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RICHARD P. BOWEN, C.E., M.E., } Editors.
ROSSITER W. RAYMOND, Ph.D., M.E., }

Cable Address: "Rothwell," New York.

Books for review and all communications for the JOURNAL should be addressed, Managing Editor, P. O. Box 1833, New York.
Communications for Mr. RAYMOND should be addressed to ROSSITER W. RAYMOND, P. O. Box 1465, New York. Articles written by Mr. Raymond will be signed thus: "and only for articles so signed is he responsible."

London Office: Finsbury Chambers, 76 Finsbury Pavement, London, E. C. Mr. Thomas B. Provis, Civil and Mining Engineer, Manager.

Mexico: Mr. R. E. Chism, M.E., Callejon Espirito Santo No. 4, City of Mexico.

Peru, South America: Mr. John Newton, No 2 Calle Constitucion, Callao.

Australia: Mr. W. Forster, 56 Elizabeth street, Melbourne.

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AN illustrated price list of goods for export, and giving export discounts, is mailed with every copy of this issue of the ENGINEERING AND MINING JOURNAL sent to foreign countries. This price list is not distributed with our home circulation.

THE very interesting and instructive paper on "Cyanide of Potassium as a Lixiviation Agent for Silver Ores." published in the ENGINEERING AND MINING JOURNAL last week, page 548, should have been credited to Mr. LOUIS JANIN, Junior, instead of Mr. LOUIS JANIN (père). The paper would have done no discredit to the experienced engineer, Mr. LOUIS JANIN, but it reflects especial credit on his son, who, though young, is evidently an acute observer and an expert who has had a wide practical training.

THE statistics of production of copper, lead and zinc in the year 1888 and the reviews of the metal and stock markets for the same year will be published in the next issue (January 12th) of the ENGINEERING AND MINING JOURNAL.

Through the courtesy of all the mines, we have been able this year as heretofore to get full and accurate returns of both the production of the several metals and the stocks of metal on hand. We have even been favored with the European statistics, in addition to those of this country.

These reports will have immense value to all interested, either as producers, as dealers, or as consumers of the metals.

THE WEIGHT PER CUBIC FOOT OF DIFFERENT SIZES OF ANTHRACITE

In answer to an inquiry as to the volumes occupied by equal weights of different sizes of anthracite coal (and we are told a wager is to be settled by the information we give), we have been at some pains to obtain reliable figures.

Mr. WALTER JOHNSON, in his report, printed in 1844, on American coals, gives the result of his investigations under the direction of the United States Government. This was probably the most complete examination that has ever been made. He found that the average weight of anthracite in lumps was 53.05 pounds per cubic foot. He found for Beaver Meadow coals, 54.9, 56.3 and 55.1 pounds; for Schuylkill coal-Forest Improvement Company, 53.6 and 53.8 pounds; for Lehigh Company's coal, 55.3 pounds; for Lackawanna coals, 48.9 pounds, and for Lykens coal, 48.6 pounds.

The Lehigh Coal and Navigation Company have, with the utmost courtesy, referred our question to their Superintendent, Mr. W. D. ZEHNER, who writes, under date November 9th, 1888:

"We have taken considerable pains to obtain the weight per cubic foot of the different sizes of our Mammoth Vein coal. We selected seven gondolas that were in good condition, got the exact weight and cubic contents of each before loading, and the weight when loaded level with the sides of the body, with the following results: Old Company's Lehigh coals: Lump, 61.88 pounds; Broken, 61.09 pounds; Egg, 61.54 pounds; Stove, 60.67 pounds; Nut, 60.34 pounds; Pea, 59.88 pounds; Buckwheat, 61.78 pounds."

The discrepancy in the weight of buckwheat coal, Mr. ZEHNER thinks, is probably due to the fact that it was washed and had not had time to thoroughly dry.

Coal from the Wyoming and Lackawanna regions is lighter than Lehigh, as ascertained by Mr. JOHNSON.

It is rather curious that at this late day it should be so difficult to obtain reliable information on so important a subject. We shall be greatly obliged if those who have such information will furnish it to us.

THE ARGENTINE REPUBLIC.

The remarkable development of the last few years in the fortunes of this South American State, makes it worth while to consider its resources, and its prospects of future progress.

A few years ago it was considered prosperous in its way, and making steady advancement in material wealth, but the impetus that the country has received from the large immigration from Europe, and the liberal loans made to both the Federal and Provincial governments, principally for railroad and other public works, has been almost phenomenal. Formerly the country was considered as only suitable for cattle and sheep raising, and these industries have indeed attained enormous proportions, the number of cattle exceeding 20,000,000 and that of sheep, competing with Australia and New Zealand, being now about 100,000,000. The growth of these pastoral resources can be judged from the increased value of the exports, in 1873, the total value of such exports being little in excess of \$41,000,000, while now it cannot be much short of \$60,000,000. In addition to this there is a large export trade in dead meat, about 7000 sheep being shipped weekly to Europe in refrigerator compartments of steamers. But the railroad development and immigration have shown the greatest effects on agricultural resources.

In 1880 the Republic imported 1330 tons of wheat, and for the few preceding years there had only been a trifling surplus for export; but since 1881 the increase in the export of this produce has gone on rapidly and steadily, from 14,070 tons in 1881 to 237,865 tons in 1887, while the amount available for export in the early months of the current year is calculated at 240,000 tons, in addition to a surplus, for export, of 400,000 tons of corn, 100,000 tons of linseed, and 40,000 tons of hay.

This is a matter of interest to our farmers, for the limit of productive capacity in the Argentine Republic is far from being reached, and we may look for a greatly increased export in the next few years as the result of the immigration which in the last few months has attained the figure of about 250,000. This sister republic bids fair to be a serious competitor in agricultural products with the United States the European markets.

THE EXPORT EDITION OF THE ENGINEERING AND MINING JOURNAL.

The immense progress made in this country in the mechanic arts has created an interest throughout the whole world in the products of American ingenuity and a desire to know the most advanced fruits of American experience in manufacturing, mining, metallurgy, electricity, hydraulics, and in general engineering practice. As a consequence, as well as a promoting cause of this interest, the *ENGINEERING AND MINING JOURNAL* has found a home in nearly every part of the habitable globe; from Siberia to New Zealand, from Greenland to the Cape of Good Hope, from Alaska to Terra del Fuego, it finds those anxious to know all about ingenious American labor-saving appliances and American engineering practice.

It is true that our home markets have been so profitable that our manufacturers have devoted but little attention to cultivating a foreign outlet for their goods, and it is a fact that foreign markets have sought this country rather than that our manufacturers have sought foreign markets, yet in spite of this want of well directed efforts on the part of our exporters, the value of our monthly shipments of domestic manufactures amount to about \$12,000,000, or about 21 per cent of our total exports, the products of the mine are about 8 per cent, and those of agriculture about 70 per cent. The exports of manufactures of wood amount to nearly \$2,000,000 a month, and of machinery and hardware we export also nearly \$2,000,000 worth a month.

These are but a few examples of what we are doing practically without any efforts. What may we not do with well-directed efforts—not the least of which consists of judicious advertising. In view of the many advantages which have come to American industry through this wide foreign circulation of the *ENGINEERING AND MINING JOURNAL*, it has been decided to devote much greater attention to this fruitful field, and in order to do so, to publish a special monthly export edition of the *ENGINEERING AND MINING JOURNAL*, which shall be devoted to the extension of the foreign markets for American manufactures of all kinds, tools, hardware, agricultural implements, railway, electrical, hydraulic, furnace, mill and mining machinery and supplies, and the innumerable articles of American manufacture or production that may find a foreign market.

The field covered by the *JOURNAL* will be greatly enlarged in this monthly issue in order to give it the greatest possible value to both our manufacturers and producers and to the large foreign constituency it will address.

The excellence of American goods and of our countless ingenious labor-saving devices, and their special adaptability to the wants of the Colonies, quickly find markets for them when they are brought to the attention of foreign consumers. In this *EXPORT EDITION* it is proposed to offer the means of doing this in the most efficient and economical manner possible.

THE PROPOSED DUTY ON LEAD ORE.

The duty which it is proposed to levy on lead ores was stated by us last week as 1½ cents a pound on the contained lead, which would amount to \$7.80 to \$9 a ton on the Mexican ore imported, since it carries from 26 per cent to 30 per cent of lead. This, at least, has been our understanding of the proposed enactment, but we have received communications from some of our smelting works stating positively that the proposed enactment contemplates a duty of "1½ cents a pound on lead ore;" that is, \$30 a ton on the ore, whatever its contents in lead.

It is of the utmost importance that the meaning of the law, or proposed law, be clear. We believe that 1½ cents a pound on the contained lead is higher than is required in the interest of our mines and smelters, while \$30 a ton on the ore would be absolutely prohibitory.

There is no good reason why lead in ore should not pay a fair duty, while copper in ore has to do so whether it be the metal of greater value or not. It may, however, well be questioned whether the duty, in either case, is of material advantage to this country.

Owing to the great degree of perfection which has been attained by American metallurgists, we can, and do, smelt many ores as cheaply in this country as in any other part of the world, even though we pay very much higher wages than are paid elsewhere. An interesting example of this is given on another page in the description of the New Almaden Quicksilver Works of California.

In copper we have for years produced more than we consume, and have, consequently, been exporters. The price here has, therefore, come to be regulated by that of London. We import a certain quantity of foreign ores, which are smelted here and the copper exported, or it takes the place here of copper that finds a better market abroad. The quantity of copper brought in in foreign ores is much less than the amount of copper exported, and does not, therefore, affect the market, while it gives employment to many people, directly and indirectly. The smelting consumes coal, the imported ore requires fluxing ores which are mined here, and by increasing the business done it reduces the cost of smelting our home ores.

The case of lead is different. Up to this time we have imported more lead than we exported, though we have now arrived at that stage of de-

velopment of the industry where we can produce at home more than we can consume. And whether we admit lead in foreign ores free or not it is evident that the price of lead hereafter is to be regulated by the cost at such a number of our most economical producers as will supply the market.

It is claimed that the same price is paid for the lead in Mexican ore that is paid for that from our own mines, which would bring the cost of lead at the smelters the same in each case. It is certain that no higher price would be paid; so that if a moderate duty were imposed some of this ore might still come in, but the Mexican miner would receive less for it.

A duty of 1½ cents a pound on the ore, whatever its contents in lead, and even 1½ cents per pound of contained lead, would effectually stop all imports. We do not, however, believe it would greatly affect the lead market, which with 3.75 or 4 cent lead will be overstocked by our home production.

HOW TO OPEN NEW MARKETS.

The right method of introducing American manufactures into the Australian Colonies, Mexico, South America, India and other foreign markets, is a very important question to our manufacturers, but we fear is little understood. We will take, for instance, the case of the Australian Colonies, being among the most important of these markets, the value of the exports and imports in 1887, as we stated in our issue of December 22d, having amounted to \$539,035,000.

Many manufacturers take great pains to find out and establish business relations with a good house to act as their agent, and having done this, believe that their part of the work is finished, whereas this is simply the first move to be made towards capturing the market.

Australia has a greater area than the United States, and the means of communication by railroad are far inferior to those existing here, in addition to which the firm carefully selected for its standing has probably the agency for fifty or perhaps a hundred other foreign houses and manufacturers. What would we think of foreign manufacturers expecting to reach the San Francisco, or even the St. Louis or Chicago markets, by appointing an agent in New York, Boston or Philadelphia. The Australians have shown themselves quite ready to use American appliances and appreciate their first-class workmanship, for there is not a people in the world with less prejudice; yet introducing our wares to them is not like sending them into an unsupplied market. What we are only slowly awakening to has long been appreciated by the merchants and manufacturers of England and Germany, and from them and their agents, who are often specially appointed to attend to the interests of one concern alone, a most active competition is to be looked for. They do not sit down, having appointed an agent, and wait for the trade to come to them, but they follow up the establishment of the agency by personally pushing and advertising and making known their goods, not in one port alone, but in all the principal cities. This is what our manufacturers must do also, if they expect to reap fully the profits to be obtained by extending their foreign markets.

Another important thing which is often neglected to the ultimate loss of the exporter is the importance of ascertaining beforehand the best way in which to present the articles for sale. There is always a certain amount of custom and fashion which may appear of little real importance, but which must be complied with. We have before us a letter from one of the leading houses in Brisbane, Queensland, which illustrates this. Our correspondent says: "A few years ago hams were shipped from America to this country direct in large quantities, but as they would not pack to suit the trade, they are now being shipped to London, re-packed, and sent out here as English hams."

To show what a wide field there is in the articles in which they have already shown a preference for those of American manufacture, we may mention wood-working machinery, American band saws, machinery for working tin-plates for preserved meat and fruit cans, mining machinery, rock drills, diamond prospecting drills, locomotive and stationary engines, bridges, pumps of all kinds, builders' hardware, lawn mowers, cheese-making machines, kerosene oil, axes, agricultural machinery, carriage material, tools of all kinds, picks, saws, shovels, castings, stoves, ranges, washing machines, sewing machines, and many other articles.

It is with the object of making the excellence of American manufactures more widely known, and thus promoting the extension of American trade, that the *EXPORT EDITION* of the *JOURNAL* has been established, and that our services are offered gratuitously to those desiring information concerning any article whatever manufactured in this country.

THE FAIRY TALES OF SCIENCE.

This is the season when we usually hear the loudest lamentations over the ruin which Science has wrought upon Poetry. The children of to-day, it is mournfully declared, have lost their fairies, magicians and giants—above all, their Santa Clause—and with them, the romance of childhood. It may well be doubted, whether the children have really lost any of

these things. Our observation has been, that children intuitively understand "make-believe"; that they are not at all concerned to establish the historic truth of a story that interests them; and that they give themselves up to the pleasures of the imagination, with a deliberate suspension of the reason—which is much more sensible than the practice of grown people.

But the destruction of Christmas superstitions, if it be assumed to have taken place, is not the death of genuine inherited beliefs, but the natural collapse of a monstrous artificial structure. These lovers of antique myths, who complain of the iconoclasm of Science, have been engaged for a generation in heaping together the most incongruous materials from all quarters. St. Nicholas from one country, Knecht Ruprecht from another, Kriss Kringle (*i. e.* the *Christkindl* or Christ-child), the Christmas tree, the "waits" and carols (reminders of the shepherds and the Magi), the yule-log, holly and mistletoe, have been piled on one another, and pieced out with the giving of Christmas presents in straightforward human fashion, until the Celtic-Saxon-Dutch-German-Medieval-ecclesiastical conglomeration must needs break down, Science or no Science.

We do not care at this time, however, to inquire how much is gone, or why it went. Let us rather emphasize what has been added to the materials of Christmas pleasure for the little ones, by the Science which is popularly supposed to have killed Romance. Our attention has been called to this point by the reports in the Philadelphia papers of a novel entertainment given on the 27th of December to some four hundred children, in the Franklin Institute of that city, by Dr. PERSIFOR FRAZER. It began with an "unscientific" talk about various wonderful things in nature: metals that were light or liquid; that would take fire, even in water; gases and liquids of curious behavior, etc.—all illustrated, as the simple, fascinating talk went on, with brilliant experiments. Then the curtain in the background rose upon a Christmas-tree, from which each member of the juvenile audience received a gift. We are much mistaken, however, if the fairy-tales that went before were not a greater delight than oranges or candy or toys. No matter what botanists may pretend, these latter fruits of the Christmas-tree are really chestnuts; but the stories that "dame Nature, the good old nurse," tells now-a-days are newer than Mother Goose.

This festive use was not unworthy of the famous old Franklin Institute, which has done so much in sober ways for the advancement of knowledge and of the useful arts. It is surprising, by the way, that the value of this institution is not more clearly recognized in Philadelphia. If concurrent accounts be true, the citizens of that goodly town are content to be proud of the Franklin Institute, very much as a man might be proud of his grandfather, while the old gentleman falls before his eyes into the hopeless decay of age. But the analogy is a false one. An institution with a glorious record and a noble purpose ought to be perennially young. At least (if we must keep the figure) youth can be maintained by the introduction of new blood. The difficulty with most of the respectable old foundations in this country is merely this: that they are not adequately endowed for the demands of the present time.

Thus, the philanthropic Mr. GRAHAM, who founded the Brooklyn Institute with a legacy of \$30,000, was supposed to have done a munificent thing; but that very useful institution almost died, as time went on, for sheer lack of means whereby to live. Within the last year, however, it has been taken in hand by public-spirited citizens of Brooklyn, and has already become (though without the needed large endowment, and only through the more modest co-operation of many) the center of science in that great city, the headquarters of nearly all scientific societies, and the scene of constant discussions, lectures and re-unions of scientific men.

This, and more than this, might be done in Philadelphia for the Franklin Institute. It is a pity that Dr. FRAZER'S Christmas-tree did not bear something for the benefit of the time-honored roof that sheltered it.

THE BRITISH GUINEA-PIG.

Where the expression originated, Heaven only knows, but it is so trite and truly descriptive of the genus to which it has been applied, that it has come into common use, and the expression "he's a guinea-pig" is looked upon in the city as just as legitimate as "he's a broker," or "he's a banker."

A "guinea-pig" is a director of a limited liability company, who, for the small consideration of one or more guineas per meeting attended and the necessary qualification in the shape of shares, allows the promoter of such company the use of his name and services in his appeal to the public for support by prospectus and advertisement, and subsequently as one of the puppets in the farcical show of management, whose strings are pulled by the invisible promoter.

Guinea-pigging is a profession, and to successfully follow it requires certain qualifications. A man cannot rise from the lower classes to the position of a "guinea-pig"—he must be born to it. It is a monopoly of the aristocratic pauper of the day—a birthright sold for a mess of pottage. It

is necessary to possess a name that will look well on a prospectus, and if a title can be added so much the better. Army titles are rather at a discount just at present, the "Colonels" and "Majors" especially having been used a little too freely. "General," however, stands pretty well. Also an address that sounds round and full, and is indicative of prosperity, such as "Beauchamp House, Beauchamp Square, W.," or "The Willows, Cheltenham." If in Ireland, in order to have the desired effect, it must be a "Castle." Membership of some good club adds strength, if judiciously used, but club addresses are not good form.

These are the outward and visible signs needed for the prospectus by the promoter as evidence to the public of the respectability of the endorsement to his enterprise. Beyond this the "guinea-pig" should possess certain personal qualifications. A genial, but at the same time subdued manner, such as well accords with the cheerful performance of the responsible business of a Board Room. He must be gifted with an abiding faith in the integrity of the promoter, and accept all that is suggested from that quarter as unquestionably in the best interests of the company. All desire to question or inquire into any matters pertaining to the business of the concern, except such as appears on the "Agenda" at board meetings, must be promptly suppressed, otherwise a coldness might spring up between himself and the promoter. The company's solicitor is invariably consulted in matters of resolutions where the question of the legality of the action of the board is concerned, and the guinea-pig relies upon his opinion.

It might be supposed that a knowledge of mercantile accounts and business methods would be of assistance to the "guinea-pig" in the pursuance of his calling. On the contrary, if displayed, it is detrimental to his position and embarrassing to the officials of the company. The secretary keeps a correct account of all meetings attended. The "guinea-pig" is financially interested in this portion of the company's business, and this only, and no objection can be raised to his keeping tally and collecting his fees as promptly as he can.

The "guinea-pig," if he is not identified with and wear the livery of any special promotion ring, generally works through some firm of city solicitors who make the incorporation of companies a specialty, and his name is suggested to the promoter through that source. Or he may be approached at his club through some member who has connections in the city.

When the suggestion is first made that he should go upon the board, the guinea-pig displays a becoming reluctance, a disinclination to add to his responsibilities only to be overcome when the promoter has suggested an adequate recompense in qualification shares and fees. Being a "rodent," the guinea-pig by instinct deserts a sinking ship, generally managing to realize upon his qualification shares before resigning.

In the humdrum business of manufacturing or merchandizing the guinea-pig cuts no figure. It is in speculative ventures with imaginative prospectuses that he is chiefly of service; and so common has the practice of using "guinea-pig" boards become that in one half the prospectuses issued the names of the directors are as much guide to the responsibility of the undertaking as are the names subscribed to the memorandum and articles of association.

It is due to the incapacity, or worse, of boards so formed that the British public are bewailing many disastrous investments in this country, for which they unjustly hold Americans responsible.

Let it be understood that in giving a description of the particular class of company director that has become notorious under this title, the remarks made are strictly confined to him.

THEORY AND PRACTICE.

Between the dogmatism of the theorist and the dogmatism of the practitioner, there is merely a difference of degree. Theory is prophecy, practice is experience; and if the practitioner were content to speak as such, he would be generally right when he contradicted the theorist. It is when he also begins to prophesy—in other words, when he becomes a theorist—that he becomes dogmatic, and, if his theorizing is based on his own limited experience only, without regard to the recorded experience of others, his prophecy is less reliable than that of the theoretical non-practitioner; since a wide induction, based on a large number of observations, even though these be affected to some extent with error, is safer than a more vigorously logical and accurate one, based on more precise but fewer observations. That the amount of intellectual or so-called "theoretical" training which will enable a practitioner to avail himself of the observations of others, and realize the true proportional value of his own, gives to the education of practice its highest value, need not be said. "Theory and practice, one and inseparable, now and forever!" has been the Websterian motto of orators on technical education since the geyser of oratory on that subject first broke forth.

The discussion has not been unfruitful. Ingenious experiments in technical education have been tried in many quarters, with varying success; but the net result has been a decided improvement in the pro-

professional ability of our engineers, and the development of a desire to tell and to hear the results of experience, together with a capacity to appreciate them and reason upon them: in other words, the creation of an intelligent professional public, which not only recognizes genius and achievement in the few, but accumulates, from the more modest contributions of the many, the energy for organized and consolidated progress. No one can more clearly perceive this beneficent change than one who, like the writer of these lines, being at once editor of a technical journal, and secretary of a technical society, is witness and medium of the active interchange of observations and ideas which constitutes the organic life—the blood-circulation—of great professions.

Without undervaluing the contribution to this progress made by the schools, in their various attempts to combine practice in laboratory or shop with instruction by means of books, lectures, and recitations, such an observer is forced to recognize anew the old fact, that life is the great educator of practice; and that this part of school-instruction must always remain a subordinate one—scarcely more than a device for bridging over the first year or two of a graduate's career. How to give our young men a start, in a business which demands practical skill of some sort at the outset, has been the problem, important enough, but not supreme. For life, with its continual instructions, sharp rebukes, examinations unerring, and verdicts beyond appeal, gives a course in practice to which admission can always be had, sooner or later, by him who is determined to get it. The engineering professions have simply passed through the period of excessive demand and insufficient supply, in which eminence was often gained with demoralizing rapidity, and have taken their place among other occupations, requiring patience, industry, fidelity and real fitness, as the conditions of success.

We have been interested to watch, during the last dozen years, the effect of the systems of different American schools upon the careers of their graduates. So far, it has been impossible to pronounce any one system superior to the others in this respect. There are certain teachers, whose pupils find employment with relative ease in their special departments. But they begin in subordinate positions, and rise or fall or remain stationary according to their character, capacity and ambition, not according to their previous shop- or laboratory- or field-practice. A recent letter from the head of a large technical establishment (himself a school-graduate), seeking a suitable assistant, contained in substance this significant passage:

"I don't care whether he does or does not understand already the work I want him to do. If he has the right character, and the habit of accurate and faithful work, and the necessary theoretical preparation, he will learn fast enough, and when he has learned, will be both valuable now and qualified for promotion hereafter, if he cares enough for it to earn it. But I have no time to waste in teaching principles or correcting careless habits."

As we have explained, we do not mean to discourage in any degree the efforts of our friends in the technical schools to impart, together with their training in theory, some of the benefits of practice. On the contrary, we desire, while we utter a mild warning against the unnecessary sacrifice of the former to the latter, to bid them all take courage from the unquestionable fact that, somehow or other, as the result of many causes, and as an illustration of the survival and domination of the fittest, their graduates are everywhere coming to the front, and already control, to a remarkable extent, the technical industries of the country.

As these technical professions become more and more crowded, their opportunities and rewards will be given more and more to character than to attainments or skill only, or rather to these when combined with moral qualities. A great inventor and manufacturer once said to us, "I can find twenty men who know enough to set up my machinery where I can find one whom I can trust to do it." And the manager of large mining and metallurgical operations wrote us some years ago,

"There are in our business smart men and honest men, but the smart are too often not honest, and the honest not smart. From a business point of view, there is little to choose between an agent who gets the advantage of everybody, his employers included, and one who, in perfect loyalty to his employers, lets everybody else get the advantage of them. One empties my pockets to line his own; the other empties my pockets without lining his own. What I want is a man with the ability to be, and the principle not to be, a rascal!"

This humorous complaint, we are happy to believe, has less foundation in fact to-day than it had when it was uttered. The standard of professional honor, as well as of professional ability, has been raised; and the real esteem and confidence bestowed upon engineers has been correspondingly increased.

Another beneficial result will follow, in the ultimate selection of professors and instructors from the ranks of the school-graduates who have become veterans in practice, without losing the wider views and powers gained through discipline in theory. In fact, these are the only practitioners who can effectively teach. Practice alone is not communicable; nor, except by means of theory, which is, after all, but a compact way of stating facts, can the results of practice be imparted. But of thoroughly educated and practical engineers a small proportion only possess the gift, or feel the impulse, to teach. As the aggregate increases, this proportion will become more nearly adequate to supply the demand for such instructors; and the result will be, shop or no shop, that the wisdom of experience will be infused into the logic of theory, to

the great benefit of the young student. As a general rule, thus far, our best engineers cannot afford the pecuniary sacrifice involved in the acceptance of such positions; and it is mainly foreigners who are both qualified and inclined to do so. In rare instances, a foreign engineer or metallurgist, thoroughly schooled in the beginning, and enriched with a wide experience besides, is also familiar with American conditions and methods, speaks English with fluency and accuracy, and has the gift of imparting knowledge. Perhaps no combination of qualities in an instructor could be better than that. We have in mind a letter lately received from a man of this type in Germany, one of the most thoroughly accomplished mining engineers we ever knew, who intimates to us, that, after many years of active practice in every quarter of the globe, including a creditable career in this country, he has become, at mid-life, weary of the mere accumulation of experience, and willing to settle down to the quieter work of instruction. Such a man would be worth more than all text-books, to teach *the theory of actual practice*.

To return once more to our main proposition. The experiment of technical education in this country is working well, and its friends may feel themselves encouraged to perseverance in the culture which has already begun to bear such fruit. Let them only see to it, that intellectual and moral discipline are not subordinated to manual training. For what we need is men who can plan as well as execute, exercise influence as well as skill, deal successfully with unfamiliar as well as familiar conditions, be the creators as well as the products of practice.

CORRESPONDENCE.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested. All letters should be addressed to the MANAGING EDITOR.

We do not hold ourselves responsible for the opinions expressed by correspondents.

Metamorphism in Rocks.

EDITOR ENGINEERING AND MINING JOURNAL:

Sir: I think Mr. Carl Henrich, in his interesting letter in your issue of December 1st on the metamorphism of rocks, underrates the amount of attention which geologists pay to the action of water at high temperatures and pressures, and is a little mistaken as to absence in geological literature of sufficient consideration of some of the points to which he alludes. If he will look into Professor Reyer's "Theoretische Geologie," published this year, he will, I think, find a very full consideration of the questions as to access of water to rocks, conditions of pressure and temperature as bearing on such access, and effects which it will bring about.

W. M. HUTCHINGS.

DEE BANK LEAD WORKS, BAGILLT, North Wales, Dec. 20, 1888.

Kansas City Smelting and Refining Company's Suit.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: My attention is called to an item in the ENGINEERING AND MINING JOURNAL of the 29th ult., page 555, stating that "it is reported the Kansas City Smelting and Refining Company has instituted suit against N. Corwith & Co for \$213,000, the value of lead sold to him," and also for \$48,000 damages resulting from violated contracts. This statement as to the \$213,000 is an entire mistake. No suit whatever has been begun by the company against Corwith for the value of lead; nor does Corwith owe the company any sum whatever for lead sold him. The only suit brought by the company against Corwith is the suit for about \$48,000, for damages claimed by reason of Corwith's refusal to take lead tendered him under contract. Please make this correction in your next issue, and oblige.

Very respectfully yours,

N. WITHERELL,

Vice-President of the Consolidated Kansas City Smelting and Refining Company.
NEW YORK, Jan. 3d, 1889.

Wiswell Amalgamation Process.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: The following description of Prof. I. C. Wiswell's new process of amalgamation for gold and silver ores may prove of interest to some of your readers.

The plant, which is in operation at Chelsea, Mass., consists of the following: A Wiswell ore pulverizer, ten horse-power engine and boiler, small Kimball & Davis dynamo electric machine, mercuric bi-chloride generator, mixing tub, amalgamating pan, furnace, retorts, etc., for retorting the amalgam.

This plant is capable of handling ten tons of ore per diem of ten hours, and by increasing the number of mixing tubs, can work a larger amount.

The mixing tub consists of a vertical iron barrel supporting a framework, through which passes a vertical revolving shaft, on the lower portion of which are projecting blades, whose object is to intimately mix the pulp and bichloride of mercury solution, which is placed in the barrel. The shaft is insulated from both framework and barrel, and carries on it a thick composition ring against which presses an ordinary commutator brush, to which the positive wire from a small dynamo is attached, thus making the shaft and blades the anode; the barrel, to the bottom of which the negative wire is attached, forming the cathode.

