection of steam line leakages, engine cylinders and valves in bad condition, insufficient power circuits, bad track bonding, etc. The coal operator who wastes coal by overlooking preventable losses is like the merchant who consumes his own stock.

In his lucid and valuable book entitled 'Preventing Losses in Factory Power Plants,' David Moffat Myers well says:

"Just as the expert accountant is able to analyze the expenditure of one hundred dollars in a business enterprise and to show where some of them are wasted or mis-spent, and finally to strike a true balance between income and expenditure, just as truly and with as great a degree of accuracy a trained engineer may analyze and balance the expenditure of energy from the original one hundred per cent income or input, to the final machine horsepower hours of useful work, and in so doing he may point out where certain portions of this energy are mis-spent or wasted, and how they may be saved and converted into useful work.

"There does not exist a power problem that is not capable of solution by the intelligent application of these principles of analysis."

Repairs to Buildings and Structures—To this item should be charged labor and material used in repairs of permanent buildings and structures of the surface mining plant.

Sundries—Small and unimportant items of expense not easily distributable to the above sub-divisions of Expense.

Necessity of Contingent Reserve

In the case of permanent enterprises, the funds derived from charges to operating cost to cover depreciation and depletion are to replace plant and equipment becoming worn out or obsolete; but in coal mining or other wasting enterprises, the purpose of such fund is to replace and redeem the capital invested in the wasting assets, and such duty of redemption fully taxes the allowable charge for depletion and depreciation.

As a general rule, the buildings and major items of plant and equipment placed at a coal mine are calculated to last, and, with proper care and repair, do last the life of the mine, and therefore obsolescence of coal mine plant and equipment results more often from accident than by installation of new appliances. Depletion and depreciation are items of prime cost which can be measured with reasonable exactness and properly provided for by charges to current expense of operation; but coal mining is a hazardous business, and in some regions extra hazardous, and obsolescence being a contin-

gency, common prudence dictates, in order to avoid possible financial embarrassment, that there should be periodically reserved and built up from net income sufficient provision to meet any probable contingency. Such reserve is not an item of current cost, and therefore not deductible in determining taxable income, but the cost upon the realization of the contingency is a proper charge to current expense, and should then be so charged, and not be charged to contingent reserve.

The increase in current expense, by reason of such happening, will reduce current net income, and therefore a corresponding amount, or as much thereof as may be possible should be transferred from contingent reserve to Profit and Loss.

The general conditions existing, and the experience of any mine or mining region, will dictate to the operator the necessary provision for contingencies.

Though maintenance expense is practically a constant factor of current expense in coal mining, prudence also suggests in accordance with the peculiarities of each case the segregation from income of a maintenance reserve.

Balance-Sheet

This should show the exact details of the financial condition of the business and be, at the same time, an historical narrative of the enterprise. The value of the balance-sheet will be in exact measure of the time spent on its production and consideration. The more put into a balance-sheet, the more can be got out of it.

[A suggestion as to a pro forma balance-sheet was submitted by Mr. Brewster, but this has been omitted.]

Bookkeeping

In the foregoing, the principles of accounting have been touched upon, and it is unnecessary to write a treatise on bookkeeping, but it may be useful to refer to the main books required and to comment upon the action of the various operating accounts. The principal books of account are: General Ledger, Cash Book, Journal, Voucher Register, Sales Register, Coal Customers' Ledger.

The Ledger, Cash Book, and Journal need no comment.

Voucher Register—To avoid a multiplicity of ledger accounts, with miscellaneous creditors from whom material and supplies are purchased, the adoption of the voucher system is recommended. The Voucher Register appropriately ruled, both horizontally and perpendicularly to allow the entry of number, name of payee, what for, date paid, and the distribution under the different headings of the amount thereof to the account or accounts to which the items covered by the voucher are chargeable. At the end of each month the total footing should be credited to vouchers payable, and the footings of the various distribution columns charged to the respective accounts. Some accountants post to the General Ledger direct from the Voucher Register, but we recommend a journal entry and posting from the Journal.

Every cash disbursement should be represented by a voucher, and charged on the Cash Book to vouchers payable, with entry of the number of the voucher and name of the payee.

Payments should be checked from the Cash Book into the when-paid column of the Voucher Register; thus the controlling account in the General Ledger covering miscellaneous creditors will be vouchers payable, and the General Ledger balance of this account will agree with the total of an abstract of unpaid vouchers drawn from the Voucher Register.

Sales Register—In cases where coal is consigned through from the mine, a convenient form of Sales Register page is a manifest of billing with columns on the right-hand side, for the entry at general office of price and extension of amount, these pages to be carried in a loose-leaf binder until the end of the year, when they should be permanently bound.

The amount of each invoice should be posted from the sales sheet to the debit of the customer's account in the Coal Customers' Ledger. At the end of the month the total should be taken up in a journal entry, charging coal customers and crediting the coal sales account of the mine from which the coal is shipped.

As payments are received from coal customers, they should be credited to coal customers in the Cash Book. Names with

the amounts paid by each customer entered in "short." From the Cash Book should be posted the "shorts" to the individual accounts in the Coal Customers' Ledger; thus the controlling account in the General Ledger representing amounts due from coal customers will be coal customers, and the total balance of individual accounts in the Coal Customers' Ledger will support the balance in the General Ledger.