The amalgamating pan is of iron, and has a set of inclined blades for thoroughly mixing the mercury with the pulp; in front of the blades iron balls are placed to assist the process.

In the mouth of the pockets are placed large copper plates, through which a current of electricity is passed while the contents of the pan is being discharged. They are called "electric rifles," and their object is to collect any fine gold or chloride of mercury that might otherwise escape.

The bi-chloride of mercury generator consists of the passage of an

electric current through a solution of sodic chloride and hydrochloric acid in which is placed a cup of mercury, which is made the anode.

In the run I witnessed 450 pounds of pulverized talcose slate ore, from a North Carolina mine, was placed in the mixing tub and a generous quantity of the mercuric bichloride solution added, and an electric current of about twenty-five amperes and four and one half volts turned on for about fifteen minutes. The action of the electric current was to set free chlorine, which being in a nascent state, immediately attacked any particles of gold present, and converted them into the chloride, in which state they were conveyed to the amalgamating pan.

The amalgamating pan contained twenty-one pounds of mercury; the pan was rotated for half an hour and its contents discharged over the electric riffles.

The fire assay of this ore averaged about \$10 per ton, and the result of this run gave \$3.27, which speaks for itself, especially so as by no other process has it been possible to obtain but little, if any, over \$1 per ton from this same ore.

This process has one thing decidedly in its favor, and that is cheapness; the chemicals used are inexpensive, and the labor required is slight, while the cost of the whole plant, capable of working 100 tons of ore per day, should not exceed \$10,000.

JAMES BLAKE CAHOON, Electrical Engineer.

BOSTON, Mass.

[We think the evidence is wanting of the alleged "action of the electric current to set free chlorine, etc." Also it can hardly be accepted as proved that "by no other process has it been possible to obtain but little if any over one dollar per ton from the same ore." On the whole, our correspondent makes statements that need much proof.—ED. E. AND M. J.]

Gold Discoveries in Batopilas District.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: During the past year there has been considerable excitement in regard to the discovery of gold in this vicinity, in what is known as the Cerro Colorado or Red Mountain, situated about five miles to the north of the town of Batopilas.

The mountain is about a mile long, in a direction extending east and west, by three quarters of a mile broad. The highest point of the mountain has an elevation of about 5540 feet. The general mass of the mountain seems to be a metamorphic porphyry of a grayish color, strongly impregnated with red oxide of iron, while streaks of brown and yellow hematite, as well as black oxide (specular iron), are also to be found. The principal deposit so far discovered is in what is known as the San Gabriel mine, owned by the Señores Becerra Hermanos, and is worked by a number of short tunnels in the south face of the mountain, which at this point rises in the form of a perpendicular bluff over six hundred feet high. In these workings the gold is found imbedded in talc or soapstone, and is of a dull color, as if deposited from a solution. It is formed in threads and seams of greater or less extent, many masses being taken out which are of large size and nearly pure gold. Where the ore is the richest it is found accompanied by talc of a bright green color, and the miners make use of this as a guide in searching for the richest deposits. About fifty men are now employed in this mine.

The first discovery of the mine dates from October, 1887. The ore is broken by hand, and sorted into three classes, that of the first grade running up to 300 and 400 ounces to the ton, the second class about 50 ounces to the ton, while the third class averages about 2 ounces to the ton; ores poorer than this are at present thrown on the dump, as it is not found profitable to work them under existing milling conditions. The reduction works consist of 10 arrastras worked by mules, and are situated on the bank of the arroyo of Muferachic, about a mile south of the mine; the ore is carried on pack mules. Each arrastra grinds about half a ton per twenty-four hours.

These arrastras are as well constructed as any I have seen in Mexico. The fact of the gold occurring in an extreme finely divided state renders probable the supposition that the loss by this process is from 25 to 30 per cent of the metal contained in the ore. Only one clean-up has been made so far, and resulted in the shipment of 2300 ounces, avoirdupois, said to be nine hundred and fifty fine, the other component parts being silver and copper. The erection of a large stamp mill for the more profitable working of these ores is contemplated in the near future.

The only other mine in which work of importance has been done is called La Gloria. This is situated in the same hill and adjoins the San Gabriel claim on the west, and is owned in part by the Becerra Hermanos. The work done on this claim consists of two tunnels, which have penetrated some 200 feet each into the mountain. The highest level has a cross-cut extending west, commencing about 30 feet from the mouth; this cross-cut has been driven about two hundred feet.

All the material extracted from the upper workings has been classified as ore, although in much of it the gold is invisible, but shows well when washed in the horn spoon. On account of limited facilities, but little of the ore from this mine has been milled, but that which was worked is said to have given an average value of \$3 per ton. The ore from this mine is of a grayish color and seems to resemble the general mass of which the mountain is composed. The gold when visible is very bright and at first sight seems to be crystallized, but on closer inspection it is found to be foliated in thin leaves or wire.

On account of the flattering prospects of these two mines the whole mountain has been located, the names of the other locations being La Esmeralda, Santa Elena, Andres del Rio, La Mexicana, El Bazar and Hidalgo, and work has been commenced on all of these claims; but although panriags from nearly every part of the mountain show colors, nothing of importance has been announced.

The owners of a part of La Gloria mine are negotiating for the sale of the same to foreign capitalists at a price which is said to be equivalent to \$900,000.

What is most needed in this camp is that it should have connection by rail with the outside world, and a railroad from the Pacific Coast is talked of. As it is now situated, only the very best mines can be profitably worked. The camp will shortly have both telephone and telegraphic communication, as the lines are now being constructed. Labor is scarce and the cost of living high.

BATOPILAS.

H. A. HORSFALL.

The Advantages of Philadelphia as a Manufacturing and Exporting Port.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Having read with much interest your enterprising journal, and believing that a word from Philadelphia would not be deemed inappropriate by your many readers, both at home and abroad, I send you the following summary of facts:

Situated on the banks of the Delaware, possessing a delightful harbor and all the advantages essential to a brisk foreign trade, her manufacturing industries large and diversified, the future commercial prosperity of Philadelphia is assured. The statistics for the year 1887 show a wonderful increase of the exports and imports at this port over that of any previous year, and every indication for the present year gives assurance of continued prosperity in this as in every other direction.

The amount of capital invested in manufacturing enterprises in Philadelphia is nearly \$400,000,000, and the annual product amounts to nearly \$500,000,000. With a population of 1,100,000, she has 12,000 factories, giving employment to more than 250,000 people. Among the many manufacturing industries located here whose products are known throughout the world, might with propriety mention the following: The Baldwin Locomotive Works; ship building by Cramp & Sons, and Teafie & Levy; J. Edwood Lee Co., metallic splints, drainage tubes, bougies, catheters, etc.; Fayette R. Plumb, edge tools, hammers, sledges, railroad and mining tools; S. L. Allen & Co., agricultural implements; the great saw work of Disston Sons; James Smith, woolen machinery; W. Simpson, Sons & Co., dry goods; Robert Smith, India Pale Ale Brewing Company, established in 1774, whose product is said, by eminent experts, to equal the celebrated Bass' ale, of old England; George V. Cresson, machinery; Fairmount Fork Works; Reading Hardware Company; the Enterprise Manufacturing Company; Carey Bros. & Greve-meyer, wall papers, the largest in the country; the American Machine Company; Ford & Kendig, manufacturers of pipes and pipe fittings, etc.

These concerns are the largest of their kind in the country, and they are but a few of those we might mention, whose goods are known over the civilized world. It might be well in connection with ship building to mention the fact that the United States Government experts have decided that the League Island Navy Yard, located here, is the best adapted of any place in this country for the construction of government vessels. The Atlantic Refining Company whose products are in demand throughout the world not only for their superiority, but for their preparation for shipment and the ability of the company to fill orders promptly, are located here. We might continue this list indefinitely, but rather than trespass too far upon your valuable space we forbear, our object being simply to give your readers an idea of the manufacturing industries of this city, and the advantages to be gained by a knowledge of these facts when entering the market for the purchase of American manufactured goods.

The old and worn-out assertion that Philadelphia is "slow" is now about obsolete. It is a well-known fact that Philadelphians took an active part in the building of some of the street railways in New York, and Dame Rumor says that two prominent Philadelphians were largely instrumental in carrying the State of New York for the winning candidate in the late national contest. The railroad facilities of Philadelphia are unsurpassed by any other city in the United States, either for freight or passenger traffic, while the advantages for foreign trade and commerce are constantly increasing.

New York gets the credit of much of Philadelphia's trade, for Philadelphia goods are shipped largely through New York; thus there was shipped from Philadelphia, via New York, to Central America, during the month of December, among other things, the following: 30 barrels flour, 7852 pounds barbed wire, 50 cases astral oil, 2000 cuspidores, 1 case dry goods, 2 cases furniture, 7 bales domestics (7000 yards), 2 bales American prints, 121 boxes soap, 4 bales horse collars, 1 bale handsome carpet, 1 carboy, dry goods and lace curtains, 2 bales of each; 700 coffee bags, 8 boxes of chairs. I would also add there is to be a national exhibition at Carthage, Republic of Colombia, S. A., in February and March of 1889, which will afford a fine opportunity for the merchants and manufacturers of this city and State to lay the foundation for future business.

Measures have recently been taken by the commercial organizations of the city for the removal of Smith's and Windmill Islands, and a portion of Petty's Island, and the recent appropriation of Congress secures the accomplishment of this enterprise—an enterprise that will give to this port plenty of sea room for the extension of piers and the building of additional storage and warehouses thereon or contiguous thereto, and the probable widening of Delaware avenue, thereby adding largely to present accommodations for dockage and wharf room, and enabling the shipping public to enter more largely into competition for the business of the world. From Port Richmond to Point Breeze is a long stretch of river front many miles in length. At the former place considerable progress has been made in an enterprise looking to the transaction of a business progressive in its character and immense in its proportions. The future of Philadelphia's commerce is being widely considered, and the present condition shows a radical advancement, which is an indication at once of good judgment and keen foresight.

Philadelphia is the seat of the oldest mint in the United States, and coins more money than all the other mints of the country combined. Her post-office is, with one exception, the largest in the United States, one half as large again as that of New York. She possesses the only Masonic Temple in the country devoted exclusively to Masonic purposes, the finest in the world, the largest park east of the Mississippi River, and many other instances could be given to show the greatness and grandeur of this matchless city on the Delaware—matchless in its manufacturing industries, aspiring and progressive in commerce, and destined to take a front rank in her relations with the commercial world.

PHILADELPHIA, 3d January, 1889.

PHILOS.

The Largest Coal Dock in America will be built at once at West Superior, Minn., by the Eastern Railway Company. It will be 2000 feet long and 800 feet wide, with a central vessel slip 2000 feet long and 100 feet wide, giving 8700 feet of dock frontage for unloading cars. Tracks will run all through the structure, which will have a storage capacity of 1,500,000 tons of coal.

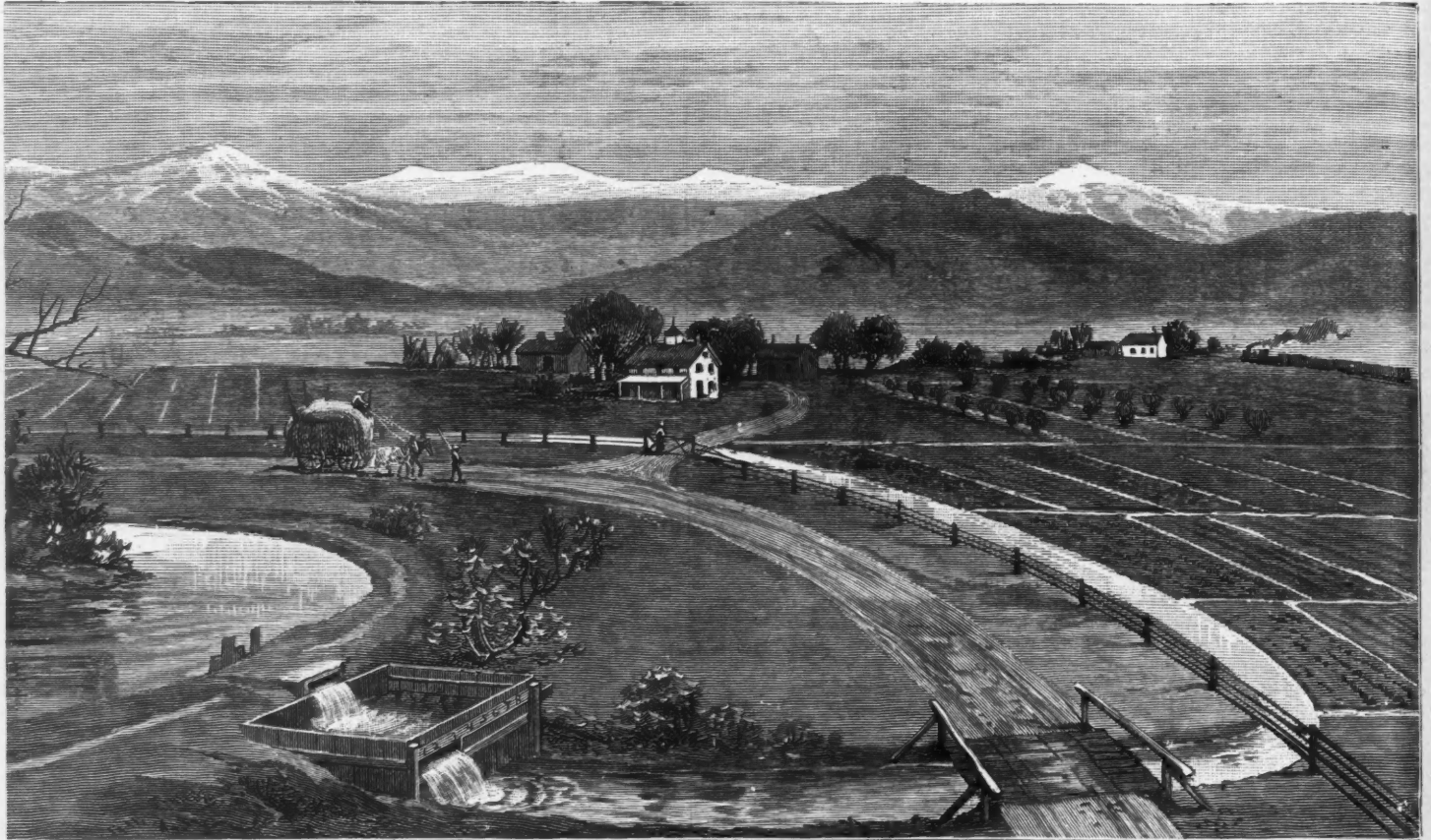
IRRIGATION IN THE ARID WEST.*

Irrigation within the United States is almost an unknown quantity, says Mr. Richard J. Hinton in *Harper's Weekly*, yet at least \$30,000,000 have been invested in California within four years in irrigation land enterprises. The value of land "under water" has already increased from ten to fifty fold. Such works have become a permanent investment. The taxable valuation has increased at the rate of one hundred millions a year during the past four years. One hundred new colonies, embracing a large acreage, have been added to its fruit-growing area. The cultivated irrigable land has more than doubled since 1883. In Colorado fifteen million dollars have been invested. A million and a half acres of land have been rendered valuable. In the past two years forty million dollars have been added to the taxable assessment of the Centennial State. Arizona, most unpromising of our mountain sections, except, perhaps, Nevada, is becoming noted for its utilization of water in irrigation. New Mexico is waking from slumber, and organized irrigation bids fair to enormously increase the productiveness and value, therefore, of that Territory. The Mormons in Utah have for forty years been demonstrating the material importance of communal or neighborhood irrigation, in the raising of grain, feed and fruits. In Wyoming, Montana, Western Dakota, Idaho, and Southwest Kansas, irrigation enterprises are everywhere being developed.

The average rainfall for complete industrial use may be estimated at

The extent of the current water supply, of which adequate data is not fully accessible, may be estimated from a few facts:

The drainage area of King River, which is an all-important portion of Tulare and Kern counties, is 1,855 square miles. From January to July its average volume is 8715 cubic feet per second. At the rate of 110 acres per cubic foot per second, the irrigable duty of this volume of water will not be less than 1,000,000 acres. Estimating the present area of irrigable lands in the San Joaquin Valley proper at about 4,000,000 acres, we now have "under water" about 650,000 acres. Possibly one tenth of this area receives water from what are termed artesian wells. In Tulare County there are nearly or quite one hundred, in Fresno and Kern nearly as many more; two hundred in all will be nearly correct. The water for these wells is obtainable at depths ranging from fifty to three hundred and fifty feet. The subterranean sources of supply are fed undoubtedly by the Sierra snows. Windmills are used to raise and distribute the water. Artesian belt farms are deemed very desirable. They are generally small. The irrigator is able to use his water at will, and as the wells are generally located in the frostless or citrus belt, they are fast becoming an important agent. This subterranean supply involves very interesting questions within the dry area. There is a very marked belt of this character under development in eastern Colorado, at Denver and vicinity, and in Wyoming at Larimer City and vicinage. In San Bernardino and Los Angeles, California, the same source of supply is being extensively used.



IRRIGATED FARM.

twenty-eight inches per annum. Major Powell, the able head of the United States Geological Survey, estimates the lowest possible amount of such industrial precipitation at twenty inches per annum. Roughly estimated, the dry area of the United States, being that in which precipitation ranges from twenty down to about two inches per annum, would, if compactly placed, make a rectangular block of nearly or quite 1000 miles square.

About one-fourth of California—the northwest portion—is outside the dry area entirely, having, like Western Oregon and Washington Territory, an ample rainfall. About one fourth of the remaining area requires irrigation facilities. In the balance of the State—and it is, in fertility and industrial availability, the most important portion—agricultural operations, large or small, cannot be conducted without the artificial application of water to the soil.

The dry area of California is divided into two sections. These are the foot-hills of the Sierras and the broad, level valley or trough lying between the Sierras and the Coast Range, known as the San Joaquin—a plain or valley of about four hundred miles in length, north and south, and having an east and west breadth of about seventy-five miles outside of its foot-hills sections.

The dry plains of the "east side" embrace an area of 7687 square miles. Of this, about seventy per cent is assumed to be irrigable from the current supply of the running streams. The west side area is estimated at 2689 square miles. The valley lands proper are estimated at 5,046,400 acres, while the foot-hill and mountain lands cover nearly nine million acres. When an adequate storage system, located in the mid-slopes of the Sierras and their loftier foot-hills, shall supplement the present river and drainage supply, it is quite possible that the foot-hills and mesas may add from one to two million acres more to the irrigable area.

* Copyrighted in *Harper's Weekly*.

The total length of these four hundred and fifty irrigation canal systems in Tulare, Fresno, and Kern counties can be roughly estimated at 1500 miles, inclusive of main and lateral ditches. In 1880 the total irrigated area was stated at 188,000 acres. The average valuation of such lands was then about \$25 per acre. It is now not less than triple that amount, or \$75 per acre—a total of \$14,000,000. This is an increase in value of \$9,800,000. The remaining 400,000 acres were worth, in 1880, not over \$2 per acre, or \$800,000. They are now worth at least \$20 per acre, or a total of \$8,000,000. This estimated increase of land values, owing to irrigation, amounts to \$16,500,000. The total cost of the estimated four hundred and fifty canals, large and small, within the San Joaquin area, may be set down at about \$5,000,000.

So much has already been achieved that it is quite certain that the future investments of capital will be enlarged as storage reservoirs will multiply: equal, at least in capacity, to the great Bear Valley enterprise, or that in San Diego County. The foot-hills regions of Central California are already in part secured by the fortunate proximity of the system of catchment reservoirs which have in years past been constructed to serve the hydraulic or placer gold-mining fields. The inability of those corporations to dispose of the debris, so destructive to agricultural lands below if poured into the Sacramento and its confluent, has already compelled the disposal of their storage waters for irrigation purposes on a much more extensive scale than formerly prevailed. California engineers are bold projectors, and, under proper conditions, there is little reason to doubt that great storage works will be rapidly constructed.

The rainfall in Southern California, as noted at fifty-two different stations, gives an average of about 12 inches per annum.

According to Major Powell there will be required per season, for the first division, an amount of water per acre, artificially applied, equal to 7.65 cubic inches of water, and in the second to 8.64 cubic inches per

acre, in order to secure certainty in production. As a matter of fact, it has been firmly established that 12 cubic inches of water, artificially applied, under proper conditions, is more than equal to 20 inches naturally applied, as precipitation. Indeed, there can be no positive certainty in agricultural operations with less than 25 inches of rainfall per annum.

Twenty acres in fruit, grain and alfalfa are sufficient to support a family in great prosperity, while a ten-acre farm will insure comfort. The population of Fresno City is about 4500. Land with water right sells at from \$50 to \$100 per acre. Fifteen years since, the same land was worth from \$1 to \$3 per acre. Where it is not irrigated it rents now as it did for cattle-grazing, at from ten to twenty cents per acre per annum. A well-cultivated fruit farm of 20 acres, with proper appurtenances, will sell for \$250 per acre. The value of irrigated land for fruit-growing is very great. At Riverside, for example, raw lands in 1885 sold at from \$250 to \$400 an acre, and very little to be had at that; improved lands from \$500 to \$1,000. The Redlands unimproved property is held at \$200 an acre; Crafton, \$200 and more; San Bernardino, from \$200 to \$500, according to location; at Etiwanda, \$100 to \$150; Ontario, \$150 to \$250; Pomona, \$75 to \$150; other newer and less favored places, from \$100 to \$150. These points are all south of Fresno County and the San Joaquin Valley.

It is unnecessary to amplify the statistics of production. Yet it is proper to make brief mention of some important facts. The enormous increase of

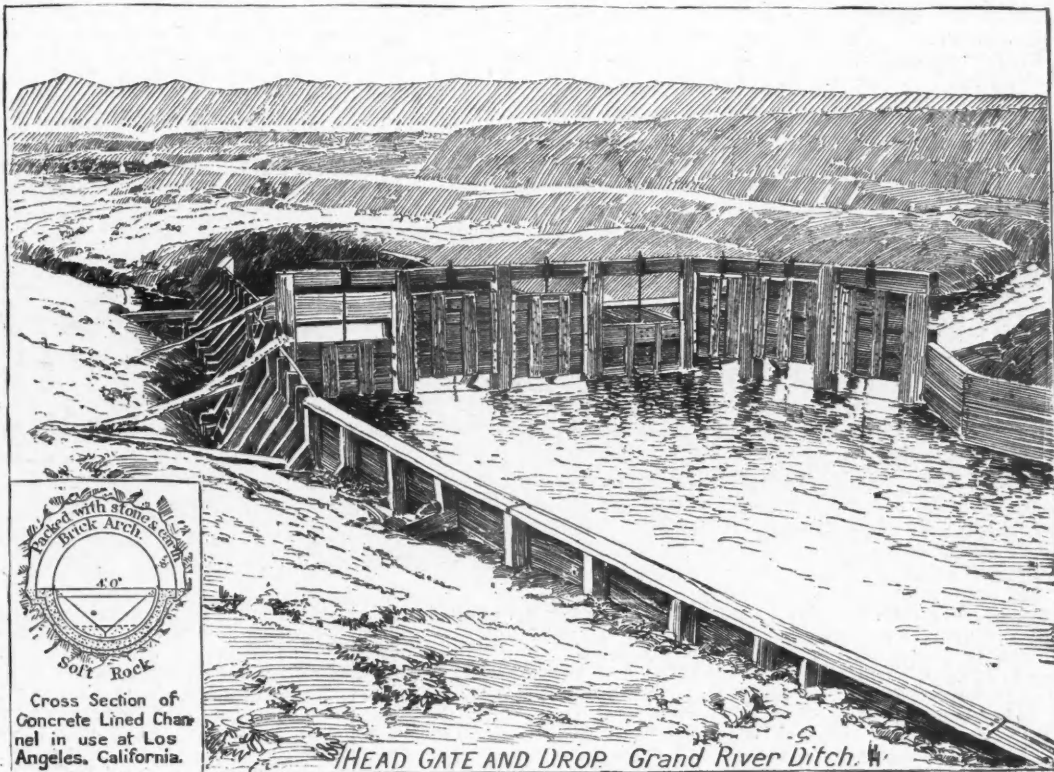
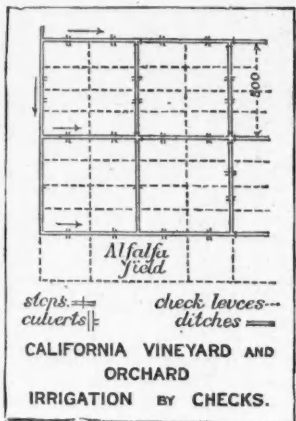
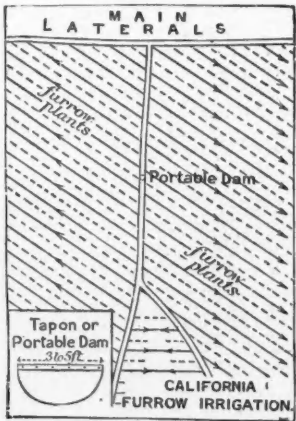
"3d. That all waters so appropriated in the State is declared to be a public use.

"4th. Rates and rents for use are to be fixed by public authority, but must not exceed 7 per cent on capital actually expended in constructing irrigation works."

The irrigators also demand that the standard of water measurement shall be one cubic foot per second. This is the rule in Colorado, Utah, and Wyoming.

In Colorado, up to 1871, farming was confined to some narrow valleys near Denver, Pueblo, and Fort Collins. In the southern counties formerly belonging to Mexico, the system of small ditches common to New Mexico was long in vogue.

A notable illustration of the material progress attending irrigation is to be seen in southwest Kansas. Eight years since Garden City was a railroad station of little importance. About a score of log cabins, or prairie dugouts, with a frame store building, constituted the "city." Now, for one hundred miles or so west of Dodge City to the State line of Colorado, there are in the valley itself and the region many scores of prosperous railroad and county towns, and thousands of farms. It now has a population of eight thousand, and, in 1887, did a mercantile business worth \$3,000,000. It has churches, school-houses, street cars, water and gas works. The construction of a small ditch for irrigation purposes and the application of water thereby to the land has produced all these



the California orange crop may be partially illustrated by the statement that in 1884 the through freight from Los Angeles alone was 17,776,470 pounds. In 1885 it ran up to 41,093,130 pounds, an increase of 23,314,660 pounds in one year, which enormous advance was due entirely to oranges. Of this freight aggregate, the orange crop in 1884 supplied 893,310, and in 1885, 24,380,440 pounds. The annual value of the Riverside fruit crop is estimated at over \$4,000,000.

The grape and wine crops of California occupy and are raised from about 180,000 acres. Over one half has been laid down in the past eight years. In 1884 the wine crop was about 15,000,000 gallons. In 1885 it was 18,000,000. Irrigation has been a main instrumentality in this growth. The olive culture is growing also. It is affirmed that California now supplies most of the pure articles used in the United States. The mulberry, lemon, fig, date, pomegranate, nectarine, etc., are all, like the orange, flourishing products of the irrigable region.

The value of water is, commercially speaking, growing much greater than land, and this makes the conflict over water rights of supreme importance in California.

The conflict in California over the riparian rights of landowners, under common law, and the rights of appropriators of water for beneficial and industrial uses, such as town and house service, mining and farming (by irrigation), has assumed a shape so important as to make of it a controlling political and economic issue in the State.

At the last State Irrigation Convention (1887) the following propositions were adopted as the demands of the irrigators. They were presented in the form of amendments proposed to the State Constitution, and cover:

- "1st. The declaration that every natural stream and water source is public property.
- "2d. That the appropriation for beneficial uses of any such stream must be made under legislative enactment.

results. The first ditch was dug in 1880. The canals now in operation are five in number. Others are projected even more extended in character.

The total length of the system so far is three hundred and thirty-six miles. The area sowed cannot be less than 300,000 acres, and as each cubic foot per second of water supplies for the season eighty acres of land, the total amount of water taken from the Arkansas River is not less than 3600 cubic feet, or over 70,000,000 gallons per year.

Arizona is rapidly developing some important irrigation enterprises. The valleys of the Gila and Salt rivers are the chief scenes to-day of such as are being systematically inaugurated. Since 1868 at least sixty thousand acres in the vicinity of Phoenix have been brought under cultivation. In that valley there are a dozen large ditches, three of them following the prehistoric courses. The new canal properties of the last six years, mostly in the Gila Valley, have exceeded \$2,500,000 in cost, and placed under water at least 200,000 acres more.

Montana, Idaho, and Nevada also offer valuable evidences of successful irrigation. In 1886 there were sixty-eight incorporated companies in Idaho having large areas "under water."

Wyoming is also feeling the advantages of irrigation. The largest enterprise will reclaim 50,000 acres; up to 1886, \$250,000 had been expended on it. A second canal has been commenced.

Utah is in many respects the model community for farming by the aid of irrigation. In 1875, the latest date at which full statistics were published, there were in twenty counties 2095 1/2 miles of main canals, and 4888 1/2 miles of laterals, or distributors, both groups costing \$2,527,678.84, and for repairs that year, \$106,884. The assessed value of property within the water districts, embracing 303,766 acres, was \$20,986,947. The total area requiring irrigation in this region was 196,582 acres. The total canal mileage was 4813; the cost thereof was \$1,889,779; and the acres "under water" was 71,101.

Now there is an area of 656,000 acres; in main canals, 2810 miles; in lateral canals, 7750 miles.

The legal principles in present use for the conservation and distribution of water sources and supply are simple enough. They can be stated without confusing terminology, and they depend upon two great systems of jurisprudence, and two primary or community forms of utilization, which have received more or less legislative indorsement and judicial acceptance. The juridical principles are:

1st. The maintenance of a general sovereignty, among all civilized nations, over all navigable waters.

2d. The Anglo-Saxon or common law jurisprudence recognizes riparian rights or control over running water, or other natural supplies, of the owners of the land bordering thereon.

3d. The Latin jurisprudence and all codes founded thereon, as well also all the oriental codes, customs and systems, place all natural waters as subject to "servitudes"; therefore public property subject to economic individual use through community rules or legislative enactments. In this country the Spanish and Mexican codes and customs in this direction govern in large portions of our territory, by reason of treaties (the Guadalupe Hidalgo and Gadsden, made with Mexico) that became the law of the land.

The matter of primary or community customs, having the force of law in our midst, is divisible into two classes:

1st. There are the Indian village or pueblo customs, in regard to the common ownership of water and its equitable distribution, that have the force of law in New Mexico, Arizona, Utah, and California.

2d. What is known as "prior appropriation," which grew up as a miner's custom. It has been legalized by the United States in its land and mining code, and by the several States and Territories through legislation, in which mining and terrene aridity are leading features of economic life.

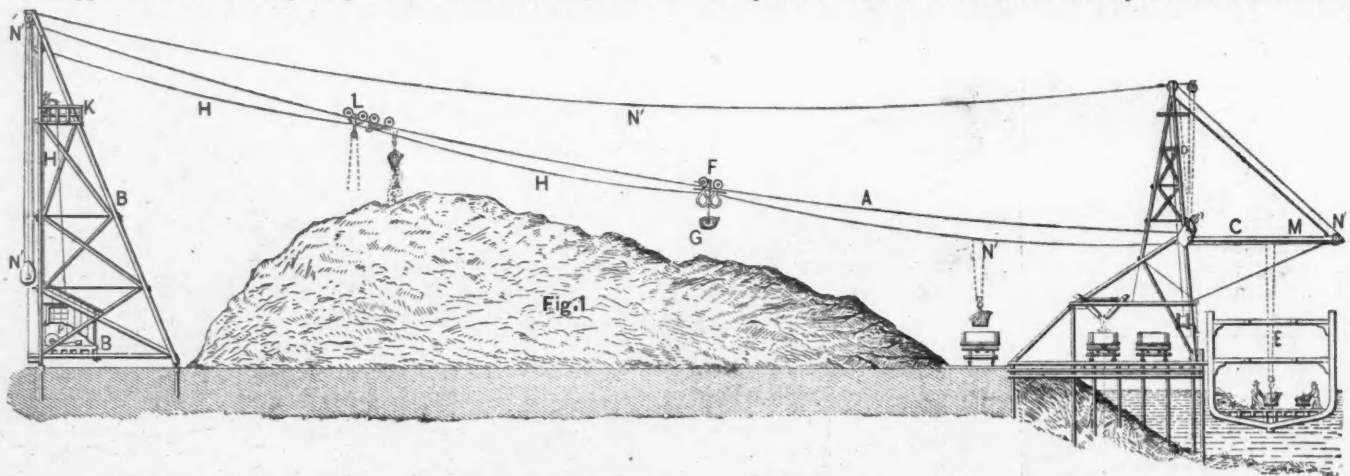
In the application of these principles and customs, all legislation

are mounted on wheels, and move on a track of a single line of rails; the back piers are on wheels moving on track of two lines of rails. The cable tramways on movable piers are of similar construction. All the bridges lately constructed are built of iron, except the cross beams and track stringers, which are of wood. The piers are made of wood, braced with iron, or are made entirely of iron, as required. These machines hoist the buckets of ore or coal from the vessel, convey it to any desired point on the tramway, and automatically dump the material on the dock, or lower the bucket to dock or cars below, as may be required. They will equally well reverse the process, i. e., take the bucket from dock or car, convey it to vessel; and lower and dump contents into the hold; also take from any point under bridges and deliver at any other point under bridge. The plants erected two or three years ago have been used extensively in loading bituminous coal from cars and docks into vessels at a low cost and a great saving in breakage, one plant of three bridges handling over 275,000 tons of coal in one season of navigation, of about six or seven months.

THE PRESENT STATUS OF ELECTRIC TRANSMISSION OF POWER.*

By Richard P. Rothwell.

At the Boston meeting of the American Institute of Mining Engineers in February last, Mr. George W. Mansfield read an interesting paper on "The Electric Motor in Mining Operations," and he entered into the calculations of power required and cost of transmitting energy in great or small quantities to a considerable distance. I do not intend to go over this ground, nor to enter into any discussion of the technical details of transmitting power by electricity, but merely to set up a milestone on the road of progress to show where we now are, how far we have come, and if possible endeavor to make out the way for a short distance in ad-



BROWN PATENT CABLE TRAMWAY.

within the dry area, as well as that of the United States, where it deals with this matter of water use, has recognized the "public servitudes," as the Mexican codes have it. California alone, through a decision of its Supreme Court, has made an abortive attempt to enforce the doctrine of riparian rights. Public opinion there is very hostile, and no executive effort has been made to enforce this strange decision.

In the matter of State legislation, the water laws of Colorado, now adopted by Wyoming, are conceded to be the most comprehensive and just. That code provides: a. The public character of all natural water sources; b. maintains the doctrine of prior appropriation; c. that the farmer has first claim in unappropriated water; d. that unused water must be returned to the stream; e. that irrigation work shall have legal right of way; f. that the standard of measurement shall be fixed by law; g. water districts to be formed with commissioners to settle disputes and water masters to distribute, appeals to district courts being allowed; h. registration in county clerk's office of all water appropriations; i. franchises to be granted with power to construct works and levy rents; j. providing for a State engineer.

BROWN'S HOISTING AND CONVEYING PLANT.

We illustrate two different forms of construction made by the Brown Hoisting and Conveying Machine Company, of Cleveland, O., for handling bulk material of any description. They are only two out of many supplied to meet various requirements, but being specially characteristic of the system adopted, and suited to most ordinary conditions, it will interest our readers to have it described. We are frequently asked our opinion on the relative values of different methods of handling large quantities of rock, earth, ore or coal, and this, we answer, is one of the systems which has proved its merit. The bridge tramway is more especially adapted for handling coal and ore from docks and vessels. They are generally built in plants of three or four; two of the bridges supported at their back ends upon one double back pier, the other bridge or bridges being supported singly on a single back pier. An engine and boiler house is erected on the double back pier, and in it are contained the boiler and the three or four hoisting engines for the three or four bridges, as the case may be. The double back pier also supports, near its top, a covered platform from which the operators can overlook the dock and control and operate the engines and hoisting machinery. Each bridge is supported in front by an independent pier, so that the front can be skewed or moved sideways to suit the hatchways of a vessel without moving the rear end, the bridges being hung with hinged connections to piers so as to permit of skewing. The front piers

vance of us. I shall merely allude to what has been done and what is being done in a few cases of interest to the mining profession.

The first case with which I am acquainted of the electric transmission of energy for mining purposes was at a stamp-mill in New Zealand, and which was described in the ENGINEERING AND MINING JOURNAL and other papers a few years ago. Since then this means of transmitting power has been much discussed, and some practical applications of it have been made. The fact of the transmission of vast amounts of energy to great distances over a slender thread of metal is still a constant marvel which creates an interest in every observer, expert or non-expert. It seems but yesterday that the first long-distance transmission from Creil to Paris was made as an experiment.

The vast extension of the system was at once suggested, but so long as the handling of high potential currents was deemed very hazardous, the size of conductors using low potentials made the cost of the copper almost prohibitory for far transmission.

Mr. Mansfield pointed out the well-known fact that the size or cost of conductors decreases as the square of the potential increases; but even so short a time ago as in February last he confined his calculations for the cost of transmitting energy to the use of 560 volt pressure, and "placed the limit at 4000 volts." Moreover the cost which Mr. Mansfield gave for a plant of given capacity was much higher than some of the manufacturers have since been contracting at, and there can be little doubt that within a year even the present cost will be much reduced.

From information furnished me by some of our best manufacturers of electric plant, I am able to cite some general figures for the cost of electric plant for the transmission of power up to ten miles. The figures are calculated on the basis of 100 horse-power units: the engine or turbines costing about \$40 per horse-power; dynamos, \$30 per horse-power; motors, \$40 per horse-power, and using a current of 1000 volts.

For one mile distance an efficiency of about 80 per cent will be guaranteed, and the cost per horse-power of the electric plant will be from \$80 to \$85, and the total cost per horse-power, including motive power, either steam engine or turbine, will be from \$120 to \$130.

For transmission over five miles an efficiency of nearly 70 per cent will be guaranteed, and the cost of electric plant will be about \$135 per HP., and the total cost, say, \$190 per HP. For a distance of ten miles the efficiency of 50 per cent to 55 per cent will be guaranteed, and the cost of electric plant will amount to from \$300 to \$210 per HP., and the total cost, including turbine and line, say, from \$280 to \$290 per HP.

These approximate figures will give an idea of what responsible contractors will guarantee now, and thus show the present status of the

* A paper read at the Buffalo meeting of the American Institute of Mining Engineers, October, 1888.

art. Each individual case has its own conditions, which may vary these figures somewhat. The weight of the uncovered wire per horse-power, transmitted with an electromotive force of 1200 volts at the terminals of motor, would be about 50 pounds for 10,000 feet per HP.

The potentials used in the following calculations are only 1000 volts. It is perfectly possible to go above these, and thus economize copper. Or the efficiency figure may be lessened, in case the primal energy is abundant, thus again saving copper, up to the point where increase in cost of dynamo plant equals the saving in copper. Incidental expenses, difficult to generalize, such as freights, etc., are to be added to any estimate, covering material only. Should the present high price of copper be diminished, the cost of such installations would be considerably lessened. On the other hand, if conditions of excessive dampness exist, it may be necessary to add a considerable sum for insulation.

Take, for example, a 10-mile transmission of 100 horse-power; the cost of the line wire is put down by Mr. Mansfield at \$200,000, while in the figures of eminent contractors it is given at \$11,000, or but little over one-twentieth of Mr. Mansfield's estimate.

It is evident that if the voltage can be increased from 1000 to 10,000 or 20,000 volts, the cost of the line wires, which form the heaviest item in a long transmission, will be so greatly reduced as to make this method of transmitting energy far less expensive than those now in general use. And the influence of this upon mining, metallurgy and on general engineering practice will be incalculable. Thus far the electric transmission of power has been made over only moderate or very short distances.

The first experimental plant transmitted 40 horse-power from Creil to Paris, 70 miles, with a loss of about 44 per cent; but in actual engineering practice the transmission has been confined for the most part to distances much less than 10 miles.

The New Zealand application of electricity in mining, to which I have

coal cutters, rotary rock drills, and electric percussion drills which are said to be a proven success also. Electric lighting of mines and mills is becoming common, and nearly every town has or proposes to have electric tram cars in its streets, and we have also electric ore separators for concentrating magnetic iron ore. In addition to electric lights, small motors in great numbers are being introduced to perform a variety of work in our houses.

We have many systems of "electric amalgamation," in which the role of electricity appears to be chiefly for the "cleaning" of the mercury by preventing its coating with an oxide film.

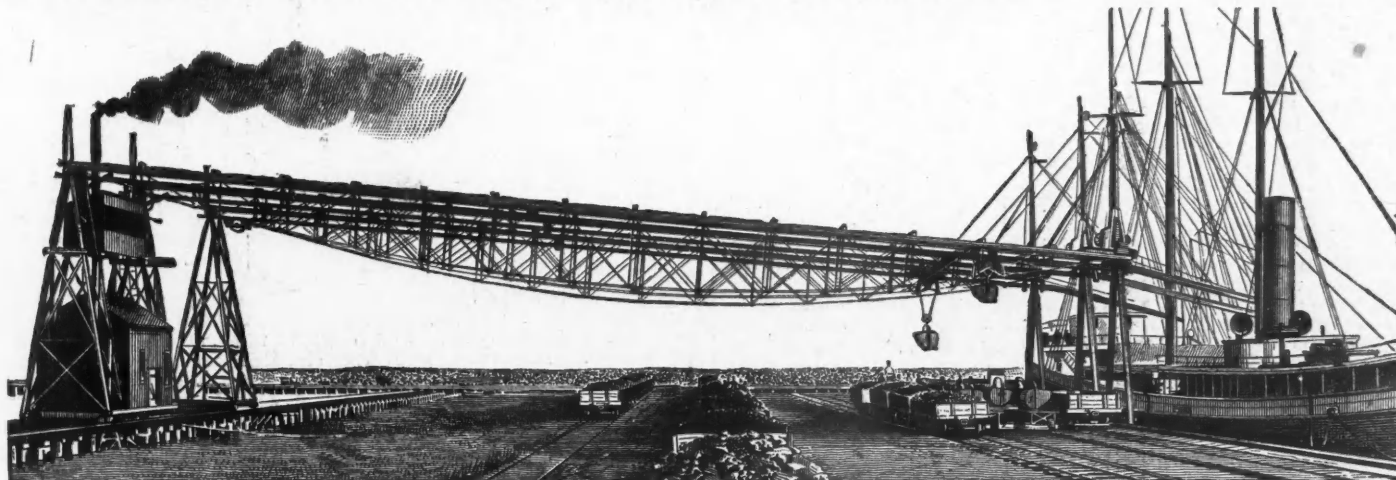
The electric smelting in the Cowles' aluminum process has long been a great success, and is about to receive an enormous development.

Electric welding, at first confined to small pieces of metal, is now effective and economical with quite large plates and bars, and with various metals.

It would be impossible in the space permitted me to enumerate all the applications which electric transmission of energy has received of late. The progress made in this department of engineering within the past year or two has been simply marvelous, and it requires no prophet to foresee that the same rate of progress continued a few years more will create a veritable revolution in engineering practice.

The questions to be settled are whether the electric transmission is more economical than the other means now in use, and finally, what is the prospect of reducing the cost in either of the systems.

The rapid adoption of electric transmission is a satisfactory demonstration that it offers substantial advantages over other systems, but there is no other system adapted to far transmission. The practical limit for wire rope transmission is quickly reached, and that by means of hot water under high pressure, as now being very successfully introduced in Boston, is far more expensive in first cost than an electric plant. A recent paper to the Institute by Mr. A. V. Abbott describes fully this Boston hot-water distribution.



BROWN PATENT BRIDGE TRAMWAY.

referred, consisted in driving a stamp-mill by the power of a waterfall distant some miles from the mill. In this country the longest circuit for mining work is that on the Big Bend of the Feather River in California, where the Sprague Company has put up a plant of motors for operating pumps, etc., on a circuit of about 18 miles. The power is obtained from turbines placed at the end of the tunnel that cuts off the 20-mile bend in the river.

This plant is reported to be working very successfully, though as the season during which it can work is very brief, it requires, and we believe possesses, extremely rich gravel to pay for pumping and sluicing. At Aspen, Colorado, there has been for some time past in successful operation a Brush electric plant driven by a neighboring water-power, whose energy is thus utilized to pump and hoist underground in the mine and to haul on the main entry. The plant is very successful, and is said to be much more economical than steam power, even there where coal is cheap.

The latest installation in mining work is the very interesting one now being put in by the Brush Electric Company in the Comstock mines, Nevada, which has been described in the ENGINEERING AND MINING JOURNAL, of June 16th and September 22d, 1888.

This plant is to be used to drive the new Nevada mill, hoisting engines, etc., and it consists of 6 Pelton impact water-wheels, 40 inches diameter each, connected directly on to the shaft of a dynamo of 135 horse-power, and these drive six electric motors of 90 horse-power each.

The dynamos and water-wheels are placed in a chamber excavated in the mine at the level of the Suro Tunnel. The water is brought down the shaft from the surface and goes through a 1/2-inch nozzle on to the water-wheel under the enormous head of 1630 feet, the heaviest pressure, I believe, ever put upon a wheel. The power is brought back to the surface over a copper strand about 1/2 inch diameter.

The dynamos are of the constant current type, wound for 40 ampères. They are said to be absolutely automatic in the government of their current strength, no current regulator of any sort being required. The variation of current between full load and no load is less than 2 per cent.

The efficiency of both machines, the dynamo and electric motor, is considerably over 90 per cent.

It is not necessary here to repeat the descriptions of the various electric plants that have been installed in this country. Besides those already mentioned, we have a mill in Idaho driven by electric motors. In Alaska it is proposed to bring power to the Treadwell 240 stamp mill on Douglas Island from a great waterfall on the main land some miles away. We have electrically driven underground locomotives, hoisting engines,

The only far distribution of the large amounts of power required in general mining operations, by means of compressed air, with which I am acquainted is that at the Chapin mine, Michigan. The use of compressed air for driving drills, etc., in long tunnels in this country and Europe, required comparatively small amounts of power. The Chapin mine example is without doubt the largest plant in the world for the transmission of power by compressed air.

The plant in question furnishes power to the Chapin and Ludington mines at Iron Mountain, Mich. At the Quinnesec Falls of the Menominee River, about three miles from the mines, there are four turbines, one of 1000 and three of 900 horse-power each. Each turbine runs a pair of compressors. The air is compressed to about 60 pounds at 60 degrees Fahrenheit, and is carried to the mines in a 24 inch iron pipe, made in lengths of 68 feet, with expansion joints every 10 lengths. This pipe cost sixty thousand dollars complete, each expansion joint costing \$500. The power is applied at the mines by supplying the air to Corliss engines for running Cornish pumps, hoists, etc., and is also applied direct to the rock drills and to the pumps and to Corliss engine running tramway cable underground. The total cost of plant is estimated at about \$500,000. A test made February 20th, 1888, shows the following result:

Indicated horse-power of compressors.....	1,430.27
Sum of indicated horse-power of engines of the mines.....	397.17

Therefore only 27 per cent of the horse-power indicated by the compressors is recovered as indicated horse-power in the cylinders at the mines.

Cubic feet of air at compressors in 11 hours.....	1,231,736
Cubic feet at engines.....	967,391
Loss in cubic feet.....	264,345

The loss of pressure between compressors and engines is about two pounds.

In these figures we see that the loss is nearly 73 per cent. This includes the losses due to the leakage, and loss of energy in the form of heat, but does not include friction of engines or compressors; so that the total loss, between the point of application of power of the turbines, and the point of application of power of engine to shafts, etc., cannot be less than 75 per cent of the total. In other words, the efficiency of the system stated as would be stated for an electric system, does not exceed 25 per cent. The figures quoted above are a fair example of tests which are made at regular intervals.

The two mines are charged each with its share of the power used. The amount used in each mine is found by indicating all its engines, and

the expense is prorated from these results. The mining companies consider that the plant supplies them power at about the same expense as if they used fuel, which at this point is worth about the same as coal at \$5 a ton.

The following figures may also be of scientific interest: The air leaves the compressor at a temperature of 330 degrees F., and at the exhaust of the engines and pumps ice is formed which would close up exhaust opening in the pump were it not for a coal fire which is kept burning beside it. By comparing the compression curves of compressor cards and the expansion curves of the engine cards with the curves of isothermal compression and expansion, there appears a loss in compressors of over 20 per cent., and in the engines of over 12 per cent. These are evidently losses which no possible device in air compressors can materially decrease.

In these mines, as in some other cases, the use of compressed air does not have any great advantage as regards ventilation, as there is a natural circulation of air, which is usually sufficient, and it is artificially increased whenever desired by the use of current produced by running water.

From the data given above it is easy to institute a comparison between compressed air and electric transmission in this case, but such comparison should not be applied too generally, for there are conditions that greatly vary the efficiency of each system, and these conditions should be weighed in each case. There can be no doubt, however, that with a pressure of even 1000 volts, electric transmission is, for long distances and under ordinary conditions, much the cheaper method of the two.

If it be possible to transmit currents of high voltage, say 10,000 or 20,000 volts, as is now intimated has been done in London by the Ferranti system of insulation, then the problem assumes an entirely different phase, and the field for the application of electric transmission of power is widened to an incalculable extent.

I am not in a position to affirm or deny the possibility of transmitting with safety currents of such enormous pressures, but the progress in the electric art has been so exceedingly rapid during the past few years that we may be permitted to believe that means for controlling these high voltages will be devised, and that they will be found in practical use before many years.

On the assumption that 10,000 and 20,000 volt currents can be handled with safety and economy, every waterfall in the country, even in its inaccessible parts, would become of value and would contribute to the working efficiency of our people.

The waste gases from our 35,000 coke-ovens could be used to generate steam and drive dynamos, until such time as a practical method of converting the heat of combustion directly into electricity shall have been perfected.

Perhaps the most momentous vision which is opened to our view by this anticipated transmission of high-pressure currents is in the influence it may have upon our coal and railroad industries.

There is no branch of engineering which is so backward, so disgraceful to the engineering profession, as that which relates to the utilization of the heat units contained in fuel. Almost the only application which attains a satisfactory economy is the iron blast furnace. The percentage of the heat units evolved in the complete combustion of coal that is actually utilized varies from perhaps 3 or 4 per cent in many open grate fires to perhaps 12 or 15 per cent in steam boilers. It may be roughly assumed that the average result obtained in burning the 140,000,000 short tons of coal estimated to have been produced in the United States this year (1888) was not better than 8 pounds per horse-power per hour.

The value of this coal averaged about \$1.40 a ton at the mines, and the average actual cost to consumers throughout the country could not have been less than \$4.20 a ton, or three times the cost at the mines; or, at the assumed efficiency of 8 pounds per horse-power per hour, say, 1.7 cents per horse-power per hour, as compared with .57 cent at the mine.

If, instead of a consumption of 8 pounds per horse-power, this coal had been used with an efficiency of 2 pounds per horse-power, which is quite practicable, the cost would have been 0.4 cent per horse-power per hour at the point of consumption, and 0.13 cent at the mines. In other words, the cost of the fuel per horse-power to the consumer averages probably ten times what it would at the mines, if using electricity generated by steam power. This is roughly the margin which an electric transmission would have to work on, and since we have assumed the average cost of transporting a ton of coal from the mines and distributing it to consumers as \$2.80, we have here a unit of measure.

Without entering at this time into detailed estimates of the cost of transmission of the vast amount of power represented by the combustion of millions of tons of coal, the high efficiency already attained in electrical transmission makes it not improbable that before very many years have passed we shall see a great part of our coal burned at the mines in specially designed furnaces, and the energy there generated carried as electric currents of high voltage to the great centres of consumption, and then reduced and distributed to manufactories and to public and private buildings, where, reconverted into heat, it will take the place of coal in cooking, heating, lighting, motive power, etc., with many evident advantages in cleanliness, safety, convenience and economy.

The cost of transmitting the energy contained in the coal from the mines to the points of consumption will certainly be far less than the cost of carrying the coal on railroads and distributing it by carts; and the efficiency of the coal would be vastly greater when burned in specially designed furnaces than in the wasteful appliances in use now by the average consumer.

The electrical transmission would give as much useful effect from one ton as is now obtained from two or three tons, so that it would have from \$5.60 to \$7.40 as the margin within which to work; and its adoption would prolong the duration of our supply of anthracite, which is being so rapidly exhausted by the wasteful methods of mining now in use.

India Rubber Pavement.—Experiments have been made in Berlin with India rubber pavement. It is said to be very durable, of course noiseless, and unaffected by heat or cold. As a covering for bridges it is said to have peculiar merits, its elasticity preventing vibration.

THE QUICKSILVER MINES OF NEW ALMADEN, CALIFORNIA.

The history of a successful mine is always attractive, but the history of a successful poor mine is a story that has a far wider interest, for it shows how success is achieved by skill and economy where the conditions are unfavorable, and it teaches many lessons that have extended application.

One of the most instructive examples of brilliant success achieved under trying conditions is that furnished by the New Almaden quicksilver mines of California. It is not only an example to admire, but it teaches a lesson to be copied by mine owners and the directors of mining companies the world over.

The annual reports of the company tell the whole story: how the company up to the year 1870 encountered disaster, it had then accumulated an indebtedness of \$1,600,000, and bankruptcy seemed imminent. By a supreme effort the company raised a final \$200,000 on preference stock, and Mr. J. B. Randol, who had for years been the secretary of the company in New York, was sent to the mine and was appointed its manager, and the company entered on a prosperous career. Its business is conducted with intelligence, skill and economy, and its directors, recognizing the rights of stockholders, whose trustees they are, give them the fullest information, so that each may know exactly how his property is administered, and where his money goes.

The quicksilver industry of the world is confined to very few hands, and the affairs of the foreign mines are conducted in the secret manner which generally prevails abroad, and which is still, we regret to say, practiced in a few notable American instances. This secrecy is nominally "for trade or business reasons," and consequently our mines would have found an unusually good excuse for following the same course here. Fortunately the *American plan* was adopted. The company makes no secrets of its receipts and itemized expenditures, and, as a consequence, perhaps, it is one of the most economically managed mines in the world.

Compared with the results attained at the Spanish Almaden the California work demonstrates the value of intelligence in workmen, and the superiority of the plan of frank and open business methods over the old methods of mystery, which some still apparently believe to be necessary to the successful administration of affairs, especially in mining and metallurgical enterprises.

All honor is due to Mr. J. B. Randol, the manager of the New Almaden mines, for demonstrating these wholesome truths, and for the clean and able administration of his trust.

The New Almaden mine is situated about thirteen miles from San Jose, Cal., at an elevation of 1700 feet above the sea, in a low range of hills composed of serpentines overlaid by black magnesian schists containing much iron and alumina, and which in their turn are overlaid by metamorphosed jaspery clay slates. Lying between these magnesian schists as a hanging wall and the serpentine as a foot wall is the cinnabar deposit. The vein matter appears to be a serpentine, somewhat altered by infiltrating water. It is sometimes extremely hard and tough to mine, at other times is soft and fragile. Associated with the cinnabar are dolomitic crystals of pearl spar, iron pyrites, chlorite, rarely quartz, and a peculiar bituminous substance resembling coal, but which when heated melts and flows like bitumen. In parts of the mine a sandstone overlies the vein matter, and in places contains small quantities of native mercury.

Prof. S. B. Christy, who has given great attention to the study of these deposits, and of the popular theories of the formation of such ores, says:

"It is probable that the deposits as they exist to-day *in situ* are the result of the action of mineral waters (solutions of alkaline carbonates, containing also alkaline sulphides), which act either by leaching out the cinnabar from neighboring rocks, or more probably by bringing it from lower rocks.

"The quicksilver deposits of California are characterized by a great and persistent irregularity, so that it makes the mining of these ores much more difficult than that of other metals. New Almaden is a striking example of this irregularity. It has often occurred in the history of the mine that there was no ore or scarcely any in sight, and it has often looked as though the mine must of necessity be shut down, and it has only been by the most careful and painstaking prospecting or dead work that it has been possible to keep up the production of the mine. Very frequently large bodies of ore will almost completely run out, and there will be visible in the face of the works only a slight coloration in the vein matter, which indicates that there is any ore left in that particular place, and by following out this little string of ore very carefully it may lead into a large deposit. As a result of this the workings of the mine are necessarily very irregular, and it requires the greatest skill on the part of the engineer in charge of the works to keep up a regular and steady output of ore. Many times in the past history of the mine the prospecting work has not been carried on on a sufficient scale, and this largely accounts for some of the irregularities of the production of the mine in former times. A steady improvement has been made in the carrying out of this prospecting work, which is necessarily very expensive."

The most of the quicksilver has come from a great chute, in which the ore occurs in vertical chimneys, in nearly horizontal beds, and on an almost endless variety of dips, and is of very various thicknesses. The mine produces about 75,000,000 gallons of water each year, which is about eleven times as much as that pumped in the Spanish mine.

The following comparison of costs of working the two Almadens, though it relates to some years ago, is of great interest. The figures are those prepared by Mr. Hennen Jennings, superintendent of the New Almaden, from the records of the mine under his charge and from a *Memoire sur les Mines et Usines d'Almaden*, by M. H. Kuss, printed in the *Annales des Mines*.