Revenue Accounts

Coal Sales—A coal-sales account with each mine to be credited with the invoice value of coal sales, as per Sales Register. To this account should be charged any freights prepaid and included in the invoice price, and any allowances and adjustments, and this account closed out monthly to the credit of Operating Account of the mine from which the coal is shipped.

Rent of Dwellings—These are credited with rents received; charged with the care, painting and repairs, taxes, insurance and depreciation; and are closed out monthly to the credit of Operating Account for the mine to which the houses belong.

Farming Operations are credited with the value of crops, timber cut, rents, if rented, etc.; and charged with labor and supplies, repairs to machinery and buildings, small implements, fertilizer, etc., taxes, insurances and depreciation. If the farm property is identified with a particular mine, close out to the credit of the Operating Account of said mine; or if not identified with a particular mine, close out to income account.

Washer Operating Account is credited with the proceeds of raw coal sent to the washer, labor and supplies, repairs to buildings and machinery, small tools, water-supply expense, taxes, insurance, and depreciation. If identified with a particular mine, close out each month to debit or credit of Operating Account of said mine. If a central washer plant, close out to Income Account.

Coke-Plant Operations are credited with proceeds of coke sold; and charged with value of raw coal sent to coke plant, labor in and about plant, repairs, material and supplies, small tools, taxes, insurance on, and depreciation of buildings. If identified with a particular mine, close out to Operating Ac-

count of said mine. If a central plant, close out to Income Account.

Mercantile Operations—If the store is identified with a particular mine, results of the store business should be closed out to the Income Account of such mine. If not identified with a particular mine, the results of the store business should be carried to Income Account.

Expense Accounts

General Expense is charged with the salaries and expenses of officers; directors' fees, legal expense, general office rent, books, stationery, telephone and telegraph; all other expenses of administration and maintaining corporate existence.

Close out by charging to the Operating Account of each mine with such mine's just proportion. This is generally prorated in accordance with the tonnage furnished by each mine.

Selling Expense—All expenses connected with the promotion and making of coal sales; advertising; salesmen's salaries as are dedicated to the selling department; books; stationery; printing; postage; telephone and telegraph; office rent; billing and collecting of coal customers' accounts.

Close out by charging to the Operating Account of each mine its proper proportion, usually based on tonnage derived from each mine.

Material and Supplies.—Vouchers covering purchases of material and supplies immediately used may be distributed direct to the debit of operating expense, but appropriate Material and Supplies Accounts should be kept of such materials as are carried in stock. For example, in many localities the purchase of props, cross-bars, and caps depends upon the season of the year, and not in accordance with current consumption, and in such cases a Mine Timber Account should be opened, to which should be charged the cost of timber, including freight and the cost of unloading and handling at the mine. As the timber is taken below it should be credited to Timber Account and charged to Operating Expense, with the expense of preparing and delivering to the working face under the sub-division Timbering.

The purchase of rails, fastenings, spikes, and ties for track-laying is always in anticipation of future requirements, and a Track Material Account should be opened, to which the cost of all such material should be charged, and as such material is taken below it should be credited to Track Material Account and charged to Operating Expense under the sub-division Track Laying.

The same may be suggested as to mining machine repair parts, but in operations where five or more mining machines are used, it will be found that there is little variation in the expense per ton for machine supplies from month to month, and so far as the general accounts are concerned, unless large stocks are carried, it will be proper to charge such supplies direct to Operating Expense, and adjust at the end of the year by comparison of the inventory at the beginning and end of the year.

Mine Operating Expense—An account with each mine to which will be charged all expenses for labor and material used in and about the mine, classified in accordance with the different accounts of work done, as recommended.

Close out by charging to Operating Account of the same mine.

Operating Account—An account with each mine to which will be credited the net realization of coal at the mine; other income belonging to such property.

Charge proportion of general expense; proportion of selling expense; transfer of operating expense; royalties; depreciation and depletion; general insurance, liability or compensation insurance; taxes, excluding income and war taxes.

Close out by transferring to Income Account.

Income Account—To be credited or charged with balance of Operating Account of each mine, results of coke plant; results of washer operation; interest received or accrued; all other income received or accrued.

Charge with contingent reserve; maintenance reserve; or other reserves; income and excess profits tax; interest paid or accrued.

Close out to Profit and Loss at end of the year.

Profit and Loss is credited or charged at end of year with transfer of balance of Income Account, and charged with dividends paid. The balance of this account to rest as profits applicable to dividends, and chargeable with the transfer of such amount as it is desired to transfer to permanent surplus.

Conclusion

In submitting the foregoing suggestions as to a standard system of accounting and analysis of cost of production, we fully appreciate that many operators have highly developed systems with which they are fully justified in being well satisfied, but we are sure that the advantages of uniformity of practice will appeal to them.

The many whose accounting methods leave much to be desired will derive the most benefit from adopting a proper system. They will know better how they stand, what they must have to cover their requirements, and proper accounting will help them to exercise the tenacity and perseverance requisite for the salvation of their capital and to win a proper return thereon.

An accounting system will not run itself, nor in itself reduce costs, nor increase efficiency; this is up to the operator himself; he must study and compare, vitalize the figures, and act on the facts they illuminate.

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