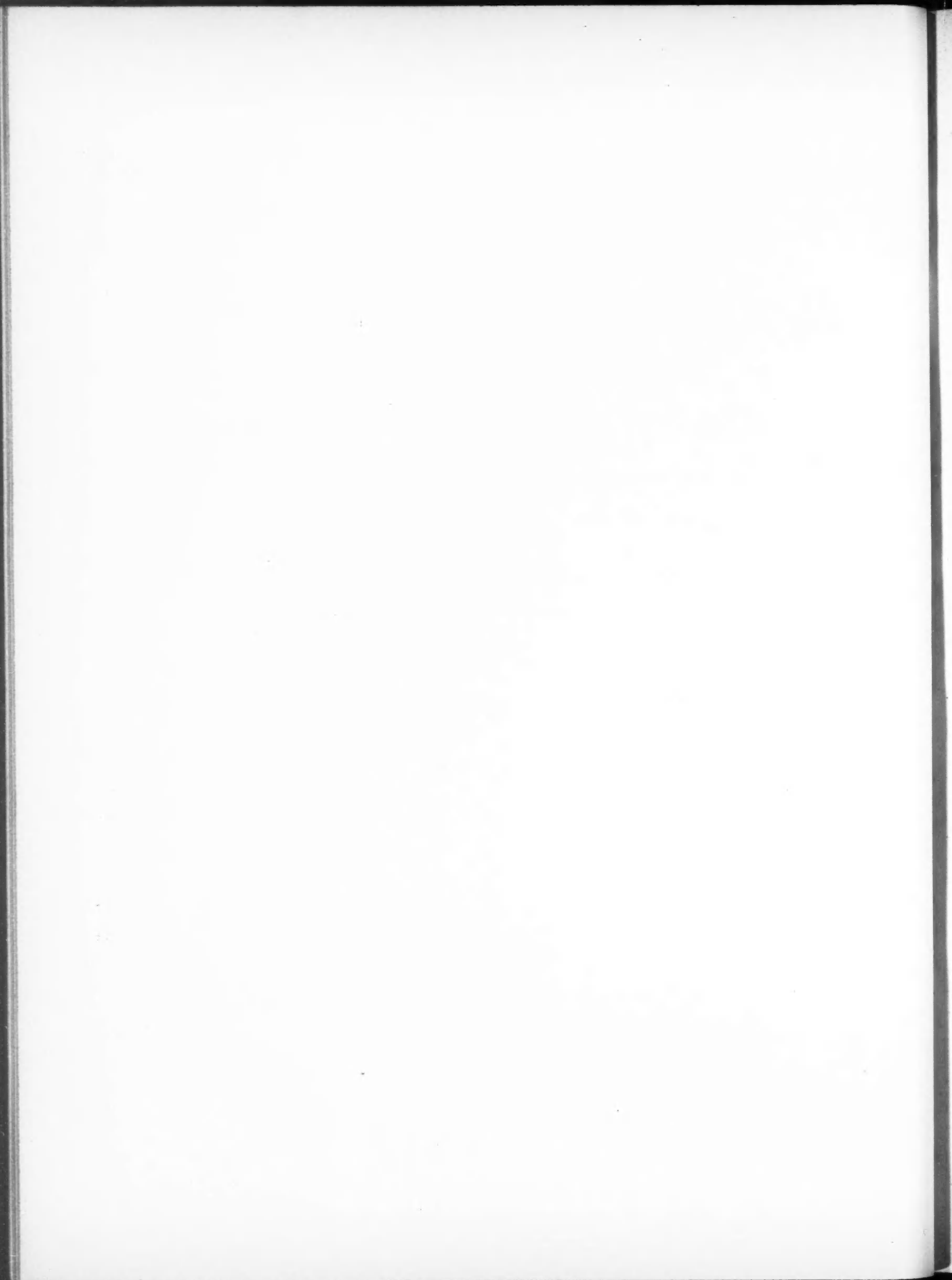
"The great Almaden mine of Spain is said to have been discovered 400 years B. C. For twenty-two centuries it has been in course of development, always paying a profit, though its production previous to the fifteenth century was comparatively small (it being principally used for the making of vermilion), when in 1557 its amalgamating qualities with the precious metals was discovered, thus creating a large and increasing demand. It is the most perfect deposit ever discovered of cinnabar, or perhaps of any other metal; consisting of three parallel veins or fissures, about 100 feet equidistant, penetrating the earth almost perpendicularly, they varying in no place over 10 degrees, growing richer and wider in metal as penetrated, until a little over 1000 feet is reached, where the bottom is richer than at any point above. There are immense reserves of ore in its lodges above the lower level, which are thought to contain sufficient metal to supply the world's demand for the next half century; for the last twelve years the average percentage of metal per ton of ore was 9 per cent; for the last two years 10.50



NEW ALMADEN QUICKSILVER MINES, CALIFORNIA. REDUCTION WORKS HACIENDA.



NEW ALMADEN QUICKSILVER MINES. 1500-FOOT LEVEL, RANDOL SHAFT.



per cent; wonderful and fabulous as it may seem. Its product since 1850 is about equal to the entire production of the eighteenth century.

"The Idria mine, in South Austria, was discovered at the close of the fifteenth century. Next to the Almaden this is the richest mine, the bottom of the lode showing diminution either in the quantity or quality of its ores; for sixty-three years ending in 1880, its average yearly profits were \$164,000. Its reserves of ore are estimated to contain 900,000 flask of 76½ pounds.

"These two mines are respectively owned and controlled by the Spanish and Austrian governments, and worked for their account; their policy always having been wise and conservative in producing only sufficient to supply the demand at good prices, having large reserves and invariably holding their surplus products for a good market.

"The whole of the underground working in the Spanish mine, after twenty-two centuries of working, can be comprised in a rectangular block 700 feet long, 350 feet broad, and 1027 feet deep," having produced since 1850 to 1888, 1,239,776 flasks of metal. The exploration and ventilation is accomplished by three shafts. In 1833-84 the total amount of material taken from the mine was:

"From ore chambers, 17,575 tons; from barren ground, 1900 tons. Of the ore raised 17,101 tons were worked only, 456 tons being worthless. Tons of ore reduced, 18,465 57, yielding 45,765 flasks, or 9'485 per cent."

The ores vary from 25 to 1 per cent in mercury. The number of workmen employed in 1883 was at the mine 2825 men and 301 boys; total, 3126. The reduction works operate 8 months in the year some 550 or 600 men and boys.

The quantity of ore handled in the year to each worker was only 6'23 tons, while at New Almaden in all the mining departments there were only 425 persons employed for the extraction of 188,640 tons, or an average of 326 tons a year to each worker, more than fifty-two times as much per year as at Old Almaden.

At the Spanish mine the workmen are, however, seriously affected by the mercurial emanations and do not work, on an average, more than one day in three and then only six hours at a time. Taking account of all these things, it appears that at our California mines fully ten times as much material is extracted to the man in equal time as at Old Almaden.

The wages in California averaged in 1885 for all employes \$2.43 a day. Average number employed, 425; average time worked in the year, 290 days. At the smelting works the average earnings per day was about \$2.30. At the Spanish mine the average wages were as follows per day:

Miners, ore-chambers contract, 81 cents; miners, barren-rock contract, 57 cents; masons in quarries, contract, \$1.03; lumbermen (per day), 55 cents; furnacemen (per day), 40 cents.

These departments probably command the highest wages, and if the assumption be correct we may conclude the average wages to be from 50 cents to 60 cents per day.

The amount of wages paid in the California Almaden mine for relative positions is, per day: Laborers in labores, \$2; miners on yardage contract, \$2.80; laborers on surface, \$2; firemen, \$1.75; timbermen, including captain, \$3 20; carpenters, \$3.04; blasters, \$2.75; surface mining, \$1.50.

The following tables giving itemized cost of producing quicksilver and of extracting ore are eloquent and instructive:

TABLE SHOWING MINING COSTS PER TON OF MATERIAL (PRODUCTIVE AND NON-PRODUCTIVE) EXTRACTED FROM MINES.

	1882-3, Almaden, Spain.	1885, New Almaden, California.
Excavations	\$3.503	\$1.636
Strengthening	1.424	.158
Drainage .....	.018	.04
Lowering, hoisting and tramming .....	.368	.282
Surface .....	.143	.102
Management of machines .....	.096	.04
General expenses	1.504	.154
Work-shops .....	.255	.042
	\$7.309	\$2.454
Supplies	1.215	.902
	\$8.524	\$3.356

TABLE SHOWING COST OF QUICKSILVER PER FLASK AT ALMADEN, SPAIN, 1882-3, AND NEW ALMADEN, CALIFORNIA, 1885.

	Almaden.	New Almaden.
Staff and office expenses	\$0.75	\$0.806
Excavations, mine expenses	1.62	10.476
Strengthening, " .....	.66	.996
Drainage, " .....	.01	.252
Tramming, " .....	.29	1.57
General expenses, " .....	.70	1.843
Supplies, " .....	.56	5.755
Distillation and flasking quicksilver	1.92	3.499
Workshops .....	.12	.452
Sundry expenses .....	.25	.....
Hospital and chapel .....	.14	.....
Pasture of Castelseras .....	.07	.....
Unforeseen expenses .....	.03	.....
Transportation by teams .....	.....	.737
	7.10	26.386

These figures show that in 1885 eight times the amount of material was extracted from the American mine that was taken from the Spanish mine in 1883, its production, however, averaging only 20 pounds of quicksilver per ton for that year, while the Spanish mine's production was 200 pounds per ton; that the average number of tons handled for each worker in the Spanish mine was only 6'23 tons, while at the American mine there was extracted over 63 tons per worker, or ten times the amount extracted in equal time; that the cost of production of the Spanish mine was $\frac{27}{100}$ of that of the American mine. It costs no more to extract and reduce rich ore than poor, and were the American ores equal in richness to the Spanish, the production of the American mines would be ten times as great, and cost \$2.64 per flask. Add for flasking \$1, and we have \$3.64 as the cost of production, as against \$7.10 in the Spanish Almaden—a striking illustration of the benefits to be derived from an intelligent and well-paid labor, and from skillful and economical management.

The excellence of this management is not confined to economical production of mineral, but New Almaden, in its care for its workmen, providing for them hospital, club room, reading room, and everything tending to elevate them, intellectually and morally, offers an example well worthy of study and imitation.

The trade and production statistics of this mine will appear in the next

issue of the ENGINEERING AND MINING JOURNAL (January 12th) with the general statistics of production and market reviews of the chief metals. The company has earned a net profit in 1888 of \$328,728.

The beautifully executed illustrations of the smelting works, and a view in the 1500-foot level, photographed by the magnesium light, scarcely call for special description. They will serve to fix upon the memory the instructive figures we have given of this admirable example of American mine management.

A CHALLENGE SHAFT SINKING RECORD.

Mr. John W. Curnow, Superintendent of the East Vulcan mine, Michigan, sends us the following record of excellent work in sinking a vertical shaft 660 feet deep. Taking account of speed, depth and cost per foot, Mr. Curnow is quite justified in considering his work as remarkable, and "if any other mining superintendent has beaten this record he would like to see it published in THE ENGINEERING AND MINING JOURNAL." This challenge is open to the whole world, and we trust will bring answers. In all cases the number of days labor expended per foot of shaft sunk and timbered and the wages rate paid should also be stated.

The progress made in sinking the deep shaft No. 2 of the Tamarack copper mine, Michigan, has reached 85 feet in a month, and at the time the report of the company was written was considered unexampled. The dimensions of this shaft are about 7 by 20 feet.

At East Vulcan mine the size of the shaft is 16 feet 1 inch by 6 feet inside of timber. The size of the timber used is 12 inches by 12 inches, and it is timbered in sets 4 feet apart, and is a three compartment shaft with dividers 6 inches by 12 inches, and is lagged up with three-inch plank, one compartment 4 feet 6 inches by 6 feet in each end for cages, and a compartment in the middle, 6 feet by 6 feet, for a Cornish plunger pump.

Sinking was commenced in the latter part of November, 1887, and the first 72 feet was put down with windlass. Then sinking was stopped to drive tunnel and cut station at the 58-foot level. Sinking was resumed April 1, 1888, using two 12 by 16 Rochester hoisting engines with 4-foot drums and two cages. The buckets used are oil barrels ironed for the purpose, and are attached to the bottom of the cages, which go above the landing, carrying up the attached bucket filled with rock. The cars are run over the shaft at the tunnel level, the bucket is detached from the cage and rests on the car, which is trammed out to the dump, a distance of 489 feet, and is so arranged as to discharge its contents automatically. The rock from the shaft is dumped at this point to fill up the stock pile ground.

The first 40 feet from the surface was sunk through sand, then 60 feet through sandstone. The next 118 feet was through red slates, and at this point was struck a very hard black jasper slate standing on edge, and this continued for a distance of 321 feet. Next 121 feet of red slates was passed through, making a total depth of 660 feet.

In timbering the shaft at each of the three different levels we put in a set of double bearers was put in to receive the large Cornish plunger pump which it is intended to use.

The whole time employed in sinking this shaft was nine months. The lowest number of feet sunk in one month was 65 and the highest was 107 feet 10 inches, making an average of 73 feet 4 inches.

The cost of sinking the shaft was as follows:

Labor, sinking, handling and timbering	\$10,993.67	= \$16.65 per foot.
" hoisting and pumping	1,437.74	= 2.18 "
Timber	3,834.77	= 5.81 "
Fuel, iron, steel, explosives, oil, etc.	10,690.97	= 16.20 "

Total cost of shaft completed

The average rate of sinking per day was 2 feet 10 inches, and the average rate of wages paid \$1.695.

The first 307 feet was sunk by hand drilling, then by two Rand slugger drills, until the last month of sinking, when three Rand slugger drills were used. The Rand slugger drills have proved to be the best drill ever used here, and all other drills have been abandoned.

The men employed to do this work were Italians, Swedes, and Polacks.

This system of sinking has never been employed by any other mine in this part of the country, neither is there another shaft timbered after this pattern.

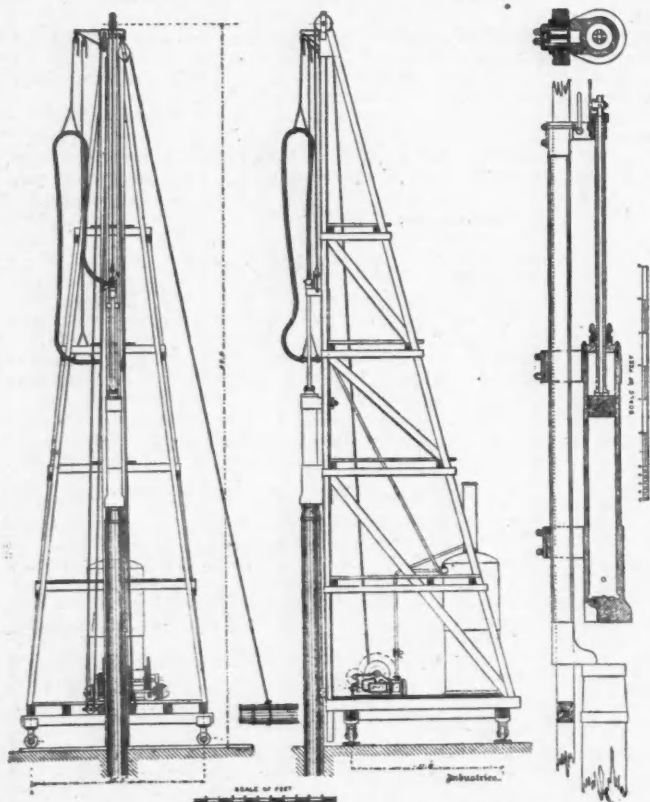
South African Gold Returns.—The complete tables of the raw gold shipments from Cape Colony and Natal to the end of October, compiled by the Cape Town Chamber of Commerce, show that the total for that month was larger than previously reported. The export from Natal amounted to £32,855, against £26,334 in September. The exports from Cape Colony in October amounted to £60,727, against £47,384 in September. The total from both colonies was £93,582, the largest amount recorded for any month since the opening of the Transvaal mines. The total from Natal for the ten months of this year, January to October inclusive, is £368,359, and the total from Cape Colony for the same period is £404,240. The total from both colonies is £772,599 for the ten months. The total for 1888 is expected to exceed a million sterling, against £235,937 only for last year and £183,534 for 1886.

Combined Fresh Water, Brine, and Gas Well.—One of the most remarkable things of which Pittsburg boasts is the combination well that has been struck at the cracker factory of S. S. Marvin & Co., on Liberty street. It produces at one and the same time cold water, pure and sweet; salt water, and a flow of gas that, when ignited, illuminates the entire surroundings. The well was drilled some time ago, Mr. Marvin's idea being to get a supply of pure cold water for use in his bakery in the summer and during flood times when city water is not desirable. At 100 feet the fresh water was struck, and at 200 feet the salt water and gas were found. Two casings were inserted, one for the salt water and gas, the other for the fresh water, and now, when the engine is started and the gas lighted, spectators behold the wonderful sight of fresh water, salt water and fire all coming out of one well at the same time.

THE DE WIT STEAM PILE DRIVER.

Direct acting steam pile drivers have now come into very general use for all works where time is an important element. The pile driver, of which we borrow the description and illustration from *Industries*, is an improvement on steam pile drivers hitherto in ordinary use, in which the piston rod and "monkey" are in one, and which of necessity have a stuffing box at the bottom of the cylinder. In the machine shown the cylinder and monkey are in one casting, and form the movable part giving the blow to the pile, while the piston rod remains stationary in relation to the pile. The bottom of the monkey being solid, there is no dripping of water from condensed steam on to the pile head. Another advantage in this pile driver is that the steam hose or pipe which conveys steam from the boiler to the pile driver remains stationary during working, consequently there is but little wear and tear. The piston rod is fixed to an H iron frame, provided at its lower part with a foot, which rests upon and guides the head of the pile. A recess is cast in the monkey, as shown, to give room for this foot. As the pile

IMPROVED STEAM PILE DRIVER.



descends, the frame, piston rod, and piston descend with it. Steam is admitted into the cylinder or monkey through the hollow piston rod and transverse holes immediately above the piston. Both piston and rod are in one forging. The admission and exhaust of steam is controlled by a three-way cock, worked by hand from a rope attached to a handle. The handle could be worked automatically, but this is not considered desirable. The machine is single acting, the cylinder and monkey being lifted by steam pressure, and falling free when the exhaust is opened. The pile driver, controlled by hand, is capable of making from thirty to thirty-three strokes per minute, and of driving from twenty to twenty-five piles per day, according to the nature of the ground. Various sizes are made, the smallest having a monkey of 6 hundredweight, and the largest one of 30 hundredweight, the latter being the machine shown in our illustrations. The stroke of this machine is 6 feet 5 inches, and the diameter of cylinder 9½ inches. The machine is constructed to drive piles up to 39 feet 4 inches long. The frame work is of timber, mounted upon four wheels. The boiler is of the vertical type, 10 feet 6 inches high by 4 feet 3 inches diameter, and the steam winch is supplied with two distinct motions, one for lifting the pile into position, and the other for raising the monkey. The total weight of the pile driver is 7½ tons, and there are 175 cubic feet of timber in the staging. We are informed that these pile drivers have done good work at Antwerp, Bremen and Amsterdam. They have also been used on the Northeastern Railway, and are being employed in the construction of the Manchester Ship Canal.

Steel Passenger Railroad Cars.—A trial trip has been made with the new fire-proof steel cars just completed for the Louisville, New Albany & Chicago Railway. The trip was made to Hammond, Ind. The car is in all respects a first-class coach. Above the trucks all is non-combustible material. The usual sills and girders are faced with steel plates set on edge. Through these and extending across the car are heavy steel bolts, firmly secured. The frame work of the car is attached to these sills, the ribs and posts, along with the raised deck, being bent without heat to the required curve. The makers claim that the cars are safe from telescoping. Steel sheets cover the frame work, making it comfortable both in winter and summer, and absolutely fire-proof. Lightness, strength, durability and resistance to fire, it is claimed, have been obtained. The New Albany road will soon put these cars in the regular service.

THE SOUTH AFRICAN GOLD-FIELDS

Special Correspondence of the Engineering and Mining Journal.

When last in New York I promised to send you an account of the South African gold-fields, but at that time I little contemplated or imagined how vast was the area with which I should have to deal.

Nearly ten months professional travel over this section of the country and a close investigation of the physical and geological features of certain portions of it now enable me to partially redeem my promise, although I shall only deal technically, for the present, with that portion of the Transvaal mineral belt known as the De Kaap and Komati gold-fields, and will also include part of Swaziland.

My data, so far as the geographical aspect is concerned, can only be approximate, the more so as no reliable surveys have yet been officially made, and, consequently, the maps of the South African Republic and its adjacent territories are by no means accurate. Both the geology and geography of the Transvaal have been sadly neglected, and it is hard to conceive that such general ignorance should prevail on these important subjects in a country teeming, as this does, with interesting problems for industry and science.

The South African Republic, or as it is popularly called, the Transvaal, lies between twenty-two degrees and twenty-eight degrees S. latitude, and twenty-five degrees and thirty-two degrees east longitude, and may be described as the northernmost of South African States south of the Zambesi.

The present rulers of the country, known as Boers, are of Dutch extraction, and their ancestors were among the earliest settlers in South Africa, and, having been successively driven out of Cape Colony and Natal, eventually trekked into and founded the Free State. With that love, peculiar to the Boer, of acquiring and possessing large tracts of land, many of the trekkers cast longing eyes on this part of the country, and separating from their brethren in the Free State, wandered further northward, dispossessing the native tribes on their way, and at last declaring their new possessions a separate state under the name of the "Transvaal" (beyond the Vaal). The present form of government may be said to be both autocratic and patriarchal, but it certainly is not republican or democratic, although it professes to be. I shall deal with this question later on in the course of these articles, and from the many abuses, burdens and shortcomings I shall have to record, your readers will be able to judge how far that republican axiom, "the greatest good of the greatest number," is acted up to by the governors of the South African Republic.

About forty miles from its eastern boundary is the fine natural harbor of Delagoa Bay, the chief town of the Portuguese settlement, called Lorenzo Marquez. Bechuanaland, one of the latest of England's acquisitions, borders it on the southwest. On the northern border runs the Limpopo, about 300 miles south of the Zambesi, and the territories of Kahama (Matabeleland), recently annexed to the British possessions under the euphonious title of *Protectorate*. South and southwest of its borders lie the Cape Colony, Natal, and the Orange Free State, with the Vaal River as a dividing line. The total area of the Transvaal may be roughly computed at about 120,000 square miles. Some 80 to 100 miles from its southern boundaries, running east and west through the country, and varying from 30 to 50 miles in breadth, is an elevated plateau known as the High Veldt, attaining an altitude of as much as 6000 feet.

This forms one of the principal water-sheds for the rivers running south to the Vaal and north to the Limpopo, the only two streams of any importance in the country, and neither of them navigable. The Vaal rises in the High Veldt and flows into the Orange River, this latter flowing to the west coast some thousand miles from its source, while the Limpopo, taking its rise on the same elevated table lands further north, primarily runs a northwesterly course, but eventually returns to the coast, where it empties itself into the Indian Ocean north of Delagoa Bay.

Three mountain ranges of varying altitudes run east and west through the country, the most important of which is known as the Drakensburg, extending over 100 miles inland. The Drakensberg runs in an unbroken chain from Table Mountain, Cape Colony, to the north of the Transvaal, where the "Mauchsberg" attains a height of 7177 feet above the level of the sea, while the highest peaks of the Lydenberg and De Kaap do not exceed 5000 feet.

When a settled form of government was first established in the country, the land was parceled out into so-called farms of about 3000 morgen, equal to about 6000 English acres each; numbers of these farms were given to the early settlers, while a large area of the country has been frittered away as concessions for various considerations by successive governments. At a later stage I shall have much of interest to communicate, not only on land concessions, but on monopolies of all kinds.

Out of the 14,000 registered farms the government still owns some 2000 or more, while immense tracts of land, more especially in the Waterberg and Zoutspanberg districts, still remain uninspected and unsurveyed. Even many of the official registered surveys in the two latter districts are worthless, the government or other inspector, whose name is appended to the documents in question, never having been near the ground alleged to have been inspected, the information contained in the inspection report having been obtained on hearsay. So unreliable, in fact, are these reports that the government has lately been obliged to decline all responsibility for any of these documents issued previous to 1867. I think purchasers of land in this country should therefore be careful to buy only on officially registered surveys and not on inspection reports. It is asserted by those who ought to know that a large extent of Transvaal territory has been sold several times over; in other words, in consequence of these defective reports and the absence of reliable beacons, there have been many more farms sold on inspection reports than exist, seeing that the imagination of the inspector and his informants are the fertile source whence many of the alleged farms sprung into existence.

In the De Kaap valley some 300 farms still remain government property, and as such have been proclaimed public gold-fields, and thrown open to diggers. Here Barberton, named after two well-known South Africans, the brothers Barber, the finders of the first payable reef in the district, was founded, and became the chief commercial centre of this

part of the Transvaal and the capital of the De Kaap Gold-Fields. Of this remarkable town more hereafter.

HISTORY OF GOLD MINING IN THE TRANSVAAL.

It may not be out of place to give an outline of the history of gold in South Africa. Tradition has long maintained that the coast country to the south of the Zambesi, and now known as Sofala, is the Ophir, whence Solomon is recorded to have obtained gold and ivory. Sibia, too, the name given to the district inland of Sofala, is supposed by Josephus and others to be the country of the Queen of Sheba, who visited Solomon and admired his wisdom.

The Zambesi was discovered by Vasco di Gama in 1498, and during the sixteenth and seventeenth centuries the Portuguese settled on the coast to the south, and sent home from their possessions much gold which the natives brought down from the interior in quills. Exploring parties who have visited the most northern parts of the Transvaal during the last few years have discovered conclusive proof that the extraction of gold from the rocks was known to the aborigines many years ago; evidences of workings and rude smelting furnaces being met with frequently, whilst no trace of any civilized habitation can be found. These workings, which consist of open cuttings and trenches, have evidently not been made for the purpose of extracting iron ore, as loose masses of this mineral are lying about near at hand untouched.

In 1818 Carl Mauch, the traveler, announced the discovery of a rich gold field eighty miles by three at Tati in Matabeleland, and three years later it was worked by the London & Limpopo Mining Company and others. The want of capital and the impossibility of transporting suitable machinery so far inland through a roadless and hilly country proved insuperable difficulties, however, and most of the claims were abandoned.

Within the Transvaal proper Mauch found gold on the Murchison hills in 1833, and in 1871 Batton discovered auriferous veins on the Marabastad fields at Eerstuling in the Zutsspanberg district.

Two years later alluvial diggings were opened in the Leydenberg district at Spitzkop, Mac Mac, Pilgrims Rest and Waterfall, and these were worked with success till the diggers were ousted by the government, conceding the land to various speculators. These speculators floated the concessions into companies known as "The Transvaal Gold," "Lisbon Beryln," "Spitzkop," "Grasskop," et ad hoc, but so overburdened them with capital that not a single one has proved remunerative.

From Leydenberg prospectors wandered south to the Duivels Kanloor (Devil's Office), which overlooks the Kaap Valley, and in 1884 the Kaap fields may be said to have first assumed a definite existence, when the Pioneer Reef was discovered on what is now the property of Moodies G. M. and Exploration Company, Limited.

The marvelous richness of the Sheba reef, which was discovered in 1896, drew the attention of South Africa to the Kaap fields, and led to the rise of the town of Barberton.

About the middle of 1886 the Witwatersrandt fields, about 30 miles south of Pretoria, the capital of the Transvaal, were discovered and proclaimed a public gold field, and prospecting has since revealed gold in almost every part of the Transvaal. The following return of the export of gold will show the rapid strides the industry has made within the last two years:

1871.....	£670 sterling.	1886.....	£134,769 sterling.
1875.....	39,432 "	1887.....	223,487 "
1884.....	69,000 "	1888.....	(estimated) 1,000,000 "

The last item is likely to be underestimated, as Witwatersrandt alone has exported nearly £550,000 value in smelted gold, whilst the output is increasing with rapid strides each succeeding month, that for September from the Witwatersrandt gold-fields alone exceeded 23,000 ounces, whilst the returns from that district for last month will not fall far short of 30,000 ounces.

Two years ago the coffers of the Transvaal government were not only empty, but it was an open question whether apparently invited bankruptcy would not again drive the Boers into the arms of England, their principal creditors. With a magician-like transition, however, the country suddenly passed from poverty to prosperity, and an ugly deficit has now become a handsome surplus of income over expenditure of some half a million sterling.

From the official gazette (the *Starts Courant*), I take the following returns on revenue account for the first nine months of 1888 from a few of the mining centres:

Johannesburg.....	} Witwatersrandt.....	£130,680
Boksburg.....		17,630
Krugersdorp.....		16,087
Blaubank.....		3,071
Schoonspruit.....		22,901
Doomsbosch.....	} Rietkint Witpoort.....	761
Venters Kroou.....		2,981
Rodee Poort.....		1,434
De Kaap.....		72,000
Total.....		£267,555

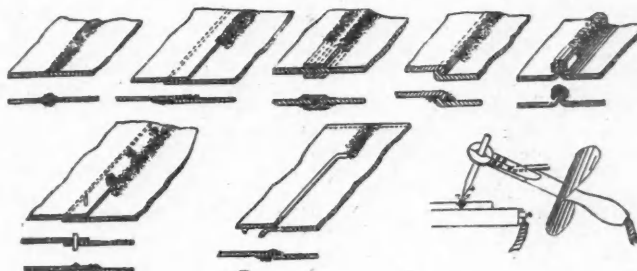
Paper from Pine Tops.—There has been considerable talk of late of the use of the cotton stalk for paper pulp, and in this connection there is a development in the use of the tops of pine and spruce trees, which have been so disastrous in originating fires in the lumber regions. It has been shown that these worthless and dangerous tree tops and branches can be steamed to extract the resinous matter from them, and ground up into dry pulp and utilized in the manufacture of paper.

Braintree Dam, Mass.—The large dam just completed by the Quincy Water Company in the town of Braintree, Mass., is thrown across the valley of a small brook, and forms a reservoir covering sixty acres of land, and is supplied by a water-shed having an estimated capacity of 833,000.000 gallons of water. The dam is 600 feet long, 35 feet high for a distance of 275 feet across the deepest portion of the valley, 160 feet thick at the bottom and 20 feet thick at the top. From end to end of the dam, in the center, is a core wall. The wall is 7 feet thick at the bottom, and tapers to 2 feet at the top, and rests on a massive concrete foundation, built between two lines of sheet piling. The water-slope of the dam is paved with stone to an average depth of 18 inches.

THE BENARDOS ELECTRICAL WELDING PROCESS.

This process, invented by N. v. Benardos, of St. Petersburg, as described in the *Railway Review*, consists in laying the pieces of metals to be united on one another, with the welding seam spread with chips of the same metal to form the negative electrode of a voltaic arc. The circuit occurs through an iron table upon which they lie, and which is connected with one pole of the source of electricity. The carbon, depending in size on the strength of the current, as well as upon the hardness of the metals to be welded, is placed in an insulated holder connected by a cable to the other pole and forms the positive electrode. This is passed to and fro over the seam by a workman, who protects his hand from sparks by a leather glove, and his eyes by a dark glass screen fastened to the carbon holder. As soon as the workman brings the carbon to the proper distance from the seam the electric current leaps from pole to pole with a strong hissing, and melts very rapidly the chips and edges of the metal bars, which are united when cooled. This process should be called rather soldering than welding, for in welding the heated metals are united by mechanical working, while in soldering a third metal is used to cement the other two together. One thing is to be noted—the metal in the weld has had its condition changed from a fibrous to a crystalline structure, which is evidently due to the complete fusing of a metal afterward rapidly cooled. The tensile strength at the weld is consequently considerably decreased, as records of a few tests furnished by the patentee seem to indicate.

Crystalline structure at the weld in all cases where varying strains occur must be avoided. It would hardly be practicable, therefore, to



Benardos' Electric Soldering.

replace riveting of seams in boiler and bridge construction by this process of soldering.

The process, nevertheless, appears to be suited to small but important repairs which can be rapidly made without the loss of time and cost incidental to stripping or taking apart the structure. Thus, for instance the current necessary for welding can be conducted without difficulty by an insulated cable to a boiler requiring light repairs, which, without disturbing the masonry, can be speedily made serviceable by soldering on a patch. Large steam cylinders which, after being put into service, often develop defects in the casting can likewise be repaired without affecting but few of the other parts.

Welding by electricity under water, although accompanied by a lively evolution of steam, oxygen and hydrogen gases, is performed without especial difficulty. The importance of this application to closing leaks in large iron ships should not be underestimated and experiments in this direction should be tried. Its introduction in the case of large ships might recommend its speedy application to correcting defects in machines and boilers. In railway repair shops such work as patching fire-boxes and welding flues to flue sheets in place of expanding them could be done by the aid of this electric spark.

In any event it is very important to secure positive knowledge concerning the structural condition of the metals which have been welded together by electricity, by numerous and unprejudiced experiments.

The cuts, which are so clear as to require no special explanation, show the different methods of procedure when welding by this process.

Since differences in strength of metals to be welded and varieties in the size of the seam require currents of different strength, it is not desirable to use a current taken directly from a dynamo, because the strength of this current can be changed only by varying the resistance in the circuit, whose heating would consume useful energy. Benardos employed, therefore, electric accumulators, and he varied the strength of the current by cutting in or out a certain number of cells. In this way he produced fine variations with but a small resistance to consume a minimum part of the energy.

For the production of a large amount of heat it is a matter of some consequence, considering the unalterable resistance W of the welding seam to use a current of great strength J , for, according to the law of Lenz and Joule, the amount of heat is proportional to the product $J^2 W$; this is done by employing a special kind of electric accumulators.

The accumulators which are employed in the electric welding are those of Plante, which, however, are specially adapted by a peculiar construction of Benardos to his process.

Electric welding or soldering, whichever we may see fit to call it, does not require much special machinery. A dynamo, which may be already in use for electric lighting, can charge the battery of accumulators to be employed in electric welding.

It is to be hoped that a knowledge of the rapid and energetic action of this process of welding may insure its practical employment in the few mechanical departments to which it is adapted.

Technical University for Victoria, Australia.—A minute has been issued by the Minister of Public Instruction of the colony, on the policy of founding such an institution, in which the evidence taken before the Royal Commission on Technical Instruction is summed up. The estimates of cost are from \$2,500,000 to \$5,000,000 for founding the university and a yearly endowment of \$150,000.

WATER PURIFICATION BY IRON.

In Antwerp, Belgium, the water supply comes from the River Nethe, which is admittedly polluted, and the system adopted for purification is Anderson's iron process. Professor Bischof has called it "little better than an open sewer," and Professors Blas and Tooissen, in 1887, stated that a sample of it was "thick, colored and exhaled a disagreeable smell, leaving an abundant brown deposit." After treatment, the same water is limpid, colorless, and without either disagreeable taste or smell. It does not deposit and does not spoil with keeping, while the ammonia and nitrous acid have completely disappeared, and the organic matter has been reduced 50 per cent. Taking the figures furnished by analysis the organic matter is reduced in the proportion of 77 to 31, the albuminoid ammonia from '27 to '08, and the free ammonia from '4 to nothing. In this last respect the purified water excels that drawn from deep wells. At the same time bacteriological tests often show that the water has been actually sterilized, and that both bacteria and their germs have been eliminated. Unfortunately a good deal of doubt still surrounds this method of testing, and the results must be received with considerable caution. But a good practical proof of the purity of the water is furnished by the fact that bottles of it have been in the possession of Mr. E. Devonshire, the resident engineer of the Antwerp Water-Works Company, since 1886, and are still unaltered in taste and appearance, a better result than can usually be obtained with distilled water.

Whether the process of water purification by iron can be relied upon to eliminate the germs of disease or not, it certainly works a wonderful improvement upon a foul supply, eliminating the color and throwing down floating matter which will pass through the deepest filtering layer which can conveniently be employed. For instance, the muddy Nile water, which requires weeks to become clear in the irrigation basins of Upper Egypt, is brought by five minutes' contact with bright iron into a condition in which it can be rapidly filtered, the effluent being exceedingly bright. The process has been several times described, but as all our readers may not be acquainted with it, we will give, from *London Engineering*, a short account of it as practiced at Antwerp. A large plate iron cylinder, resembling an externally fired boiler, is arranged horizontally on trunnions, so that it can rotate on its longitudinal axis. The trunnions are hollow, water flowing into the cylinder through one and out of it through the other. The incoming current is deflected into a bell-shaped stream by a round plate situated in front of it, while the outflowing water is gathered from the lower part of the cylinder by a curved pipe and a bell. Running lengthwise along the sides of the cylinder are rows of curved shelves, the purpose of which will appear presently. When operations are to be commenced the cylinder is filled one tenth full of fragments of iron; these may be cast-iron borings or small balls, or burrs from a punching machine; in fact any kind of small pieces of iron which will easily roll, either cast or wrought, will serve the purpose. It is then filled up to the top with water, the air being emitted through a cock provided for the purpose, and is set in rotation at a speed of six revolutions per minute. The shelves mentioned above carry the iron up the rising side of the cylinder until it nearly reaches the top, when it slides off the shelf and falls through the water in a shower. There are so many shelves that the action is practically continuous, and the water passing through the cylinder is always in contact with the iron. As the fragments fall and are scooped up again they are in constant friction with each other and with the shelves, the result being that they are rubbed quite bright and are kept so. They are attacked by the carbonic acid in the water, and there is formed carbonate of iron, which is rapidly transformed into a soluble oxide. About one-tenth of a grain of iron is dissolved in each gallon of the water as it emerges from the cylinder.

This constitutes the first part of the process, which, taken alone, does not seem to have any great purifying effect on the water. The next operation is to complete the oxidation of the iron salt, and to change it from the soluble ferrous condition to the insoluble ferric state. This is done by exposing the water to the atmosphere, from which it absorbs oxygen. The exposure may be simply in settling ponds, or by running the water in a thin stream down a culvert, or over cascade steps made of coke. This last seems to be the most rapid method, but the others are equally effectual if sufficient time be afforded to them. As oxygen is absorbed by the water the particles of the iron salt gather together into exceedingly fine flakes, which can then be removed by a rapid filtration through sand. In the process of separation the iron appears to inclose the bacteria and many other impurities, as if by a process of coagulation, and the water runs from the filter in the condition spoken of above. The iron is left on the top of the sand and forms a layer which appears to add much to the efficiency of the filter. Professor Kemma, of Antwerp, says that "The film of oxide, once formed and well settled, constitutes a homogeneous and continuous membrane through which the water passes, not by a flow through the interstices or capillary 'transpiration,' but by a veritable osmosis." Whether this be so or not a very thin layer of sand is sufficient for the filtering, which can be done very rapidly.

In addition to being in use at Antwerp, Anderson's process is employed in the Gouda water-works and the Dordrecht water-works. It has also been experimented with at Ostend, Paris, and Berlin. Gouda is in Holland, and draws its water from the river Ysel, which is often stained a deep yellow color by water flowing over peaty soils. No practicable amount of filtration will remove this color, but it is entirely removed by the iron, together with 55 per cent of the oxidizable matter. This, however, is not always sufficient to satisfy the prescribed permanganate test, and sulphate of aluminate has to be added to the water after it has passed through the revolving cylinder to aid the precipitation. Before Anderson's process was adopted, perchloride of iron was used alone for this purpose at a cost of fourpence per 1000 gallons; now the total cost is two-pence per 1000 gallons, of which the iron process, including all charges, accounts for rather more than a halfpenny. At Dordrecht an Anderson revolver was erected to deal with the yellow coloring matter with which the river water is stained at certain seasons of the year, and also to enable a larger quantity of water to be passed through the filters than they were originally designed for. The color was found very difficult to remove until special means were taken to insure the full oxidation of the dissolved

iron. To this end air from a blower was forced in minute streams through a sheet of perforated zinc fixed in the bottom of the trough along which the water flowed from the revolver. By the aid of this device unusually thick river water was rendered quite colorless after filtration. At Ostend trials of the Anderson process have been made on a large scale, and it has been decided to adopt it. The water experimented upon was from the Canal de Bruges, which is fed by the River Escaut; this latter is liable to contamination from the waters of the Espierre, a stream flowing through the great wool-washing districts of Roubaix and Turcoing. In addition, at the time of the experiment there were flowing into it the waters of the Lys, which, owing to the flax-retting carried on in it, is probably the foulest stream in Belgium.

A small revolving purifier was erected in Paris in 1886 to supply works of the Société Anciens Etablissements Cail with Seine water; and judged by the ammonia standard, the result was very good. An experimental plant was also tried at Berlin, but there the result was not satisfactory, the supposed reason being that, as the water was already charged with salts of iron, a double set of reactions were going on at the same time, and interfered with each other.

The working cost of the apparatus erected at Antwerp is stated to amount to 4s. per million gallons for iron, power, labor and supervision in the purifiers, and about 14s. for filtering and sand-washing, the filter cleaning costing 9s. 6d. of this amount. With an establishment specially constructed with settling reservoirs for the grosser impurities to subside in before the filtration was commenced, it is believed that the entire cost would not exceed 13s. per million gallons. The capital outlay for the revolving purifiers is 1000*l.* for each million gallons dealt with daily, and the speed of filtration is 80 gallons per day per square foot of surface.

Californian Importation of Houses.—Owing to the high price of lumber and other building materials in Los Angeles, Cal., several houses have been made in Chicago and imported by rail. Six such buildings were received in one week.

Value of French Walnut in Chicago.—One Chicago veneer firm, according to the *Lumber Trade Journal*, has in its possession a single burl of French walnut, weighing less than 400 pounds, cut into veneers measuring 8500 feet and valued at \$1,400, or nearly \$4 per pound, being more than four times as valuable as amaranth or ebony; and its high price does not prevent its being used quite extensively in Chicago by wood-working manufacturers of fine goods.

New Chinese Port.—A suitable port in the West or Canton River will soon, it is announced, be opened to foreign trade. Wuchow is the port named; but it is said that the advantages of Nan-ning, which is higher up, are so great that a survey of the river between the two towns is to be made, with a view to seeing whether steamers can ascend to Nan-ning without difficulty. The Canton merchants are alarmed lest the position of the French in Tonquin, and of the British in Upper Burmah, should destroy the importance of Canton as the chief market for foreign goods for Southern and Southwestern China.

South African Diamond Industry.—According to a report of the German Consul at Cape Town the South African diamond trade in 1887 exceeded that of the previous year by 463,869 carats weight, and £737,173 in value. In 1887 the export was 3,598,930 carats, valued at £4,242,4703 against 3,135,061 carats, worth £3,504,756 in the previous year. The produce of the different mines was as follows: Kimberly, 1,410,207 carats, valued at £1,410,207; De Beers, 1,014,048 carats, valued at £1,014,048; Dutoitspan, 696,576 carats, worth £987,283; Bultfontein, 602,246 carats, worth £612,962; St. Augustine's, 197 carats, valued at £250.

Condition of Chilean Trade.—The *Bulletin du Musee Commerciale* notes that the importance of the export of guano from Chili has lately been declining in consequence of the successful competition of the artificial manures which are now prepared from phosphates. The product of the Chilean guano in 1887, collected from the Island of Lobos de Arucea, Punta de Lobos, and Pabellon de Pico, represented a value of about \$450,000, while \$37,050 of this had to be paid to Peru, as representing 5 per cent of the guano of Lobos, in conformity with the treaty of peace in 1883.

On the other hand, the export of saltpeter is developing. In the course of last year the Province of Tarapaca exported 712,000 tons of this article. The Chilean Senate has adopted the bill for selling the concessions of saltpeter belonging to the State in the newly-annexed Tarapaca region. This property is divided into sixty-seven concessions, and was obtained by the government at the price of \$5,800,000.

Old Indian Corn.—It is reported that a jar of corn has been unearthed near Yuma, Arizona, that gave evidence of having been buried in the ground for centuries. In a cut twelve feet in depth, on a canal in process of construction, was found an "olla" or earthen jar. The olla was in the shape of a large bottle, and its narrow neck was sealed up with a thick coating of mesquite gum, while the outside of the vessel was painted with a very remarkable and fantastically drawn design or drawing. Upon breaking the sealed top it was found to be filled with corn, weighing about thirty pounds. The corn was snow white, and the kernels large, yet extremely tender. The corn was planted in a tract of nearly ten acres, and just thirty-five days from the date of planting roasting ears were taken from the field. The corn is very sweet, and produced an immense crop. The planting did not grow over two and one half feet high, and bore from three to six large-sized, well filled ears of corn.

Trial of a Forged Steel Projectile.—An important experiment at the naval proving ground was made last week at Annapolis, Md. An eight-inch piercing projectile of forged steel was fired against a compound plate of wrought iron and steel, manufactured by the firm of Cammell & Co., of Sheffield, England.

The plate was eight feet wide by six high and ten inches thick, and was supported upon a backing of oak twenty-four inches thick. The gun used was one of the new steel breech-loading rifles belonging to the United States steamer "Chicago." The weight of the projectile was 250 pounds, and of the powder charge 126 pounds, giving the velocity of 2000 feet per second. The projectile pierced entirely through the plate and lodged broken in the oak backing. The plate was cracked to the edge at two points. The performance of the projectile is considered admirable,

and is most encouraging in the prospect it holds out of the successful development of steel forged projectiles in this country, it having been made and tempered at the Washington Navy Yard. Lieut. Austin M. Knight, Inspector of Ordnance, in charge of the proving ground, conducted the experiment.

A German Floating Exhibition.—The German Export Society in Berlin intends to devote a capital of 5,000,000 marks to the building of a large steamer which will contain a complete emporium of every species of manufacture to be sold in foreign ports. The board of directors of this society have just issued a prospectus in which the whole undertaking is explained. It says, amongst other things: Export sample stores alone will never supply the place of exhibitions. Although the efforts of the former have been very successful, they do not carry that amount of conviction as to the value and cheapness of German manufactures to the minds of foreigners that is necessary in the interests of German trade. The only right way, or at least the best way, is to visit the foreign dealer in his own country and there bring his attention to such articles as would suit his market. It is intended that the cruise shall last two years, and extend to the Baltic, the coasts of North and South America, China, Japan, India, Australia and all the principal ports in the Mediterranean. The steamer is to be named the "Kaiser Wilhelm." [This method of introducing wares is worthy the imitation of our American exporters.—Ed. E. & M. J.]

Trade Marks in India.—The Indian Government has introduced a bill, to come into force on April 1, next, and of which the following are the chief provisions as furnished by a correspondent of the *Oil and Colorman's Journal*.

The bill defines "trade marks" and "trade descriptions" in accordance with the universally accepted meaning, and states a "false trade description" to be one that is "untrue in a material respect as regards the goods to which it is applied," whether it has been false when applied, or rendered so by subsequent alteration.

The bill differentiates between "trade marks" and "property marks" as follows: "A mark denoting that goods have been made or manufactured by a particular person, or at a particular time or place, or that they are of a particular quality, is called a trade mark," and includes marks that are registered out of India.

"A mark used for denoting that movable property belongs to a particular person, is called a property mark."

Whoever marks any "goods, or any case, package, or other receptacle containing goods," or uses "receptacles so marked as to mislead as to time or place of manufacture, or as to the quality of the goods, etc.," is said to use a false trade mark, and shall, unless he proves that "he acted without intent to defraud, be punished with imprisonment of either description for a term which may extend to one year, or with fine, or with both.

Whoever counterfeits such marks, or knowingly uses as genuine a counterfeit mark, or has in his possession any "die, plate, or other instrument for the purpose of counterfeiting any such marks," is made punishable with imprisonment up to three years, or with fine, or both.

Whoever sells or exposes for sale goods that are falsely marked, shall, unless he proves his good faith and discloses the source whence he obtained the goods, be liable to imprisonment for one year, or to a fine, or both.

The application of a "name or initials—(a) not being a trade mark or part of a trade mark; and (b) being identical with, or a colorable imitation of the name or initials of a person carrying on business in connection with goods of the same description and not having authorized the use of such name or initials," is deemed a false trade description.

The definition of "application" of a mark or trade description to goods is most exhaustive, and seemingly sufficient to cover the entire ground.

Saving clauses are inserted for the protection of those who act inadvertently or in ignorance. Provision is made for the forfeiture of goods falsely marked, and for the intervention of the Customs officers. This bill makes no difference in the manner of registering trade marks in India, but is meant to correspond with the British Merchandise Marks Act.

How Common Circular Saws are Made.—Ordinary circular saws are of all sizes from six inches to six feet in diameter. The plates from which they are shaped come from steel mills in circular form, almost round, if not perfectly so. The first thing to be done is to see that each plate is made a perfect circle. A hole is then cut in the centre, and the teeth are marked around the rim. The plate is then taken to a machine on which the teeth are to be cut. It is placed upon a pin at such a distance from the machine that the edge becomes beneath the die, and the operation of teeth-cutting begins. The steel is cut cold, each tooth being made by one blow. All sizes and descriptions of dies are necessary, as the style of saw and saw-teeth are many. After the teeth have been cut the next operation is that of tempering, which is the most difficult and important process in the making of a saw. Several saws are placed in the furnace at a time, and allowed to remain until they have reached the proper temperature, a light cherry red, when the plates must be taken from the oven and plunged into a vat of whale oil, heated by pieces of red-hot iron or steel, which are placed in the vat one after another until its contents are properly heated. As each piece is dropped in a brilliant flame leaps from the surface of the oil, and continues to burn until extinguished by stirring the liquid with a long iron rod. The large, glowing plates are then cautiously slid into the vat. Leaving the tempering department, the saw goes back to the main shop to be hammered and straightened ready for grinding. This work is done by hand. After the plate, which has been more or less warped during the tempering process, has been made perfectly straight again, it is placed in the grinding machine, which is a carriage between two wheels, which turn it, and at the same time press its sides against a rapidly revolving grindstone. The carriage is fixed in automatic bearings, and is moved back and forth at the will of the operator. It usually takes about two hours to grind a large five-foot circular saw, though the time varies according to the kind of saw that is being made. The next operation is that of polishing, which is done with emery wheels. To polish a large circular saw the plate is secured to a large wheel or flange, which turns, carrying the saw with it, the workman meanwhile pressing an emery ball (attached to a handle) against the side.

The saw must then be "rounded"; that is, care must be taken to pre-

vent one tooth projecting farther than the others. For this purpose the saw is placed in a bearing, and made to turn slowly. It is then gradually brought in contact with an emery wheel, the latter turning very swiftly, until the edge of every tooth touches the wheel. The saw is next sharpened and submitted to further hammering for the purpose of "truing" and straightening, and is then cased ready for shipment.

One important part of the sawmaker's business is the renovation of old saws injured in fires. It is straightened up, tempered over again, and provided with a new set of teeth.

This article has dealt only with common circular saws, the teeth of which are not separate from the plate. Other saws, however, supplied with inserted teeth of various kinds, are made in large numbers. These are all patent saws, and can be supplied with new sets of false teeth as often as necessary.

Railroad Gauges of the World.—From a review of the history and development of the railroad gauges of the world, by Herr Claus, in *Glaser's Annalen*, the following particulars are extracted: After a battle of the gauges, 4 feet 6 inches, 4 feet 8½ inches, 5 feet, and 7 feet, it was agreed in England, about 1848, that a uniform gauge of 4 feet 8½ inches should be used on all new roads, except those already served by the 7 feet gauge. The first German road, from Nuremberg to Fürth, was built with 4 feet 8½ inches gauge, which is now used by all the principal roads of Germany, although there is a very considerable mileage of narrower gauges, mainly 1 metre, or 3 feet 3¾ inches. France started her roads with a width between rail centers of 4 feet 11 inches, which has led to some slight variations of gauges according to rail width. The later roads have been built with a gauge of 4 feet 8½ inches. Holland began with a 6 feet 4 inches gauge, but has now altered all its roads to 4 feet 8½ inches. The Railroad Congress at Vern, in May, 1886, adopted the following resolution, which is to apply to Germany, Austria-Hungary, France, Italy, and Switzerland: "The gauge of railroads measured between the inner edges of the rail heads shall, for roads built or altered as to gauge after this resolution takes effect, not be less than 4 feet 8½ inches on straight lines, nor more than 4 feet 9¾ inches on curves."

In Russia, the first road opened in 1838, from St. Petersburg to Zar-skoe-Selo, about 16 miles, had a 6 feet gauge. When the second road was made in 1842, from St. Petersburg to Moscow, the Czar, at the instance of our countryman, Major Whistler, fixed the Russian gauge at 5 feet.

Ireland has a standard gauge of 5 feet 3 inches; Spain and Portugal, 5 feet 6½ inches; Sweden and Norway have the 4 feet 8½ inches gauge over the majority of their railroads, but 20 per cent of the Swedish roads have other gauges varying from 2 feet 7½ inches up to 4 feet; Norway has 592 kilos. of standard gauge, and 970 kilos. of 3 feet 6 inches gauge.

In Asia, of the British-Indian roads, with a collective length of 12,366 miles, about 7450 miles have a gauge of 5 feet 5½ inches, the remainder being divided among six gauges from 2 feet to 4 feet. Of the narrow gauges, the most prevalent, embracing 4,200 miles, is the meter, 3 feet 3½ inches. The Ceylon railroads have the standard Indian gauge. The Russian Trans-Caspian lines have the Russian standard gauge of 5 feet. In Asia-Minor, the line Mudania Brussa has a gauge of 3 feet 7½ inches. The island of Java has 449 miles 3 feet 6 inches gauge, and 126 with 4 feet 8½ inches.

In Japan, with the exception of an 8-mile piece begun in 1885, with a gauge of 2 feet 9 inches, all the roads have a 3 feet 6 inches gauge.

In Africa, the Egyptian railroads, amounting to 932 miles, are of the 4 feet 8½ inches gauge. Algiers and Tunis, with 1203 miles, in 1884, had the 4 feet 8½ inches standard on all except 155 miles, which had a 3 feet 7½ inches gauge. The English Cape Colony had, in 1885, 1522 miles, all of 3 feet 6 inches gauge.

In America, apart from the comparatively small mileage of United States roads with 3 feet gauge, practically the whole of the United States and Canadian railroads are of 4 feet 8½ inches to 4 feet 9 inches gauge. In Mexico, in 1884, 2083 miles were 4 feet 8½ inches and 944 3 feet gauge. In Brazil, at the end of 1884, there were 869 miles of 5 feet 3 inches gauge, and 4164 miles of various gauges between 2 feet and 4 feet 7 inches, over 3700 miles being 1 meter, or 3 feet 3¾ inches, so that this may be considered the standard gauge of Brazil.

In Australia, the different colonies, rather singularly, have different gauges, that of New South Wales being 4 feet 8½ inches; Victoria, 5 feet 3 inches; South Australia, 5 feet 3 inches and 3 feet 6 inches, and the other colonies, 3 feet 6 inches.

The total mileage in operation in the world at the end of 1885 was 303,048 miles. Of this length 74 per cent were of the 4 feet 8½ inches to 4 feet 9 inches standard, 12 per cent had larger gauges, and 14 per cent smaller.

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

The following is a list of the patents relating to mining, metallurgy, and kindred subjects, issued by the United States Patent-Office.

- PATENTS GRANTED JANUARY 1ST, 1889.
- 395,339. Machine for Reducing Old Rails. Sidney McCloud, Chicago, Ill.
 - 395,344. Furnace. Joseph P. Oliver, Oakland, Cal.
 - 395,350. Apparatus for Retrolling Old Rails. Abram Reese, Pittsburg, Pa.
 - 395,363. Machine for Covering Wire. Henry Splittdorf, New York, N. Y.
 - 395,400. Machine for Straightening Metal Bars, Tubes, etc. William A. McCool, Beaver Falls, Pa.
 - 395,418. Air-Draft Engine. Otto A. Benkendorf, Wilmot, Kans.
 - 395,434. Converter. Fred. W. Gordon, Philadelphia, Pa.
 - 395,453. Blow-Pipe. Edward B. Powers, Taunton, Mass.
 - 395,456. Attachment for Compressed Air Engines. Albert Sauer, Pittsburg, Pa.
 - 395,502. Elevating and Discharging Apparatus. Chas. A. Morris, Bloomfield, N. J.
 - 395,505. Apparatus for Concentrating Acids. Edmund C. Nation, Passaic, N. J.
 - 395,529. Water-Motor. Henry E. Trumble, Kalamazoo, Mich.
 - 395,530. Water-Motor. Henry E. Trumble, Kalamazoo, Mich.
 - 395,534. Roller Reduction Mill. John H. Woolcott, Cincinnati, O.
 - 395,575. Electro-Magnetic Rock Drill. Harry N. Marvin, Syracuse, N. Y.
 - 395,605. Method of Manufacturing Planished Sheet Iron. Waters D. Wood, Pittsburg, Pa.
 - 395,624. Apparatus for Dredging, Washing and Separating Sand and Gravel. James M. Miller, Washington, D. C.
 - 395,633. Process of Converting Crude Iron into Malleable Iron or Steel. Gustave L. Robert, Stenay, France.
 - 395,643. Smelting Furnace, Slag Steam Generating Furnace and Plant. Orsemas T. X. Adams, Chicago, Ill.
 - 395,645. Slag Furnace. Orsemas T. X. Adams, Chicago, Ill.
 - 395,665. Slag Steam Generator. Orrin B. Peck, Chicago, Ill.
 - 395,670. Quartz Mill. Prince A. Snell, Philadelphia, Pa.

PERSONAL.

Mr. W. H. Stevens of Detroit, Mich., is at present in Denver, Col.

Mr. P. T. Farnsworth has been appointed manager of the Houn-Silver Mining Company at Frisco, Utah, to succeed Mr. H. C. Hill.

Mr. Joseph C. Platt, of Waterford, N. Y., sailed for Bermuda on the 3d inst., where he will spend some time for the benefit of his health.

The Indiana Society of Civil Engineers and Surveyors will hold its ninth annual meeting at Indianapolis on January 15th, 16th and 17th.

Mr. John C. F. Randolph, Mining Engineer, of New York, has returned from South America, where he has been on professional business for over a year.

Mr. J. M. Pattee, of St. Louis, died there last week. He was largely interested in a number of important mining enterprises in Colorado, and president of the Puritan Company, operating in Clear Creek County.

Dr. Charles Osterlin, aged 82, who was, it is said, the first to discover natural gas in Northwestern Ohio, was stricken with paralysis at his home at Findlay, Ohio, on the 2d inst. His death is momentarily expected.

Messrs. S. Tanabe and Takage, of Tokio, Japan, who have been sent to this country by the Japanese Government to investigate the advance of electrical science, were at Aspen, Colorado, last week to examine the electric hoisting plant at the Veteran tunnel.

It is stated that Duluth is preparing to urge upon the Minnesota State Legislature the necessity of making provision for a mining school at that point, to be maintained and supported by the State, in the same manner as the mining school at Houghton is sustained by the commonwealth of Michigan.

Mr. G. Kirkegard, of New York, has been appointed superintendent of the mill of the Mogollon Consolidated Mining Company, of New Mexico, and Mr. R. W. Barrett, of New Providence, N. J., has been appointed assayer by the same company. Both gentlemen secured their appointments through the ENGINEERING AND MINING JOURNAL, which publishes every week a list of positions vacant.

The Ohio Institute of Mining Engineers holds its ninth annual meeting in Columbus, Ohio, beginning January 10th. The Secretary of the American Institute of Mining Engineers requests us to say that officers and members are cordially invited to attend the meeting of the Ohio Institute. Papers are announced to be read on Vessel-Loading by Machinery; Miners' Hospitals; The Hocking Valley Coal-Field; Spring-Pole Drilling; Mine Surveying, and other subjects of interest.

The Society of American Naturalists has the following officers for the ensuing year: Professor George L. Goodale, of Harvard University, President; Professor G. Brown Goode, of the Smithsonian Institution, Vice-President; Professor Henry H. Donaldson, of Johns Hopkins, Secretary; Professor William T. Sedgwick, of Massachusetts Institute of Technology, Treasurer. Rev. J. P. McMurray, of Haverford College, and Professor George H. Williams, of Johns Hopkins University, were chosen the executive committee. A communication was read from the Zoological Society of Paris, stating that it is organizing an international zoological congress to convene about August 1st, in some place not yet determined upon, and requesting the co-operation of all naturalists.

The nineteenth annual meeting of the American Institute of Mining Engineers will be held in New York City, beginning Tuesday evening, February 19th, 1889.

The following programme is provisionally announced:
Tuesday, February 19th—Evening: Opening session.

Wednesday, February 20th—Morning and Afternoon: General excursion to the Spiral Weld Tube Works and the Edison Laboratory, at East Orange, N. J., with a session at the Edison Laboratory, devoted to the Applications of Electricity in Mining. A paper is promised from Mr. Edison.

Evening session devoted to papers and discussions connected with iron and steel.

Thursday, February 21st—Morning and Afternoon: Sessions at which, if the Council so desires, the subjects of the Wednesday evening session may be continued. At the afternoon session the election of officers and other business will be transacted. Evening: Subscription dinner.

Friday, February 22d—Morning and Afternoon: Numerous local excursions, in parties, according to the preferences of individual members. Evening: Social reception.

Saturday, February 23d—Morning and Afternoon: Local excursions.

Mr. R. P. Rothwell, Editor of the ENGINEERING AND MINING JOURNAL, has special charge of the programme of the session of Wednesday, devoted to Electricity in Mining, and Mr. Charles Kirchhoff, Jr., Editor of the Iron Age, has special charge of the programme of the session or sessions devoted to Iron and Steel. Members intending to present papers on these subjects should correspond with Mr. Rothwell or Mr. Kirchhoff, according to the nature of their papers, notifying the Secretary of the Institute also of their intention.

INDUSTRIAL NOTES.

Mr. J. B. Brewster, of New York, manufacturer of the Centrifugal Amalgamator, writes to the ENGINEERING AND MINING JOURNAL under date of January 3d, 1889: "Your paper has brought me more letters than all others put together."

A charter has been granted to the Tacony Iron and Metal Company, of Philadelphia, Pa.; the capital stock is \$150,000.

It is proposed to establish a brass rolling-mill at Attleboro, Mass., similar in all respects to the mills at Waterbury, Conn.

The Pineville Coal, Iron and Land Co., of Pineville, Ky., is, it is stated, negotiating for the erection of a mill to make Russian sheet iron and ordinary block sheet.

The Oxford Iron and Nail Company's works at Belvidere, N. J., have been shut down for an indefinite period. Over production is given as the cause of the shut down.

Factories in the employ of the Reliance Iron Works of A. P. Allis & Co., at Milwaukee, Wis., have designed a 20 ton crane to be operated by electricity, which is about to be built.

The Detroit Spiral Tube Company has been organized at Detroit, Mich., with a capital stock of \$100,000, to manufacture metallic tubes, tanks, reservoirs, and pressed sheet and plate metal work.

The American Association, Limited, is said to be considering the proposition for the erection of an 80-ton iron furnace at Middlesborough, Ky., and is organizing a stock company to build four other furnaces.

The Haines, Jones & Cadbury Company, of Philadelphia, Pa., announce the close of the second year of profit sharing with their employes. The wages for 1888 amounted to \$140,000, and the dividend for distribution was \$9100.

The Scranton Steel Mills, at Scranton, Pa., shut down on the 31st ult., having worked up all orders, and will remain idle a month or six weeks, in which time it is hoped to close some big contracts. Meanwhile some improved machinery will be added.

The extensive foundry of the Reading Foundry Company in Reading, Pa., where large iron pipe for gas and water mains for many of the larger cities are made, closed down indefinitely on the 1st inst. Dull trade is given as the cause for closing the works.

The St. Louis Ore and Steel Company, St. Louis, Mo., is preparing to restart its blast furnaces, and may finally follow with the steel works, though that depends upon circumstances. The company has, it is said, over 100,000 tons of ore at its Pilot Knob mine.

The ship yards of the great lakes exhibit active operations this winter. Fifty-nine new vessels are to be built, and eleven of them will be entirely of steel. They will cost \$7,124,000, and they will add 100,950 gross tons to the carrying capacity of the commerce of the great lakes.

With the contradiction of the report that the National Tube Works Company, of McKeesport, Pa., had purchased the Alikanna, Ohio, rolling mill, comes a rumor that Mr. Joseph R. Jackson, Superintendent of the Republic Iron Works, South Side, Pittsburg, Pa., has purchased the plant and will operate it.

The Great Western Steel Rolling Mill and Steel Wire Company, with a capital of \$200,000, will erect a factory at Randolph, near Kansas City, Mo. Mr. Edwin A. Beers, of Springfield, Mo., is President. The company will manufacture merchant iron, iron nails, steel wire, iron and steel rods and barb wire. It has a new process for converting old steel rails into steel wire and steel rods, invented by N. S. Reynolds, who will have charge of this department.

The Stiiwell & Bierce Manufacturing Company has issued a new circular announcing that it is prepared to undertake the manufacture of all classes of mining machinery in addition to their former business. Mr. W. H. H. Bowers has been appointed General Agent, with a branch office opened in Denver, Colo., and it is intended by the company to make a specialty of supplying Mr. Bowers' patented inventions, the sole right to make and sell which it has acquired.

The output of the Baldwin Locomotive Works for the year 1888 reached a total of 736 locomotives, a greater number than the company has ever before built in one year. The percentage of heavy engines built was also materially increased. Of this total, 188 were of the American type and other eight-wheeled locomotives; 277 of mogul and other ten-wheel engines, and 269 consolidation. The contracts have included 50 locomotives for the Pennsylvania, 60 for the Philadelphia & Reading, 5 for a Brazilian road and 30 for a road in Argentine Republic.

The Schenectady Locomotive Works have lately turned out fifteen 10-wheel engines for the Southern Pacific, with cylinders 18 x 24 inches. Four of the same type were also delivered to the Chesapeake, Ohio & Southwestern, and one to the Mexican International. Twenty 12-wheelers, with cylinders 20 x 26, were delivered to the Southern Pacific; two 18 x 24 switchers for the Belt Railway, of Chicago, and one 17 x 24 8-wheeler for the Dayton & Union. The works are running full time, turning out about 28 engines a month, with a force of 1600 men.

CUSTOMS TARIFF OF BOLIVIA.—Under the Customs tariff of Bolivia a very large quantity of goods are now admitted on payment of 25 per cent duty on value. The following articles, however, have been placed on the free list, viz.: Harrows, two-wheeled, with cylinder; iron in bars, square or round, and rough sheets; iron poles; axes, common iron, rough, without handles; axes, small, common, cast-iron, variety-bed, without hammer, with or without handle; agricultural implements, when not enumerated; sickles, with or without handles; matchets and pruning-knives, all kinds; machinery for agriculture, mining, etc.; and any labor-saving mechanical apparatus, washing machines, sewing-machines (without spools or needles).

The Canadian Locomotive Works at Kingston, Ont., have lately completed 14 locomotives for the International Railway, designed by Mr. H. A. Whitney, Mechanical Superintendent of the road. They are eight-wheel engines, with cylinders 18 x 24 inches and driving wheels 62 inches in diameter. The total weight of the engines is 99,750 pounds, 63,200 pounds being on the drivers. They are now working on an order of 20 mogul engines, designed by Mr. F. R. F. Brown, for the Canadian Pacific. These engines have cylinders 18 x 24 inches, and the driving-wheels are 57 inches diameter. The total weight on the drivers is 98,000 pounds, and there is 14,000 pounds on the pony truck. The boiler carries a working pressure of 175 pounds.

We call the attention of the electrical companies to the following: After commenting upon the introduction of electrical power in various mining districts, the *Eagle County Times*, published at Red Cliff, Colo., says: "On Battle Mountain, where the question of power has long been the principal drawback to development of many properties, the introduction of electric power to this camp would be a god-send. The generating plant could be placed at or near the Biden switch, drawing the power from Eagle River. Power could then be transmitted to the principal mines on the hill at a cheap figure. Wires could be run to both the town of Red Cliff and Golman for illuminating purposes, furnishing light for the town and residents, and from this source alone, revenue enough to repay the owner of the plant could be had in a short time. We think it will not be long until the practicability of this plan will present itself to some enterprising company of resident mine owners."

The M. C. Bullock Manufacturing Company, of Chicago, manufacturers of general mining machinery, write us that the business of the past year has been very large, and during the year they have put on the market a full line of Lane's patent band friction portable hoisting machines, and their improved Corliss engine, which is meeting with great success. They have also brought out their new hand power diamond drill, the "Bravo," intended to be used in prospecting in the mountains or other places inaccessible to steam or power drills. It is so light and portable that it can be packed and carried on men's backs to points where even a pack mule cannot go; the Crescent, a light and portable power prospecting core drill, and their medium weight diamond prospecting core drill and the "Dauntless," which has made some of the most successful borings ever made by a diamond drill. A "Giant" diamond drill, with a complete outfit to bore holes to a depth of 3000 feet, has been shipped to the Government of Victoria, Australia. This is the fifteenth Bullock drill bought and operated by the Victorian Government. The company in closing their letter say: "We take pleasure in crediting the JOURNAL with many inquiries which we can trace directly to our advertisement in your valuable paper."

AMERICAN GOODS IN ENGLAND.—The *London Ironmonger* says: Whatever may be the opinion of those who cavil about foreign productions, everybody is agreed that our American cousins are gifted with a large measure of mechanical ingenuity, and the style and manner of the goods they turn out have been imitated all over the world. In many cases, not only have the specialties brought over here possessed the merits of handiness, adaptability, and finish, but their price is favorable also, and it needs no great power of understanding to perceive that with such a combination the public readily appreciate and persist in purchasing them. The "Enterprise" Manufacturing Company, of the United States, has introduced many of its specialties. The "Shipman" engine is making excellent progress, its application to steam launches and other purposes where petroleum fuel is esteemed as a substitute for coal on account of its cleanliness and quick action in raising steam, finding much favor. A large trade is doing in Batchelder & Son's crucible cast steel bay and manure forks, the character of which is fully established for reliability and durability, and this is also the case as regards ash and hickory handles, scythe-snaths, "Lightning" bay-knives, oil-stones and scythe-stones. American hatchets and axes are likewise systematically pushed. "Hartshorn's" self-acting blind-rollers find a steady sale, and in American woodenware, clothes-pegs, wash-boards, broom handles, wood bench-screws, washing-tubs, and pails the output is very large indeed.

CONTRACTING NOTES.

Our list of machinery and supplies wanted will be found on page xii. Manufacturers of machinery, engineers and contractors should also consult our directory of "Contracts Open" on page xi. This week, proposals are invited for the following new contracts: No. 1241, Construction of Sewers; No. 1242, Construction of Sewer Main; No. 1243, Dredging; No. 1244,

Construction of Water-Works System; No. 1245, Grading; Excavation, Masonry, and Bridge Superstructure; No. 1246, Building Sewers; No. 1247, Furnishing Brass Goods; No. 1248, Furnishing Cast-Iron Water Pipe and Special Castings; No. 1249, Railway Construction; No. 1250, Electric Lights.

The El Paso Irrigation Company has been organized, with a capital stock of \$250,000, to build a canal 50 miles long, and wants to correspond with firms manufacturing excavating and other machinery for canal and dam work. Address Ernest E. Russell, Secretary of the El Paso Irrigation Company, El Paso, Tex.

The following proposals for 500 barrels of cement have been received by the Docks Department, New York City: Erskine W. Fisher, \$2.29 per barrel; James Brand, \$2.30; E. Thiele, \$2.34; Emil Lenz, \$2.39; S. L. Merchant & Co., \$2.41; A. C. Batem, \$2.43; Eckmeyer & Co., \$2.75. The contract was awarded to E. W. Fisher.

GENERAL MINING NEWS.

TENNESSEE COAL, IRON, AND RAILROAD COMPANY.—Official reports to us show that during December the company received directly from the mines of the Tracy City Division 12,957 tons of coal and 15,387 tons of coke, making a total during 1888 of 171,629 tons coal and 153,394 tons of coke.

ALASKA.

The important question of the boundary line between Alaska and British Columbia in the Yukon gold district is to be reported on by Mr. Ogilvie, Dominion Land Surveyor, recently returned from the exploration of the Yukon country. It is stated that he will recommend that the boundary line between British Columbia and Alaska should be fixed at least four miles further south than the point fixed by Schwatka.

ARIZONA.

GRAHAM COUNTY.

The directors of the Arizona Trust and Mortgage Company have issued a report which gives a résumé of the negotiations between the company and the Arizona Copper Company, and states that since May 15th the sums received from the copper company amount to \$57,003, and the trustees have no reason to doubt that the sum payable next May will be forthcoming. The trustees have employed the sums received from the Arizona Copper Company in retiring debentures so far as they were able to do so. They have already paid off \$41,000, so that the balance of the debenture debt is now reduced to \$134,400. With the sums still to be received from the Arizona Copper Company before May 1st next, the trustees will be able to retire a large additional amount of the debentures; and the amount which they may not be able to pay off at that date they now anticipate no difficulty in renewing for a short period at a lower rate of interest. The trustees see no reason why the company should not now declare a dividend, and they therefore recommend that a dividend of 2s. per share (which is equivalent to 10 per cent upon the capital of £1 per share called up) be declared.

PINAL COUNTY.

CRISPIN.—This mine at Silver King has passed into new hands and a new company has been organized to work it, and is trying to compromise the debts of the old company, for which it is liable.

TORTILUTA GOLD AND SILVER MINING COMPANY.—The developments in this company's Jessie Benton mine, says the Tucson Citizen, at 300 feet deep show rich but rebellious ore in good quantities.

CALIFORNIA.

NAPA CONSOLIDATED QUICKSILVER MINING COMPANY.—The company is now out of debt and laying by a surplus.

AMADOR COUNTY.

The project to incorporate the three mines at Drytown—the Crown Point, Olive and Bonanza claims—is making satisfactory headway. It is stated all the stock, with the exception of about 5000 shares, has been subscribed. It is intended to make the stock \$1 per share. An installment of three cents will be payable on delivery of the stock, and thereafter it will be liable to monthly assessments of 1 cent per share, to pay working expenses. The purchase price of the three claims is \$20,000, to be paid for out of the proceeds of the mine. There is no stated time for the payment of the purchase money. It is proposed to first erect water-power hoisting machinery, and sink 200 or 300 feet deeper, using second water from the Gover, to utilize which it will be necessary to lay 3000 feet of pipe.

AMADOR GOLD MINE.—The county surveyor is now at work locating the route for a tramway to connect the mill with the mine at shaft No. 3. Shaft No. 1 is 280 feet deep, shaft No. 2 91 feet deep, shaft No. 3 328 feet deep. A large ore bin is cut at shaft 3 on the 250-foot station, and preparations generally throughout the mine are being made to take out ore to keep 60 stamps in operation. An air-compressor of the National pattern runs four drills in different parts of the mine. The machinery is all run by water-power from the Amador Canal under a pressure of 165 feet. The mill will also be run by water-power from the same canal, but under 390 feet head or pressure. The mill will be supplied with the Gates ore crusher No. 5 or with two No. 3's. The mill will have twenty-four Frue concentrators. The mill is well under way, the building and batteries all up, and nearly all the heavy machinery on the ground

ready to go in. The building is 108 feet long, 90 odd feet wide, and the height, including ore crusher, is 88 feet, and is of the most substantial character. The superintendent says he can deliver the ore from the mine to the mill for 5 cents a ton. The company is now getting up large hoisting and pumping machinery to put on shaft No. 3, when the present works on shaft 3 will be taken to shaft 2. The Pelton water-wheels are the kind used by the company. There is about \$16,000 worth of timber, lumber, shakes, lagging and other supplies now in the yard.

NEVADA COUNTY.

STOCKTON MINE.—The owner of this mine, Mr. P. G. Gardner, of Stockton, intends to organize a company to have it fully developed. It is proposed to run in a tunnel 1800 feet, which will strike the ledge at a depth of 500 feet.

COLORADO.

The coal production of the State in 1888, as estimated by reports made by Mr. John McNeil, State Inspector of Coal Mines, amounted to 2,508,428, showing an increase of 716,694, as compared with 1887.

The Monitor Zinc Company has been formed in Denver, to erect works for the operation of the Croseimine zinc process. It is probable that the works will be erected in the spring. The tests which were made last autumn at the Bailey smelter, near Valverde, were, it is said, satisfactory in their results.

But little has been done with the Low process recently on account of the changes which have been made in the Holden Smelting Company, at Denver, and its works. Mr. Chauvete, of the latter company, is interested in the process, and it is probable that in the coming spring the company will take some steps towards putting it in practice. There is also a possibility that the Philadelphia Smelting and Refining Company, of Pueblo, may conclude to take hold of it. Nothing has yet been done with the Low process beyond laboratory experiments and the securing of patents for it. Mr. Low bears the reputation of being one of the most expert chemists in Colorado; from a purely chemical standpoint his process is a good one and very interesting. Its main idea is to subject the zinc blende to an oxidizing roasting, dissolving the sulphurous acid gas which is given off in water. This solution is then used to dissolve the zinc oxide from the ore, from which the zinc is precipitated as sulphide by heating the solution. This process can probably be done very cheaply.

The Iron Silver Mining Company has been making a series of experiments with the Slater process, at the Grant Smelting Company's works at Denver. The company has spent \$3000 or \$7000 in making the tests, and has now about concluded to abandon them. It is stated, however, that another syndicate proposes to take the process and erect works at Leadville sometime during the coming year.

BOULDER COUNTY.

Messrs. Andrews & Chambers, of Louisville, are making arrangements for the development of a twelve-foot vein of coal struck at a depth of only 108 feet, near Louisville. It is stated to be a remarkable discovery, as a shaft 180 feet in depth was sunk in the Welch mine to catch the vein, and 230 feet at the Simpson mine on the Miller farm. The Marshall Coal Company, while prospecting upon David Kerr's farm has opened up a large body of coal, which is a continuation of the old Welch vein. These strikes will revive Louisville, which was classed among the exhausted mining camps a short time ago. It is thought that by next spring the camp will be in position to ship several hundred tons of coal per day.

POORMAN MINING COMPANY.—The superintendent writes us: "This mine has been worked by the company only six months, during which time we have paid six monthly dividends of \$5000 each, aggregating \$30,000, entirely from development work."

CLEAR CREEK COUNTY.

ASTOR ALLIANCE MINES, LIMITED.—The sale of the Astor Alliance group of mines situated on the east slopes of Republican and Democrat mountains, took place at Georgetown, on the 29th ult., by the Sheriff. Mr. George W. Hall was the highest bidder, and the property was sold to him for \$19,900. The personal effects were also sold, and purchased by Mr. Hall for \$400. In our issue of January 1st, 1887, we referred to the organization of this company in London.

EAGLE COUNTY.

[From our Special Correspondent at Gilman.]
Recently your correspondent made a tour of the producing mines in this vicinity, and gained the following information:

THE SPIRIT.—This claim, lying adjacent to the Iron Mask, has encountered sulphides in heavy quantities.

THE GARBUTT.—This mine has also opened up a large body of carbonate ore in the form of an immense perpendicular pillar, upon which they have driven 45 feet, with no signs of pinching. Shipments are frequent.

Rumor has it that the Belden and Silver Wave, both carbonate properties, will soon resume operations; and it is very evident that the Crown Point and Little Chief, a property from which several years ago \$150,000 was extracted in about six months, will commence again by sinking a shaft to the quartzite strata.

IRON MASK.—The McDonald lease on this property is exhibiting fresh ore-bodies with every foot of ground developed, and the lessees are making money. A vast amount of speculation has been indulged in regarding the Iron Mask, by parties and newspapers who know little or nothing concerning the true outlook, and in several instances statements, of an ex-

ceedingly disparaging character relative to the "outfit operating it have been circulated because the owners did not see fit to disclose their business to the general public. If I may rely upon the statements of several responsible gentlemen, the Iron Mask is a veritable bonanza. Their sulphide bodies are enlarging every day. A carload shipped recently from these new bodies netted \$1100; an exceedingly high grade for carbonate ores.

BLEAK HOUSE.—The lessees of this fissure are mining a large body of mineral, which runs up well.

GROUND HOG.—Stonebeaker & Co., the lessees, have a fine chute of ore running close to \$150 per ton in the "Old Ground Hog" incline, one of the earliest ventures in the quartzite. The Gillilan lease on the same property shipped a carload netting \$1100 last week.

From present indications, the Cheesman & Clayton shaft will reach the quartzite in two months, when the true litigation in the United States Circuit Court will begin. It is understood that these gentlemen have obtained the services of Messrs. Chas. J. Hughes and Edw. Wolcott, of Denver, as their attorneys, while Perkins, Hart & Co., of the Champion, have retained United States Senator Teller, of Colorado.

The fissure veins in Eagle Cañon are improving steadily as they gain depth.

WARRIOR'S MARK.—Here there is a fine body of pay ore in the wize, and the contract tunnel, in 180 feet, has encountered the sour of the main vein.

STAR OF THE WEST COMPANY.—Two ventures of a rather doubtful character are being undertaken by this and the Ben Butler companies. Each is driving a tunnel on the level, in granite, to intercept the overlying quartzite on its dip, which is on an average 13 degrees to 14 degrees. At an angle of 13 degrees to 14 degrees the overlying strata will not be attained inside of 2000 feet as a safe estimate, without calculation.

GREAT HOPES.—A. H. Fulford et al have uncovered a fine vein of copper in this fissure beneath the Iron Mask mine. An assay shows 21 ounces gold at a depth of 116 feet. As I intimated, the large volume of water in the Belle shaft has proven to be the forerunner of an immense ore-body. The lessees here have their water under control, and it shows a body 40 to 50 feet in width and the height of the breast. Jno. Harvey, the Leadville coal king, and others are having their placer claims on Cross Creek patented. They evidently place great faith in the placers, some of the results of which I mentioned in a late issue. Several parties of capitalists from various eastern points have visited this camp within the last two weeks. They express themselves as greatly pleased by the mining outlook. There is no question, but that next year, 1889, of the traditional "9's" in which great mining strikes are made, will extend, at least a finger of fortune to the mine owners in this vicinity.

PITKIN COUNTY.

FARWELL MINING COMPANY.—The properties owned by this company are under lease and bond to Mr. Mr. Richard R. Bolles et al. During the past summer the old mill has been fixed up and kept running, and from its workings has been deduced improvements of great value in the treatment of this ore. A new mill has been constructed and will be put in operation next spring. The drifts of the old workings of the Farwell company have been cleaned out, and the ore-bodies blocked out. Old dumps have been tested and found that considerable value can be got out of them.

SAN JUAN COUNTY.

SHERIDAN MINING COMPANY.—The Smuggler mine has been sold to the Sheridan Mining Company. The latter is to take possession on July 1st. A small force will remain at the mine until the new company takes possession.

SUMMIT COUNTY.

VICTORIA MINING COMPANY.—The mill has closed down for the purpose of making needed alterations found necessary by the run since starting. It is stated that considerable unnecessary labor can be dispensed with by the outlay of a small amount of capital and time. When the mill starts up again it will be run to full capacity.

DAKOTA.

According to press reports, anthracite coal has been discovered on the Crow Creek Reservation, near Chamberlain.

(Special Correspondence.)

DEADWOOD, Dec. 27.

The Homestake Mining Company for several months past have been testing in their mills the Centrifugal Amalgamator, a machine designed for the purpose of saving all the free gold, and to prevent any loss of amalgam or quicksilver. The first machine introduced was not adapted to the work, but the inventor soon overcame the difficulty, and now claim to have a perfect machine, adapted to Homestake ore. In proof of this the Homestake Company has ordered some of the machines for use in their mills at Lead City. This fact, I think, speaks a great deal for the machine and its success, as the company are not in the habit of buying machinery to experiment with, nor of placing useless machinery in their mills. The last test made with the amalgamator was on tailings after it left the mills. The machine ran on tailings from five stamps for two weeks, and cleaned up three ounces of amalgam and sixteen ounces of quicksilver. This, of course, had been lost by the copper plates, and although the saving in some cases would be insignificant, in this instance it was all that could be asked, as the ore itself is very low grade. On tailings of higher grade ore, where the loss is greater, the showing would be more appreciable. The machine is very simple in its construction. It is

a copper pan five feet in diameter, much the shape of a gold pan, with a depression in the center large enough to hold several pounds of quicksilver. The pan is arranged so that it is revolved twenty-four revolutions per minute by a two-inch belt, and requires one quarter horse-power to run it. The pulp enters the amalgamator in the center so as to drop into the quicksilver reservoir, from which place it travels over the pan until reaching the edge, where it is discharged; it is calculated that the material undergoing amalgamation passes over the equivalent of 240 square feet of copper plate before being discharged. The amalgamating pan is covered with a copper cover so that it is neat and clean at all times. The machine is intended to take the place of the stationary copper plates now in use, and can be used on the pulp as it leaves the batteries as well as on tailings. It is well worth looking into by those desirous of reducing the percentage of loss by the ordinary modes of amalgamation.

Harney Peak Tin Mining Company have at last begun at the beginning; they are doing the only work, except assessment work, done since the Etta mill *fiasco*. Professor Vincent recommended the sinking of two shafts and running a tunnel as development work. Work has commenced on the two shafts, and bids are invited for running a tunnel seven or eight hundred feet in length. It is to be hoped, for the sake of the tin interest generally and Harney Peak Company in particular, that this work will develop the property and show sufficient value to make it a mine instead of a lot of prospect holes as at present.

This development work on the part of Harney Company was brought about by the London *Financial News*. The promoters, finding themselves unable to place the property on the London market with that influential paper against them, arranged with the paper to have a representative present for the purpose of testing the specimen rock shipped to London some months ago to show the *bona fides* of the property. The company were represented by Johnson, Matthey & Co., assayers, in whose works the ore was sampled, and the Bank of England assayer; the *Financial News* being represented by Capt. Davis, a practical tin miner. Ten tons of the specimen rock was crushed and found to contain 82 pounds of tin ore to the ton of rock, against 534 pounds represented by the prospectus to be the yield per ton. As the test was made with a view of substantiating the statements made by the promoters in the prospectus and claimed by them to have been made up of figures and facts from the reports of prominent mining engineers, it fell short of its purpose, showing quite a discrepancy between actual yield and the glowing statements advertised in the prospectus.

The *Financial News*, however, admits that even eighty-two pounds of tin ore to the ton is a good yield for unassorted tin stone but not for specimen rock, and recommended the owners and venders of the Harney Peak mines to do some development work on their own account before trying further to place the property in London, and for the further purpose of showing that ore of this grade existed in quantities to make it of some commercial value, and, if so found, then to call on the *Financial News* again. This is a step in the right direction, and it is hoped the company will carry on development work with the same persistency that has characterized them in trying to place the property in London, and I, for one, hope they will be more successful in the role of prospectors than in that of venders and promoters.

I noticed in the *ENGINEERING AND MINING JOURNAL* a few issues back, either in the article on Dakota mines, by one of your correspondents, signing himself "More Anon." or in the general news mention of the Silver Plumas Mining Company, which was evidently intended for the Pluma Consolidated Mining Company. This company owns ground east of the Homestake and south of the Caledonia, and has a 20-stamp mill on Whitewood Creek, about a mile from the mine. The mill has been turning out between seven and eight thousand dollars per month, and making a net profit of three or four thousand dollars each month. This month they broke five cams, and have only run 15 stamps, consequently the clean-up will be smaller. It is owned by a Des Moines company, incorporated under the law of Iowa, in 250,000 shares. David Haater, one of the locators and principal owner, is superintendent.

THOMAS H. WHITE.

LAWRENCE COUNTY.

DEADWOOD REDUCTION COMPANY.—It is expected that the works at Deadwood will commence operations early this month. All the machinery is on the ground. Nothing remains to be done but to complete the ore elevators and set the screens and a single line of shafting. There are nearly two thousand tons of ore at the works.

ILLINOIS.

The miners of Southern Illinois met in St. Louis on the 29th ult. and organized a branch of the National Federation of Miners.

IOWA.

Official advices to us state that the output of coal for this State in 1888 was as follows:

District No.	Tons.
No. 1.....	1,528,967
" No. 2.....	1,663,206
" No. 3.....	913,185
Total.....	4,105,358

This report includes lump and nut coal.

WEBSTER COUNTY.

The engine house and top works at the mine of the Collins Brothers, located at Coalville, were burned on

night of the 28th of December, throwing out of employment about 150 men; loss about \$6000, insured for \$1500.

MICHIGAN.

COPPER MINES.

FRANKLIN MINING COMPANY.—Captain Vivian, agent of the company, writes under date of December 28th: We have cut through the east lode at the thirty-first level, which is about fifteen feet wide at right angles with the dip. For about twelve or thirteen feet in width it will yield about 1½ per cent of mineral. We shall open both north and south of the cross-cut as fast as possible to prove its value in length. Between this and the thirtieth level there is a large block of ground that will pay a good profit. The thirtieth level north on the main lode is showing some fair stamp-rock, but is not so rich as we would like to see it. The east lode at this level is still showing some good stoping-ground. The east lode at the 29th level north is poor. South of the cross-cut is showing some stamp copper, but not of much value. The drift and stope north at this level on the main lode are rich in all grades of mineral. At the 30th level both north and south of No. 5 shaft the lode is from 13 to 15 feet in width, which will yield about 2 per cent of mineral copper.

KEARSARGE MINING COMPANY.—During December the mine produced 100 tons of ore.

OSCEOLA MINING COMPANY.—It is reported that the eighteenth level south of No. 4 shaft is good for copper. The other openings generally are promising. Since the new compressor has been at work the drills have done better work and rock is beginning to accumulate in the mine. This will enable the putting in of another drill at work in opening soon. The Opechee shaft shows a good looking lode, carrying a little copper. The production during December amounted to 202 tons of ore, making a total for 1888 of 2411 tons.

QUINCY MINING COMPANY.—The output of mineral of this mine for December and the year, in comparison with 1887, was as follows:

	1888.	1887.	Com- parison
	Tons.	Tons.	Tons.
December.....	205	366	Dec. 161
Year.....	3,882	3,371	Inc. 51

This is the largest product for any one year in the history of the company.

TAMARACK MINING COMPANY.—The openings are pushing toward the eleventh level. The first winze under the tenth level is down 37 feet; the second, 4 feet. The tenth level drifts are both very good. The ninth level south is promising for something more than usual. The stopes here are improving. No. 2 shaft was sunk 83 feet for the month of December. During December the mine produced 635 tons of ore, making a total for the year of 7486 tons.

IRON MINES.

NORRIE.—The pumpman on the 4th level of No. 6 shaft, this mine, fell asleep on night of 26th, and about 3 A. M. awoke to find pump house in flames, barely escaping with his life. The Bessemer *Iron Spirit* says that the shaft was immediately closed, but the fire is hotly burning, and is becoming a serious matter. It is impossible to estimate probable damages, which will be great, and may close mine for some time.

MONTANA.

The mechanic's lien law is being tested in court in Helena, in the cases of Conrad Bros. vs. George W. Oker et al, and Larson vs. the same. In each of these cases the South Montana Mining and Milling Company is made a defendant. It appears that this company employed Oker to sink a shaft on its mining property, and Oker bought powder and fuse from Conrad Bros., merchants at Marysville, for use in the mine, and bought cordwood from Larson for running an engine connected with the mine, and failed to pay either. Plaintiffs filed a lien upon the mining property, and these suits were brought to foreclose this lien. The mining company demurred to the complaints on the ground that the materials furnished did not come under mechanic's lien law. The court holds that the powder and fuse furnished by Conrad Bros. does come under the head of materials furnished and therefore overrules demurrer. But in the Larson case the court holds the cordwood furnished to run the engine is too remote to be classed as material furnished and sustains demurrer. Defendants in the Conrad case are granted 30 days in which to answer.

LEWIS & CLARKE COUNTY.

MONTANA COMPANY, LIMITED.—From a circular issued by the company, dated December 22d, we learn that the directors having received from the resident director at the mine an approximate estimate of the company's financial position to the 31st December, are enabled to declare a further dividend for the current half-year of three-pence per share, free of income tax, payable on the January 15th, 1889. A large proportion of the cost of the new hoisting gear, etc., has been paid for out of the revenue of the current half-year. The directors have pleasure in informing the shareholders that the character and quality of the ore now admit of pan amalgamation, which has been resumed in the 50-stamp mill. Mr. R. T. Bayliss states that the new hoisting engine in No. 1 shaft will be at work by the 1st of January, 1889, when the drive of the exploratory levels below the 400-foot level will be resumed. Bearing in mind the heavy expense incurred on account of the new hoisting machinery, cutting and securing ground for the engine and drums and re-arrangement of No. 1 shaft, as also the unavoidable and

unexpected delays which have retarded the work, and taking into consideration that during the last six months the ore available has been of very low grade, the results obtained may be considered satisfactory. From the latest report received from Mr. R. T. Bayliss, an improvement in the monthly returns may be reasonably expected. "All the surface works are progressing in a very satisfactory manner, and with the commencement of the new year I look for a renewed period of prosperity, which will, I am sure, be a satisfactory change for everybody."

SILVER BOW COUNTY.

BOSTON & MONTANA CONSOLIDATED COPPER AND SILVER MINING COMPANY.—At a meeting of this company held in Boston last week, the increase of capital was voted, and company is only waiting for official notice that certificate for such increase has been filed before sending notice to stockholders.

NEVADA.

ELKO COUNTY.

TORNADO MINING COMPANY.—We are informed that the statement of our Tuscarora correspondent in last week's *JOURNAL* to the effect that no work has been done on the claim for over a year was erroneous. A gentleman interested in the property states that three men have been engaged in doing assessment work and that a tunnel has been driven about 150 feet, and that the shaft, which our correspondent stated was full of water, is therefore not necessary, except to locate the vein.

ESMERALDA COUNTY.

PAMLICO MINING COMPANY.—This company has declared a dividend amounting to \$21,000, leaving a balance in the treasury of \$11,635.35. This is the first dividend since the company was incorporated, October 29th, 1888. The following officers have been elected to serve the ensuing term: President, John Forbes; Vice-President, R. J. Laws; Secretary, J. A. Yerington; Manager, S. A. Knapp. Trustees, John Forbes, R. J. Laws, J. A. Yerington, S. A. Knapp and W. D. Tobey.

HUMBOLDT COUNTY.

CLIFF MINING COMPANY.—Two concentrators have arrived for this company's mill at Spring City. The mine, it is said, looks well, and the reduction works are being increased.

LANDER COUNTY.

The Manhattan and other mining and milling companies in Lander County, are to be prosecuted for cutting timber on Government land.

STOREY COUNTY—COMSTOCK LODGE.

We condense the following from the *Virginia City Chronicle*:

ALTA MINING COMPANY.—The mill started crushing ore from the mine on the 20th inst., and the pulp is being handled by the new double process of concentrating and amalgamating, suggested by Superintendent Boyle. That part of the ore which is pure milling flows from the concentrating tables into the tanks, and is handled by the usual amalgamating process, while the concentrates are retained for reduction.

CONSOLIDATED CALIFORNIA & VIRGINIA MINING COMPANY.—The bullion shipments up to December 24th, amounted to \$106,977.98. The daily ore shipments to the Eureka mill have been increased from 168 to above 200 tons.

CHOLLAR MINING COMPANY.—The Nevada mill is now dropping 40 stamps on ore from this mine, the battery sample assays showing an average value of about \$20 a ton.

HALE & NORCROSS MINING COMPANY.—During the week ended December 24th there were hoisted 961 tons of ore, and there were shipped to the Mexican mill 1011 tons, and reduced 1050 tons; average battery assays, \$29.24 per ton. There is bullion on hand and previously shipped for the month amounting to \$67,188.32. The December bullion yield of this company will not fall far short of \$100,000, which will cover the cost of production and leave a small surplus. The company is impatiently awaiting the completion of the electric system of power transmission, which will operate the Nevada mill to its full capacity and furnish more ore-crushing facilities.

JUSTICE MINING COMPANY.—The mill was to resume crushing ore from the mine with stamp power on the 1st inst.

OCCIDENTAL CONSOLIDATED MINING COMPANY.—There is now estimated to be 60,000 tons of ore stripped in the mine, which will assay above \$20 per ton on an average, and this area is constantly added to by explorations. The company will erect a twenty-stamp mill at the mine next spring and equip it with concentrators and amalgamating pans, the same as the Alta Mining Company.

OPHIR MINING COMPANY.—At the annual meeting the following officers were elected. President, Charles H. Fish; Vice-President, A. B. Hull. Secretary Holmes' report shows receipts of \$92,635.88 for the past fiscal year, of which \$9594 was realized from bullion produced. The following is a summary of the points of interest in the annual report of the Superintendent: On and above the 1465 level considerable ore was developed and a body of quartz 194 feet in width, of which the report says: "When we look upon this extensive body of quartz, the matrix of Comstock ore, which appears to be lying along and in the immediate vicinity of this east cross-cut, we cannot help regretting that it carries only a nominal value, not sufficiently to pay the cost of extracting and milling it. From the various openings a total of 777 tons of ore were extracted, yielding \$18,948 in bullion."

SAVAGE MINING COMPANY.—The ore hoisted during

the week ended December 24th amounted to 512 tons shipped to the Rock Point mill 488 tons, the average battery assay of which was \$17.79 per ton. There is bullion on hand and previously shipped amounting to \$19,236.36.

NEW MEXICO.
GRANT COUNTY.

[From our Special Correspondent.]

AZTEC MINING COMPANY.—This company began milling the ore from its mine, the Asiatic, on December 24th, at the Bremen fifteen-stamp mill at Silver City. The ore is pyrite, with some galena and a little blende, and carries from \$25 to \$40 per ton in gold and silver. The veins are large, averaging about two feet of high-grade ore, and the mines are capable of an output of 50 to 100 tons per day.

COLCHIS MINING COMPANY.—A considerable amount of iron ore is now being sent to the Socorro and El Paso smelters from the enormous deposits which exist in this vicinity of Silver City. The principal shipments are being made from the property of the Colchis Mining Company. This company controls a large extent of mineral ground adjacent to Silver City, and it is understood that it will soon test on a large scale the practicability of milling the low-grade quartz silver ores which are known to exist in immense bodies on its property.

NEW YORK.
STEBEN COUNTY.

ALLEGHENY & GREENWOOD OIL AND GAS COMPANY.—About three weeks ago this company began to drill a test well in the town of Greenwood, and on the 2d inst. the drill struck the second sand at a depth of about 700 feet, and immediately a flow of gas began, which rapidly increased in force until the drillers were compelled to stop work. Drilling will be resumed as soon as the casing, which was blown out by the force of the gas, can be replaced.

PENNSYLVANIA.

A short branch road is to be built between the Philadelphia & Reading Railroad and Lehigh Valley Railroad tracks at Silver Brook, which will open to the former company a coal-field heretofore monopolized by the Lehigh Valley Company.

The United States Circuit Court recently entered the final order terminating the receiverships of the Philadelphia & Reading Railroad Company and the Philadelphia & Reading Coal and Iron Company, and discharging the receivers thereof, thus terminating, probably, the largest and most important trust ever committed by any court in this country to the administration of receivers. The receivership was in force from June, 1884, to January, 1888, a period of over three and one half years.

NEW YORK & WESTMORELAND GAS COAL AND COKE COMPANY.—Negotiations are now pending, it is stated, for the purchase of this company's plant, at Manor Station, by the Penn Fuel Gas Company, which is controlled by the Philadelphia Company. A number of officials of the latter company have for some time been trying to purchase the plant for the manufacture of fuel gas. The mines are slopes with two openings each, and have all the latest improvements, new machinery, etc. They have a fan which cost \$15,000, and since the opening of the largest pit, four years ago, the company has spent about \$140,000 in improvements, etc. The plant has an output of about 1000 tons per day. The company owns 11,000 acres of coal land. The company was organized in 1871 by Thos. Moore and James S. Kuhn, of McKeesport. In addition to the coal plant the company owns 75 coke-ovens.

COAL.

The H. C. Frick Coke Company has put wire rope haulage in the Trotter pit. It is a mile in length, and is operated by a first-motion 16 inch cylinder engine. So smoothly and successfully did everything work that a full run of coal for 72-hour coke was charged on the trial day. The same system of haulage is being placed in the Plummer pit at the Davidson works.

At a meeting of the coke workers of the Connellsville district on the 29th ult., it was decided to demand an advance of 6 1/4 per cent at once. The advance is based on \$1.35 per ton for coke, which is ten cents above the present selling price.

Mine Inspector Blewitt, of the first anthracite district, of which Lackawanna County is the principal part, reports that in 1888 there were 390 accidents in and about the collieries of that district. Of these seventy-two were fatal.

CAMERON COAL AND IRON COMPANY.—This company has completed its new furnace at Emporium, and is producing 100 tons of iron daily. One hundred coke ovens are now being built, and the coal and iron mines developed.

FAIRMOUNT COAL AND IRON COMPANY.—Upon the application of C. B. Wright, who holds \$30,000 worth of the bonds of this company, Judge Fell, at Philadelphia, on the 2d inst., appointed William M. Stewart receiver of the company, which has been in default for eighteen months upon its interest. The bonds outstanding amount to \$575,900, and were issued in 1881, secured by a mortgage on the company's property in Armstrong and Clarion counties, Pennsylvania, for which the Farmers' Loan & Trust Company, of New York, was trustee. B. K. Jamison is the present President; John A. Wilson, Vice-President, and Francis B. Owen, Secretary. The collieries of this company in the vicinity of Ashland are resuming after a suspension of several weeks. The Merriam and Bast collieries were the first to start up. The rate of wages has been fixed at 3 per cent above the \$2.50 basis.

PHILADELPHIA & READING COAL AND IRON COMPANY.—The annual statement of earnings of this

company will be published in a few days it is stated. It will show net earnings for the fiscal year of about \$10,000,000. The November statement will show a decrease of between three and four hundred thousand dollars. The question of paying interest on the junior bonds will probably come before the board in a few days. It is now believed that full interest will be paid on the 2ds, and a portion of the interest on the 3ds.

WEST SHENANDOAH.—Part of the abandoned workings in the Buck Mountain seam of this colliery, near Shenandoah, caved in during Tuesday night, the 1st inst., doing considerable damage.

NATURAL GAS.

CITIZENS' OIL AND GAS COMPANY.—The usual monthly dividend of 2 per cent for December has not been declared, the company having decided to sink another well on the Weaver farm.

JEFFERSON GAS COMPANY.—This company, which was recently organized by Messrs. Jones & Laughlin, of Pittsburg, and to which we referred in our issue of December 8th, has bought the Cochran gas well, about three miles from Elizabeth.

PHILADELPHIA COMPANY.—The proposed issue of bonds by this company is meeting with the approval of the stockholders, as they have shown that they are willing to make extensive purchases of them. One of the officers of the company states that the replies to the circulars sent out some time ago have been numerous.

UTAH.

Mr. James Hedges, of Frisco, is about to make a sale of his sulphur mines near Antelope Springs and five miles west of the proposed extension of the Utah Central Railway.

BEAVER COUNTY.

HORN-SILVER MINING COMPANY.—With the advent of 1889 the new management of this company assumes the active control of the property. Mr. P. T. Farnsworth has taken Mr. H. C. Hill's place as Manager, and A. I. Harrison has been appointed Secretary at the New York office. Work will probably be commenced in the mine soon, but the matter is left to the resident Utah directors. Upon retiring Mr. Hill made a brief report on the condition of the property, a summary of which we shall publish as soon as space permits.

SUMMIT COUNTY.

CRESCENT MINING COMPANY.—The concentrator has now closed for the winter.

VERMONT.

Messrs. Gilson & Woodfin have sold their marble quarries and business at West Rutland, with their interest in branch yards in other cities, to the Vermont Marble Company, the latter assuming all outstanding obligations. The cost to the purchaser is about \$300,000.

ORANGE COUNTY.

UNION.—It is stated that this copper mine in Corinth, for which the old Ely Copper Mining Company paid about \$15,000, has recently been sold for \$1000, including valuable machinery and several buildings added by the Ely Company after its purchase.

FOREIGN MINING NEWS.

CANADA.

PROVINCE OF NOVA SCOTIA.

The official returns so far received at the Mines Office for the month of November show 2441 1/2 tons of quartz, crushed and a product of 1048 3/4 ounces of gold.

MEXICO.

[From our Special Correspondent.]

SONORA.—The Leandrana Gold Mining Company is working an old mine that was opened more than one hundred years ago by the Spaniards at a place about 25 miles southwest of Nogales. A recent report says that there have been some rich gold discoveries on the property from which specimens have been taken that assay \$15,000 to the ton. The president and general manager of the company, Mr. George Christ, has taken a quantity of the ore to Denver to arrange for additional capital.

Valuable discoveries of silver, native and chloride, are reported to have been made in a mine near Hermosillo, owned by the Governor of the State.

A company is reported to have been formed in the East to work a group of lead-silver mines near Gavilan, on the Sonora River, about 30 miles east of Hermosillo. A large smelter has already been ordered.

The Eva mine, in Northern Sonora, has sent a consignment of ore to El Paso which is phenomenally rich; some of it assayed 87 per cent of silver. The mine is owned by J. J. Deaver.

CHIHUAHUA.—A very rich gold strike is reported to have been made by some American prospectors in the Jesus Maria mining district on the line between Sonora and Chihuahua. Some of the quartz was assayed in El Paso and is said to have yielded \$98,000 per ton.

The Santo Domingo mine, in the Sabinal district, of which Mr. Adolph Munzenburger is the principal owner, is shipping ore regularly to El Paso. The ore consists of galena and carbonate of lead, carrying from 50 to 60 ounces of silver per ton, with from 40 to 50 per cent of lead.

Several capitalists from New Orleans have been at Sabinal inspecting the famous Plancha de Plata mine with a view to its purchase. It is their intention, in the event of a purchase, to erect an extensive mill plant, and to work the property for all it is worth.

The group of mines in the same camp, consisting of the Florenza, San Diego and Denver properties, have been let out on contract, and have already shipped some very rich ore.

The Magdalena and Moctezuma districts are commencing to look up again, and are shipping some ore to El Paso.

In the Santa Maria district, which is situated about eighty miles to the west and a littlesouth of the city of Chihuahua, the Sierra Madre Mining and Milling Company will soon put up a steam hoist on their gold property. H. A. W. Tabor, of Colorado, is interested in the Santo Eduwiges mine in this district. It is said that efforts are now being made in the East to organize a company to work the Cinco Senores mine in this district. The ore is said to be all free milling, and the vein is stated to be thirty feet wide, carrying ore which averages \$30 per ton in gold and silver. The El Regugio M. and M. Company, in the same district, has started a new twenty stamp mill to work on ore from the mine of the same name.

COAHUILA.—The newly-opened mining district of San Antonio de los Alamos lies about 50 miles to the northward of the mining town of Sierra Mojada. Enthusiastic prospectors are said to regard it as the richest in the Republic. Be this as it may, the desert character of the country and the want of water are great obstacles to its development, though they may be overcome in time as they were in the case of the Sierra Mojada. The mineral is said to be found in great abundance and in contact or in true fissure veins. The San Patricio mine is said to be in a contact vein between limestone and porphyry, which is 130 meters wide, and has been traced for a distance of two and a half miles. The gangue is said to be quartz, carrying oxidized ores of copper and lead with free gold and native silver.

The Mina Blanca and Red Quartz mines are close together on parallel veins, which can be traced for more than a mile. Assays of ore from the former mine gave 47 ounces of silver to the ton, and six per cent of lead. It is intended to build a mill as near the mines as possible to work these ores, or at least such of them as are of too low grade to bear transportation, while the richer ores will be hauled to the Monclova station on the Mexican International Railroad, which is at out 160 miles to the eastward, and sent from thence to the best market. Negotiations are said to be in progress in San Francisco, Cal., for the formation of a company to work in this district.

At the Fronteriza mine in the Sierra del Carmen, the company will commence operations with a ten-stamp mill early in the new year. The superintendent reports 10,000 tons on the dump which will average \$60 to the ton.

The Central mines at Santa Rosa are reported to be in full blast with an average output. The San Juan mines at the same place are now being drained by a new company, of which Col. John Halliday is the resident manager.

From Sierra Mojada I hear that the mining interests are very much depressed as the leading mines, in consequence of being badly worked, are now yielding very little ore. The bonanzas of last year have, it appears, given out, and although shipments of ore are still kept up by the Esmeralda company, they are said to be drawing on the reserve dump, which has been accumulating during the more productive times of last year.

The Panuco Gold and Silver Mining Company, which is located at New Philadelphia, thirty miles from Candela, has decided to move its quartz mills to a point near the mouth of their mines, and six miles distant from where they are now situated.

The Legislature of the State has authorized the Governor to employ a State mining engineer and to prescribe the duties of this new office as well as to assign a suitable salary and emoluments.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Jan. 4.
Statistics.

Production of Anthracite Coal for week ended December 29th and year from January 1st.*

Tons of 2240 lbs.	1888.		1887.
	Week.	Year.	Year.
P. & Read. R.R. Co.	77,733	7,159,045	7,555,252
Cent. R.R. of N. J.	53,185	5,726,942	4,852,859
L. V. R.R. Co.	131,925	6,724,327	5,784,451
D. & W. R.R. Co.	99,333	6,931,612	6,220,793
D. & H. Canal Co.	181,268	4,497,673	4,043,230
Penna. R.R.	49,185	4,525,309	5,515,143
Penna. Coal Co.	7,123	1,615,210	1,605,456
N. Y., L. E. & W.	15,000	964,933	759,835
Total	514,807	38,145,101	34,641,019
Increase		3,504,082	

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

* The figures given for 1887 are the totals for that year. † For eight days ending December 31st.

Production for corresponding period:
1887..... 31,793,027 1885..... 31,623,529
1884..... 30,718,293 1886..... 32,136,364

Production of Bituminous Coal for week ended December 29th, and year from January 1st.*

Tons of 2240 lbs.	1888.		1887.
	Week.	Year.	Year.
Phila. & Erie R.R.	4,918	70,179	20,335
Cumberland, Md.	60,000	3,590,433	3,292,667
Barclay, Pa.	3,500	161,366	165,000
Broad Top, Pa.	9,192	385,150	357,437
Clearfield, Pa.	50,926	3,364,952	3,264,150
Alleghany, Pa.	11,914	810,806	828,240
Pocahontas Flat Top	25,087	1,387,280	1,035,722
Kanawha, W. Va.	30,000	1,621,079	1,440,604
Total	195,537	11,931,395	10,404,155

* The figures given for 1887 are the totals for that year.

WESTERN SHIPMENTS.

Pittsburg, Pa.	13,425	729,184	577,017
Westmoreland, Pa.	26,839	1,568,121	1,456,396
Monongahela, Pa.	6,016	380,096	381,525
Total.....	46,280	2,677,401	2,414,928

Grand total..... 241,817 14,068,696 12,819,083

Production of Coke on line of Pennsylvania R.R. for week ending December 29th and year from January 1st, in tons of 2000 lbs.: Week, 93,459 tons; year, 4,126,303 tons; to corresponding date in 1887, 3,757,344 tons.

Anthracite.

The year 1888 was the best in the history of the anthracite coal trade. The shipments to market aggregated not far from 39 million tons, and the total output of the mines, including the amount consumed for steam and other purposes at the collieries, must have reached, if it has not exceeded, 41 millions of gross tons.

The prices at which anthracite was sold throughout the year were highly remunerative to the mine owners, or at least to the great coal companies which own both mines and roads, for the roads take the lion's share, and in some cases take all the profit.

It will be conceded by those in the trade that never within their recollection have prices been so well maintained at the figures which were named by the associated companies. It is true, of course, that some under-cutting has been done, as it always will be, by the individual operators who are obliged to sell to save the heavy expenses of demurrage, but the large companies nearly all held firmly to the prices that were named.

The year has closed on a fairly satisfactory condition of the market. Stocks are nowhere excessive, and if the winter should prove of average severity next season would open in even a better condition than did 1888.

At the present moment the market is extremely dull, though prices are maintained by the companies, and this dullness is due chiefly to the unseasonably mild weather we have had thus far this winter. The consumption of coal has fallen much below the average up to this time, and if the same weather should continue the stocks on hand will be far more than sufficient to carry us through the winter. It is evident that the companies must exercise a Spartan virtue in the matter of curtailment in production, cost what it may. At present a serious reduction is being made in the output, but stocks are still accumulating.

Large stocks on hand and free cutting of prices by individual operators are bad foundations on which to establish high prices. We continue our quotations of last week as follows for free burning coal, f.o.b. at New York shipping ports: Broken, \$3.95; Egg, \$4.30; Stove, \$4.65; Chestnut, \$4.65; Pea, \$2.25.

But these prices are deeply shaded. Pea coal is in better demand.

Bituminous.

The mild weather has considerably increased the shipping facilities of the bituminous mines, and we hear less of a shortage of transportation. The companies have caught up with their contracts pretty well, and the supply is now abundant. Prices are firmly maintained, and there is the same talk as heretofore of the necessity of keeping them up and living up rigidly to the standard throughout the year. This joke is somewhat old, but it seems to stand repetition every year.

We have no further information concerning the final signing of the Seaboard Association agreement, but there is no doubt that it will be signed and put in operation in name at least, and perhaps on a better basis than it had last year. It would be perhaps unreasonable to expect that every one will live up to the agreements, even considering the fact that they have put up a money guarantee to protect their honor. The trade is quite familiar with a good many ways of getting around such things. We continue our quotations as heretofore: \$2.60 f.o.b. at Baltimore and Georgetown, \$3.25 for New York Harbor shipping ports, \$3.50 alongside New York.

Boston. Jan. 4.

[From our Special Correspondent.]

The Boston coal market was never known to be so dull in January, and it is only because no one is trying to sell that f.o.b. prices are not lower, so that quotations may be considered very nominal. There is absolutely no anthracite market. Retail trade is at a standstill, with few arrivals during the week. We have now had sixty days warm winter weather, which is an unprecedented record.

Bituminous coal market is in somewhat better shape, and we may say that there is a moderate movement at full prices. Baltimore freights are easier, other ports firm, and while all craft is still very scarce there are more barges available. Altogether the market is better than might be expected, as individual operators are not forcing prices.

Buffalo. Jan. 3.

[From our Special Correspondent.]

The last days of the old year were mild, and the new year thus far is warm and pleasant, with indications, however, of a coming change within 24 hours.

The anthracite coal trade is dull, with prices nominally unchanged at wholesale, and steady at retail, and that is all that can be said on the subject.

Bituminous coal in fair demand and firm, at unvaried quotations. Stocks about adequate for the requirements of the trade, but larger receipts are expected in a few days.

Coke quiet and unchanged.
No items of interest to report.

Pittsburg. Jan. 3.

Coal.—Market remains dull, with more sellers than buyers, the supply in all Southern and Western markets largely in excess of the demand, this, however, is nothing new, and has been the situation for a long time. The year's shipments by the Ohio River exceed all previous years, aggregating 109,572,000 bushels, or 4,136,792 tons. There is still a limited amount of mining going on. The nominal rates are:

PRICE OF COAL PER 100 BUSHELS = 7600 LBS.	
First pool.....	\$4.75
Second pool.....	4.50
Third pool.....	3.90
Fourth pool.....	\$3.25
Railroad coal.....	5.00

Connellsville coke prices are as unsettled as ever, with two parties in the field talking about the price of coke. Those that have contracts at \$1.25 unfilled want prices to remain as they are. The other side wants the advance. Nominal rates f.o.b. at ovens: Furnace Coke.....\$1.25@1.50 Foundries.....\$1.50 Crushed.....2.20

Freight rates from ovens to Pittsburg, 70c per ton; to the Mahoning and Shenango valleys, \$1.35; East St. Louis, \$3.20; Cleveland, \$2.80; Chicago, \$2.75. The week's production aggregated 127,383 tons, as against 126,818 tons for previous week, shipments reaching a grand total of 7120 cars.

FREIGHTS.

Pig-Iron Freight Rates.—The freight agents of the railroads centering in Pittsburg, Pa., have decided to advance the rates on several classes of merchandise, to take effect on January 14th. The increase in rates will be considerable. The special pig-iron tariff issued by the Pittsburg & Lake Erie Railroad shows that the rate on that article will be advanced from a certain point 10 cents per 100 pounds, and a corresponding increase from all other places of shipment will be made. The tariff on special iron articles has been abolished by the railroads, and hereafter such merchandise will be rated as fifth and sixth class freights. This is an advance in rates.

The latest coal charters per ton of 2240 lbs.
From Baltimore to:—Bangor, Me., 1.60; Bath, 1.60; Boston, 1.75; Bridgeport, Conn., 1.45; Bristol, 1.25@1.30; Brooklyn, 1.25; Charleston, 1.00; Fall River, 1.40; Galveston, 3.00; Gardner, Me., 1.75; New Bedford, 1.35; Newburyport, 2.25; New Haven, 1.35; New London, 1.35; New York, 1.20; Portland, 1.75; Portsmouth, N. H., 1.85; Providence, 1.35 @1.40; Quincy Point, 1.50; Richmond, Va., .70; Roxbury, 1.50 @.30; Salem, Mass., 1.75; Savannah, 1.35; Somerset, 1.35@1.40; Williamsburgh, N. Y., 1.25; Wilmington, 1.35.

From New York to:—Bangor, Me., 1.25@1.30; Bath, 1.30@1.40; Beverly, 1.15; Boston, 1.10; Bridgeport, Conn., .60; Cambridge, Mass., 1.15 @.30; Cambridgeport, 1.10; Charlestown, 1.10; Chelsea, 1.10; Com- Pt., Mass., 1.15; E. Boston, 1.15; E. Cambridge, 1.15. Fall River, .75@.90; New Bedford, .80@.90; Newburyport, 1.25; New Haven, .60; Newport, .75@.90; New London, .85; Norwalk, Conn., .60; Portland, 1.10; Portsmouth, N. H., 1.20; Providence, .75@.90; Salem, 1.15.

From Philadelphia to:—Bangor, 2.00; Boston, 1.60@1.75; Charleston, .90@1.00; Chelsea, 1.55@1.60; Com- Point, Mass., 1.60; E. Boston, 1.70; East Cambridge, 1.50; Fall River, 1.15@1.25; Galveston, 3.00; Gardner, Me., 1.60; Georgetown, D. C., 1.00; Lynn, 1.75@1.85; New Bedford, 1.15@1.25; Newburyport, 1.75; New York, .90; Norfolk, .70@.75; Portland, 1.60@1.75; Portsmouth, N. H., 1.90@1.70; Portsmouth, Va., .55; Providence, 1.35@1.40; Richmond, Va., .80@.85; Rockport, 1.25; Sacon, Me., 1.75; Salem, Mass., .90; Savannah, 1.25; Wash- ington, 1.00; Weymouth, 1.15; Wilmington, N. C., .60.

* And discharging. 3c. per bridge extra. † Alongside.
‡ And towing.

METAL MARKETS.

NEW YORK, Friday Evening, Jan. 4, 1889.
Prices of silver per ounce troy.

Dec.	Sterling Exch'ge.	Lond'n Pence.	N. Y. Cts.	Jan.	Sterling Exch'ge.	Lond'n Pence.	N. Y. Cts.
29	4.88	42½	93-16	2	4.87¾	42½	92¾
31	4.88	42½	92¾	3	4.87¾	42½	92¾
Jan 1	*	*	*	4	4.87¾	42½	92¾

* Holiday.

Silver market firm, but foreign exchange weaker.

Foreign Bank Statements.—The governors of the Bank of England at their weekly meeting made no change in its rate for discount, and it remains at 5 per cent. During the week the bank gained £77,000 bullion, and the proportion of its reserve to its liabilities was reduced from 40 82 to 29 90 per cent, against a reduction from 43 11 to 38 90 per cent in the same week of last year, when its rate for discount was 4 per cent. Thursday the bank gained £204,000 bullion on balance. The weekly statement of the Bank of France shows a loss of 11,075,000 francs gold and a loss of 9,750,000 francs silver.

Copper.—A good speculative inquiry has been observed during the last eight days, and several hundred thousand pounds of Lake copper have changed hands for December and January at 17 40@17 50, and it is evident that some shorts still remain to be covered. At the same time one of the brokers of the syndicate has also been bidding fair prices for the first four months of the year. Casting copper remains pretty firm at 16c.

The fire in the Calumet & Hecla mine seems now to be practically extinguished, or at any rate under control, but operations have not as yet been resumed in the damaged portion of the mine. With regard to be rumors about the Anaconda mine nothing definite

has yet transpired, but there is no doubt that a new arrangement with the French syndicate has been made. It is understood that negotiations are still pending between the syndicate and the Lake companies as to the modification and extension of the existing contracts.

The foreign markets have been quiet, and in London quotations of G. M. B. and Chili Bars are a little easier being now £77 5s. to £77 7s. 6d. for spot and £78 to £78 2s. 6d. 3 months, but there is virtually no change to report.

In the European markets the demand for consumption appears to have been rather slack lately, but this is the usual condition of affairs at this season of the year and a revival may be now expected.

The stocks again mark an increase, and according to cable advices from Messrs. Henry R. Merton & Co., the total visible supplies now amount to 104,035 tons, against 42,300 tons on January 1st, 1888.

From Valparaiso we hear that the production of Chili bar copper has increased lately, and it is consequently not unlikely that the total exports for 1888 will prove to exceed those of 1887.

The exports of copper from New York during the past week were as follows:

To Liverpool—	Copper Matte.	Lbs.	
By S. S. City of Chicago.	Bbls.	227	224,007
	Bags.	1,406	170,127
By S. S. Celtic.....	Bags.	1,906	239,709
	Copper Ore.		
By S. S. Chicago.....	Bags.	364	42,916
	Copper.		
By S. S. Lake Ontario.	Pckgs. (old)	71	9,286
By S. S. City of Chicago.	Casks.	112	112,000
By S. S. Celtic.....	Casks.	96	112,000
	Old Copper and Brass in Transit.		
By S. S. Lake Ontario.	Total.	188,885	14,727
To Hamburg—			
By S. S. Polaria.....	Pckgs.	22	24,191
	Yellow Metal.		
By S. S. Polaria.....	Bbls.	80	1,811
To Liverpool—			
By S. S. Wyoming.....	Bbls.	79	9,843

Copper report from James Lewis & Son, dated Liverpool, December 18th, 1888: The consumptive demand for copper has been practically at a standstill during the past fortnight and the value of English copper has receded until best selected of good brand offered for delivery in Swansea at £78 per ton.

The value of Chili bars and good merchantable copper has, however, been sustained by the syndicate at £77 10s. for cash and £78 for three months, all offering at these prices being taken by them. 50 tons bars have gone into consumption.

Furnace material is difficult of sale, smelters not yet having worked off what they bought from the syndicate prior to the 5th of November at prices 6d. per unit above what they offer now. A large portion of the copper in the ore, matte and precipitate sold by the syndicate to the smelters comes back again to the syndicate as good merchantable copper, which they are obliged to purchase. In this way the stock of English G. M. C. has increased 480 tons the past fortnight, and is now 3948 tons.

The visible supply of copper has increased 3083 tons during the past fortnight and is now 100,506 tons, against 43,677 tons a year ago. Imports to date this year are 36,575 tons greater and deliveries 39,275 tons less than last year.

Arrivals from the United States have been 1115 tons fine here and in Swansea, and nil in France, and from Chili 865 tons here and 175 in France.

Chili charters for the fortnight are 1800 tons, and the closing rate of exchange is 28½d., bars being quoted at £27.70 per quintal.

Quotations to-day are: Chili bars and good merchantable copper, £77 10s. cash, and £78 three months, prompt. Ore of good produce 14. 7½d. and matte 15s. per unit. Best selected, £79@£80 per ton in Birmingham.

Tin has been rather irregular throughout the week. The London market has been fluctuating from day to day rather widely, the highest price touched for spot being £100 2s. 6d. and the lowest £98. At the close the tone is rather firm at £99 2s. 6d. for spot tin. In our New York market dullness has been the prevailing characteristic, and in the midst of the want of animation prices have remained fairly steady and we now quote spot and January, 22½; February, 22 15; March, 22 25.

Lead.—The tone of this market, which has been quiet but firm during the last few weeks, closes to-day decidedly firmer, with prices higher. A sale of about 800 tons, which took place at auction yesterday at the Real Estate Exchange (supposed to be a lot held on advances to the speculators recently failed), realized the comparatively high prices of 3 85½ and 3 86 per pound, being bought up by speculators. After this sale some dealings took place at 3 90, but the close to-day cannot be called quite so strong, and it is noticed that a good deal of metal is coming on to the market at the higher quotation now established.

In London the market has been uneventful during the week, with Spanish lead at £12 15s., and English at £13, the market closing firmer at £12 17s. 6d. for Spanish, and £13 2s. 6d. for English.

Chicago, Ill.—Messrs. Everett & Post telegraph us to-day as follows: Business has been quiet, and of a limited character, with quotations at 3 60. Sales will not aggregate 200 tons. Latterly a firmer feeling prevails; 3 60c. asked.

St. Louis, Mo.—Messrs. John Wahl & Co. telegraph us to-day: "There has been more doing, and there is a better feeling. Sales will probably foot up 750 tons at prices ranging from 3 55 to 3 60. Offerings are very light. Sellers look forward to higher market. At the close 3 60c. bid, 3 65c. asked.

Spelter has been in fair demand, with sales of

prime Western at about 5c. Hardly any stock of foreign spelter is held here, and for this description the present quotation is nominally 5½@8c. The London market had given way to £18 2s. 6d. for good ordinary, but has since rallied, and last cable reports are market firm at £18 10s.

Antimony is still very scarce, and we quote Hallett's 11@11½c.; Cookson's, 13c.

CHEMICALS AND MINERALS.

NEW YORK, Friday Evening, Jan. 4.

Heavy Chemicals.—Aside from the temporary interruption of trade, incidental to the holiday season, the market is in good condition and dealers and makers look forward to the new year's business with considerable confidence.

We are unable to record much spot business of importance, but there is considerable inquiry for futures, particularly for carbonate soda ash. Our usual letters from our Liverpool correspondents will be found below.

Quotations for nearly all articles are practically unaltered. We quote for carbonated soda ash 1.25@1.27½c. for large quantities and 1.35c. in a small way from store. Caustic soda ash, 48 per cent, is quiet, with small transactions. Spot stock is light, however, and 1.35c. might be obtained for small lots in this position. In a large way, the quotations are usually 1.25c. to arrive.

Caustic soda is quiet. Little new business, either on contract or spot, is reported. We continue to quote 2.27½@2.30c. for all the higher tests, 70, 74 and 76 per cent, and nominally 2.50c. for 60 per cent.

Refined Alkali.—An improved demand is reported, particularly for future delivery. Prices are firm at 1.22½@1.25c. for 48 per cent and 1.17½c. for 58 per cent.

Sal soda is quiet, owing to the limited inquiry, but as supplies on the spot are light, prices are firm at .95c. for both spot and arrivals.

Bleaching powder is a little firmer than last reported. A number of small lots that had been obtained on 1888 contracts, and which were pressing the market last week, have now been disposed off, and the market is consequently more buoyant. Spot may be quoted at 2@2½c., according to quality. For futures, sellers ask 1.95c.

Acids.—This market continues quiet and prices are steady.

Acetic Acid.—The prevailing quotation of 2@2½c. for prompt delivery is purely nominal.

Nitric acid is moving in a small way at the old figures, ranging from 4c. to 7c. for 38°, 40° and 42°.

Muriatic Acid.—The inquiry for muriatic is very light. We continue our quotations of last week, viz.: 1.15@1.80c. for 18°, 20° and 22°.

Oxalic Acid.—Although the advance in price which was expected before the New Year has not yet taken place, importers inform us that it is now daily looked for. In the meantime sales are only for immediate needs. The ruling quotations are still 8½@9c. per pound, according to quantity, for prime English and German makes, ex store, New York, Boston and Philadelphia.

Tartaric Acid.—Prices have not been changed since the reduction was made two weeks ago. We quote 41@43c. for crystals, according to quantity, and 42@44c. for powder.

Sulphuric Acid.—A fair and steady movement is reported in this acid. We continue to quote for 66 degrees .95c. in a large way. For small lots for prompt delivery, 1.15@1.30c. might be obtained. For 60 degrees the usual asking price is .90@.95c.

Fertilizers.—The holidays apparently have not affected this market so much as other lines. Dealers report a fair business, which has been steadily maintained. The revised price-list is about as follows: Azotine, \$2.65@2.70; dried blood (city), low grade, \$2.60 per unit; Western high grade, \$2.70 per unit for ground material; tankage, high grade, \$25@26 per ton; low grade, \$23 per ton, as to quality. Fish scrap, \$25 per ton f.o.b. factory. Sulphate of ammonia, \$3.40 per cwt.

Refuse bone-black, guaranteed 70 per cent phosphate, is quoted at \$19 per ton. Dissolved bone-black is 95c.@\$1 per unit for available phosphoric acid, and acid phosphate 80c. per unit for available phosphoric acid.

Steamed bones, unground, \$19; ground, \$25@26. Charleston rock, undried, \$5 per ton; kiln dried, \$6 per ton, both f.o.b. vessels at the mines. Charleston rock, ground, is held at \$10@10.50 ex steamer at New York.

Muriate of Potash.—Spot is quoted 1.82½@1.85c. Contract prices are now 1.80c. Arrivals may be had at 1.80c. by sail shipment and 1.82½c. by steamer.

Double Manure Salts.—Sales are small at 1.15@1.20c. on a basis of 48 per cent. High grade sulphate of potash is firm at 2.35c. on the spot and 2.50c. to arrive, basis of 90 per cent.

Kainit.—Available supplies are light. Former quotations continue to rule. We continue nominally \$10.50 on the spot, and \$9.75 to arrive.

Brimstone.—There is little of interest to report concerning this article. There have been offerings, ex vessel in port, at \$20.50 for best unmixt seconds. For shipment we quote \$19.25@19.50. Thirds to arrive are \$18.75.

Nitrate of soda is easier owing to arrivals of some 32,000 bags during the week. Spot supplies are now quoted 2.32½@2.35c. Arrivals may be had at 2.25c.

Acetate of lime is dull at 1.05c. for brown and 2@2.10c. for gray.

Cream of Tartar.—The "combination," or the agreement of manufacturers, expired with the year 1888, and the market is consequently unsettled and weak, no definite plan of action for the new year having been decided upon. As yet, however, there has been no open change in quotations, which may be written 31@31½c. for crystals, and 31¼@32½c. for powdered.

Minerals.—Sulphate of barytes is quiet. Jobbing sales only are reported. Prices remain at \$21.50 for best special brands of imported, \$17.50@18.50 for best No. 1, and \$12@15 for offcolored grades.

Borax.—We quote refined 8½@9½c. for California and 9½ for city. Concentrated is held at 8@8½. The combination rates for carload lots, f.o.b. in San Francisco, are 6½ for concentrated and 7½ for refined or powdered.

Chalk.—The market is rather unsettled. Local quotations are \$2.50 by steamer, and \$2.90 by sail.

China Clay.—Although spot supplies are light, sellers are not able to secure any advantage on this account owing to the limited demand. We continue to quote \$13.50@18, according to grade.

Liverpool. Dec. 22. (Special Correspondence.)

Chemicals.—Messrs. J. P. Brunner & Co. write us as follows: "Chemicals are rather weak this week, but a fair business has been done in several lines at the decline. Soda ash: Most makers are very fully sold, but 3½d. has been accepted in one or two cases for 48 per cent caustic ash, prompt delivery, by makers who happened to have a little stock on hand. We quote spot values: Caustic ash, 48 per cent, 3½@1½d.; high test, 1@1½d.; carb. ash, 48 per cent, 1@1½d.; high test, 1@1½d. For forward delivery 1½@1½d. is asked. Soda crystals are neglected, but quotations are nominally unchanged, at £2 10s. to £2 12s. 6d. Caustic soda is still for sale by resellers and for 70 per cent prompt delivery, £6 17s. 6d. has been accepted, while makers hold for 5s. to 7s. 6d. advance on this figure. Sixty per cent has been sold at £6 and for some brands more money is required. Seventy-four per cent has been done at £7 10s. and a fair inquiry for this strength. The association committee have ordered a restriction of one week's make in January, and we should not be surprised to see an upward movement in this article before many weeks are over, although in such a deplorable state at present. Bleaching powder reduced 2s. 6d. a ton, and a number of orders placed at £7 12s. 6d. Chlorate of potash has gone very flat in consequence of the makers having disagreed at their meeting held on 20th inst., with the result that the combination has been broken up. It seems a great pity that they were unable to fix up their differences, as the market showed a firmer tendency in the early part of the week, but has been knocked flat again on this report. Nominal values at the close for prompt delivery are 5½@5¾d., but business stopped. Bicarbonate of soda well maintained at £4 12s. 6d. to £4 15s., and makers well supplied with orders."

Minerals.—George G. Blackwell reports as follows: "Our market still continues firm, with an upward tendency. Manganese: Arrivals continue small and prices are still stronger, with a prospect of further advance. Stocks are very much reduced. Bauxite in increasingly strong demand, and brings full prices, especially for Irish Hill brand—20s. for lump; seconds, 15s.; thirds, 12s.; ground, 25s. Dolomite, 7s. 6d. per ton at the mines. Barytes (arabonate) still inquired for, especially for best qualities. Selected crystal lump scarce at £6 5s.; No. 1 lumps, 90s.; best, 82s. 6d.; seconds and good nuts, 75s.; smalls, 50s. to 60s.; best ground, £6 5s.; and selected crystal ground, £8 10s. Sulphate in demand: best lump, 35s. 6d.; good medium, 30s.; medium, 25s. 6d. to 27s. 6d.; common, 18s. 6d. to 20s.; ground, best white, GGB brand, 60s.; common, 45s.; grey, 32s. 6d. to 40s. Pumicestone continues firm at the advanced quotations, ground being quoted at £10, and specially selected lump, finest quality, £13. Emerystone in demand, and prices are stronger for best qualities—£5 5s. to £5 15s. for lump; and smalls, £5. Wolfram and tungstate of soda continue drooping. Chrome ore continues firm, strong qualities being in demand. Antimony ore continues firm; £16 to £22 for fair quality. Asbestos: Best rock, £17 to £18; brown grades, £14 to £15. Plumbago: Best Ceylon lump, £25 to £35; good, £20 to £21; chips, £8 to £16; best ground, £20, £25 and £30; Italian and Bohemian, £4 to £12 per ton. French sand in cargoes, 16s. to 17s. Ground mica, £50. China Clay: Common, 18s. 6d.; good medium, 22s. 6d. to 25s.; best, 30s. to 35s. (at Runcorn)."

BUILDING MATERIAL MARKET.

NEW YORK, Friday Evening, Jan. 4.

The "turn of the year" has not affected in any way the market for building materials. The week on the Exchange has been quiet and uneventful. In our next issue, together with our annual reviews of all other markets reported in this JOURNAL, we shall pay attention to the Building material interests.

Bricks.—Navigation may still be called "open" to Haverstraw and even to Newburgh. There is nothing on the market, however, to be had for less than \$7@7.75. Although arrivals are more or less irregular, as a rule they keep pretty well up to the existing demand. No upriver and very little Jersey stock is obtainable. Quotations are nominally as reported last week.

Lime.—The little Rockland lime on the market could probably be easily disposed of, but as there is a no-

ticeable scarcity at present, the spot market being almost bare against a fair demand, most dealers are holding what little they have "for an emergency." In other brands there are no features of interest.

For prices of building materials and wages of laborers see our current prices.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Jan. 4.

The past week has been a very quiet one, with few transactions recorded, and no change to note in the condition of the market. This is natural for the first week of the year, when almost all manufacturing concerns are busy making up accounts and taking stock.

American Pig.—The market is unchanged, with demand not brisk. Prices are still quoted at \$18, \$17 and \$16 for No. 1, No. 2 and Forge of standard brands, although \$19 is sometimes obtained for choice No. 1 for special purposes. No one seems to expect any advance in prices, and in some quarters there is the feeling that, with the opening of spring, lower rates will generally prevail. Consumption continues large, the product of about six million tons in 1888 having been practically absorbed, leaving stocks light.

Scotch Pig.—The market is without interest. Prices in Glasgow are very slightly changed. The British market is excellent, but prices here are unchanged and weak. The demand is very slack, and the American trade in Scotch pig-iron is likely soon to be a thing of the past, as the various Scotch brands are being more and more replaced by American irons.

Bessemer Pig is lifeless. With the present small demand which the American furnaces can more than meet, importations are rare. In fact, for some months past, the price of English Bessemer pig has been too high for importation, the demand being excellent in Great Britain.

Steel Rails.—Prices for heavy sections are pretty firmly held at \$28 by all Eastern mills. This figure would hardly be shaded, it is said, although the prices at which several orders placed lately, including the 10,000 tons for Virginia, mentioned in our last issue, are not given out. The total product for the year will not be far from 1,300,000 tons, agreeing with our estimate made several weeks ago.

Old Rails.—No new sales are reported. There are buyers of Tees at \$23 and sellers at about \$23.50. Doubles are hard to quote, being scarce, but it is not likely that they could be bought below \$25.

Iron Cut Nails are very dull and weak. This branch of manufacture has suffered seriously during the past year by the introduction of cut steel nails and of wire nails.

Quotations will be found in our regular weekly register of prices.

Lack of space prevents our publishing this year our usual full review of the iron trade for the year past, which we propose to furnish in our next issue.

Louisville. Jan. 2. [Special report by HALL BROTHERS & Co.]

There have been several orders of moderate sized quantities placed from this market during the past week for deliveries extending considerably into the coming year, and some sales aggregating considerable quantities for spot deliveries having been made covering off grades, which practically clears the yards of this class of metal that some of the furnaces had. There is still some fairly good business in sight, and a moderately good buying movement is looked for in the opening of the new year's business.

Our quotations are cash f.o.b. cars at Louisville.

Philadelphia. Jan. 4. [From our Special Correspondent.]

There are several indications of activity in the iron trade this week, but they mainly consist of inquiries from both forge and foundry buyers. Mill men are looking for concessions. The larger consumers among them will not buy much iron this month unless some inducement is offered. Brokers and makers to-day said that there is no probability of weakness, but that the inquiry is not as active as they had expected. It is still too soon to make predictions that have a solid basis. The mills throughout the State are running nearly full time, and from all advices there will be business enough coming along to keep them running full time through the winter. Pig-iron salesmen who have made a tour through the country during the holidays, return with the information that stocks are low at most points, but that they found a dislike among mill men to buy far ahead. The only anxiety now is for choice irons, because such brands are hard to get and command outside prices. The foundry irons are dull at present, but if the inquiries within the past week indicate anything, it is that there will be an active demand. Muck bars are weak. Scarcely any business has been done since Monday. Representatives of bloomeries are confident that strong prices will continue this month, but they have not much business to report. Merchant bar sales have been trifling. No changes in price. Nails are weak, but inferior brands are being offered on the market. Skelp iron is also weak, and pipe men say that at the present quotations they will not buy much. There is no activity in wrought-iron pipes or tubes. Very little activity is reported in plate iron, but mills are running as usual. Manufacturers and dealers in structural shapes are not able to report much business. Several rumors are afloat in regard to steel rails. One is to the effect that a couple of large orders were placed in Pennsylvania mills, but those who ought to know are refusing to give prices. The usual quotations are given. Brokers handling old rails have plenty of buyers willing to take iron at about 50 cents

less than current prices. The yard men are making active efforts to fill some orders that have been received.

Pittsburg. Jan. 3. [From our Special Correspondent.]

Raw Iron.—We have nothing very new or important to note in regard to the iron trade. All things considered, the volume of business, although not large, was fully up to the average, taking the season into consideration. Buyers, as a general thing, are not anticipating requirements, and brokers find it difficult to negotiate for large lots at this time, there being a wide difference of opinion between the parties. Buyers insist that the conditions of the market are gradually working round in their favor, and that within the next thirty days at furthest, on account of the increased production promised, prices will rule in their favor. On the other hand, pig-iron companies take no stock in these anticipations, and figure out very cleverly that the conditions are all favorable to the maintenance of strong prices throughout the winter, that at the present rate of consumption the large purchases made in the fall will soon be absorbed, and new purchases will have to be made in order to keep their works going and fill the orders they have booked. Quotations for some time have been irregular and uncertain, depending on size of order, time of delivery and terms of payment. It seems likely that business during the new year will open in a similar way; that is, a good deal of business in limited amounts at quoted rates, larger lots on such terms as can be arranged between buyer and seller.

Table listing prices for Coal and Coke Smelted Lake Ore, Coke, Native Ore, Charcoal, Steel Slabs and Billets, Muck Bar, Ferromanganese, Steel Wire Rods, Old Iron Rails, Skelp Iron, and Bloom Ends.

FINANCIAL.

NEW YORK, Friday Evening, Jan. 4.

The new year has opened with but little change in the condition of the mining market. The week's business has been small, and the prices on the whole remained unchanged. In our next issue, January 12th, we will give a full review of the market, together with tables showing the fluctuations in the prices of the different stocks in 1888.

In our Financial Review last week, we ventured to remark that it would not be surprising if the price of Amador and other mines of the same group should before long take a downward course, as the Hollywood has already done. Naturally, this has aroused the ire of Mr. H. L. Lounsbury, an old and highly respected member of the Consolidated Exchange. In language much more vigorous than elegant he claims that the ENGINEERING AND MINING JOURNAL has wronged the Amador Company. He states that the parties interested in the Amador do not own a share of the Hollywood stock, and he promises to write us a letter, to be published in our next issue, in which he will show what the actual condition of the Amador mine is, how conscientiously it has been managed, and how mistaken are those who have denounced the property. Mr. Lounsbury says that the principal owners of the Amador mine are Senator Wm. A. Wallace, of Pennsylvania, Chas. R. Trotter, of Brooklyn, and H. R. Lounsbury, of this city. He also states that the superintendent, Mr. A. P. Minear, does not hold any of the stock. Notwithstanding Mr. Lounsbury's faith, the stock has already taken a downward course, as

IMPORTS AND EXPORTS OF METALS AT NEW YORK DECEMBER 21 TO DECEMBER 31, AND FROM JANUARY 1.

Large table with multiple columns detailing imports and exports of various metals (Spelter, Zinc Sheets, Pig Lead, Antimony, Copper, Nickel, Tin, Tin Plates, Steel Sheets, Steel Iron Rods, Scrap Iron, Charcoal Iron, Copper Ore, Copper Matte) across different companies and time periods.

CURRENT PRICES.

CHEMICALS.

Table of chemical prices including Acetic, Muriatic, Nitric, Oxalic, Sulphuric, and various salts and acids.

Table of domestic and foreign pig iron prices, including Scotch Pig, Clyde, and Dalmellington.

Table of building materials including Bricks, Tiles, and various stones.

Table of building stone prices for Amherst, Brownstone, and other types.

Table of labor prices for various trades such as masons, carpenters, and plumbers.

Table of iron and steel prices, including Bessemer Pig, Spiegeleisen, and structural iron.

Table of various metals including Aluminum, Arsenic, Bismuth, Cadmium, Calcium, and others.

Table of iron and steel prices, including Bessemer Pig, Spiegeleisen, and structural iron.

Table of Philadelphia prices for various goods and services.

Table of stock market quotations for Baltimore, Md., listing various companies and their stock prices.

Table of stock market quotations for Birmingham, Ala., listing various companies and their stock prices.

Table of stock market quotations for Pittsburgh, Pa., listing various companies and their stock prices.

Table of foreign quotations for various goods and services, including London prices.

Table of iron and steel prices, including Bessemer Pig, Spiegeleisen, and structural iron.

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DIVIDEND-PAYING MINES

NON-DIVIDEND-PAYING MINES

Table with columns: NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS (Total levied, Date and amount of last), DIVIDENDS (Total paid, Date and amount of last). Includes entries 1-150 such as Adams, Allice, Alturas, Amy & Silvermountain, etc.

Table with columns: NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS (Total levied, Date and amount of last), DIVIDENDS (Total paid, Date and amount of last). Includes entries 1-150 such as Agassiz Cons., Alouez, Alturas, Alpha Con., etc.

Gold. Silver. Lead. Copper. Non-assessable. This company, as the Western, up to Dec. 10th, 1881, paid \$1.4 M. D. D. \$ N n assessable for three years. The Dead wood previously paid \$275,000 in eleven dividends, and the Ferris \$75,000. Previous to the consolidation in Aug., 1881, the California had paid \$31,323.00 in dividends, and the Con. v. r. data, \$24,390.00. * Previous to the consolidation of the Copper Queen with the Atlanta, Aug. 1883, the Copper Queen had paid \$1,350,000 in dividends. * 1,300,000.

NEW YORK MINING STOCKS QUOTATIONS. DIVIDEND-PAYING MINES NON-DIVIDEND-PAYING MINES

Main table of New York Mining Stocks Quotations, listing companies like Adams, Alice, Argenta, etc., with columns for dates (Dec. 29, Dec. 31, Jan. 1, etc.) and sales figures.

Ex. dividend. †Dealt in at the New York Stock Ex. Unlisted Securities ‡Assessment paid. Dividend shares sold, 6,820. Non-dividend shares sold, 84,904. Total New York, 91,724.

BOSTON MINING STOCK QUOTATIONS.

Table of Boston Mining Stock Quotations, listing companies like Atlantic, Bodie, Bonanza Developm't, etc., with columns for dates and sales figures.

* New Year's Day. † Rights. ‡ Cash. Boston: Dividend shares sold, 7,119. Non-dividend shares sold, 2,933. Total Boston, 10,052.

COAL STOCKS.

Table of Coal Stocks, listing companies like American Coal, Barclay Coal, Cameron Coal & Iron Co, etc., with columns for par value and prices for various dates.

San Francisco Mining Stock Quotations.

Table of San Francisco Mining Stock Quotations, listing companies like Alpha, Alta, Belcher, etc., with columns for closing quotations on various dates.

*Bid. †New Year's Day. ‡Sale on Friday, Dec. 28, 1888. *Of the sales of this stock, 41,486 were in Philadelphia, and 102,310 in New York. Total sales, 232,906.

* New Year's Day.

