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We learn from Cornell University that a complete course in history and political science has been organized there, in imitation of those already established at Columbia College and Michigan University. After President WHITE'S forcible presentation, in the Paris Exposition reports, of the need of such instruction in this country, it was to be expected that Cornell would come to the front in the movement.

AN indication of the magnitude of the operations of the famous Rio Tinto Company, of Spain, is indicated by the statement made during a recent special meeting. During the first ten months of the present year, 790,000 tons of pyrites were mined, and it is expected that before its close very nearly one million will be reached. The sales of shipping pyrites cover the output of the next three years, and in the leading works at the mines the ore in process of treatment contains a stock of 20,000 tons of copper.

THE first of a series of "Letters from the West," by "J. D., Jr.," will be found on another page, and will be read as soon as found. The writer marks the intense activity in railroad building at the West, points out its

influence in promoting the interests of the miner and the metallurgist, and concludes with a comparison of the railroad lines subsidiary to mining in 1870 with those of 1881. While admiring the magnificence of enterprises which involve the laying of the iron path "on a graded bed, which must be built on terraces, piled up against the sides of steep cañons, or tunneled out of the mountains," in order to reach a scanty and ever-shifting population, one is tempted to ask, Is this railroad construction, or is it railroad frenzy?

THE present time is one in which, more than ever before, attention is given throughout the country to concentrating machinery, and numerous devices of more or less merit are brought to the attention of the mining public. Inventors and their representatives generally seem to consider an enumeration of good mechanical points and the exhibition of a series of bottled samples sufficient to prove the efficiency of their apparatus. We do not wish to say that they are to be blamed for so doing; the chief responsibility probably lying with buyers who have not been educated to judge of the performance of such machines. Often they are content to have a trial of a few hundred pounds made; and upon finding that the tailings will run only so and so many dollars, while the assay of the concentrates was in the hundreds, promptly issue their orders. Neither party does justice to itself; and in consequence, both are sufferers from a system which might easily be improved. As far as slime-tables are concerned, the matter is a simple one, the only points to be accurately determined being the weight and assay of the ore to be dressed, the dry weight and assay of the concentrates, and the weight and assay of the tailings. Then even a person not at all familiar with the subject can calculate readily just what the machine is doing. Notwithstanding the fact that such a test is inexpensive, and would appear almost self-evident, it is but rarely resorted to by either buyer or seller. The necessity for such experiments becomes much more urgent, however, when three products—concentrates, middlings, and tailings—are made. In such a case, a bare statement of the assay value or coin value per ton of the concentrates or of the tailings, or both, is absolutely valueless. As soon as buyers insist upon full and accurate returns, the makers of this class of machinery will learn to meet the demand, and both will be gainers.

EVEN Mr. HORATIO C. BURCHARD, Director of the Mint, who has been an enthusiastic advocate of the present silver law, is reaching the conviction that its enforcement is calculated to do serious injury to the business interests of the country, and that in view of the failure of the Paris Monetary Conference and the possible demonetization of six hundred and fifty millions of dollars in Europe, it will be dangerous to continue the compulsory coinage of twenty-four millions of silver dollars every year. Mr. BURCHARD'S views may best be expressed by the following abstract from his report:

"The International Monetary Conference which met at Paris in April last instructively discussed the subject of a common ratio in the coinage of gold and silver, but no practical conclusion was reached. Delegates from several European countries gave little encouragement for the expectation of any effective aid from their governments in the effort to restore silver to its former place in the monetary circulation. The hope, however, seems to have been entertained that further deliberation and a consideration of the inevitable complications and disturbances to commercial exchanges between Asiatic countries and the western world to be feared from the exclusion of silver from coinage will enlist the co-operation of those nations in this, possibly the final effort, to retain silver conjointly with gold as a measure of values. In view, however, of the failure of the Conference to agree upon any practical measure, and while awaiting its future action, it is a question for our serious and early consideration whether it is not desirable to suspend the further coinage of silver until by international agreement and effective legislation the unlimited coinage of silver and gold at a common fixed ratio shall have been authorized by the principal commercial nations of Europe and America.

"The United States has done its part toward retaining silver as a monetary agent in measuring and exchanging values. For three years, it has appropriated to coinage purposes one third of the world's production of silver, and maintained its average bullion price nearly to the average of 1878. As was said in my first report: 'Should the \$650,000,000 of silver coin, now full legal-tender in Europe, be demonetized, the United States could not, single-handed among commercial nations, with no European co-operation or allies, sustain the value of silver from the inevitable fall.' With that danger menacing us, we can not, without serious embarrassment, continue such coinage, unless other commercial nations will agree upon the general use of silver as well as gold. But should such international agreement be secured, neither our ratio of comparative valuation nor even one based upon the present exchangeable value of gold and silver will probably be adopted. The ratio of fifteen and a half to one, already approved and in use among the nations composing the Latin Union, would doubtless be chosen. This would, if the coinage of silver as well as gold at all the mints of the world were made free, as bi-metalism implies, cause the voluntary withdrawal from circulation of the standard dollars and their recoinage. In such case, the further coinage of silver dollars of the present weight, unless needed for circulation, is a useless expenditure."

How fully the value of having such a country as the United States holding up the market for silver under the present policy of the government is understood abroad is indicated by the urgency with which the advice is given by German economists to their imperial government to get rid of its old stocks of silver at the current rates. Until now, the large imports of gold have prevented our being swamped with silver; but if our imports of that precious metal cease, and we were again to send gold abroad, as we have done in former years, we should, with a continued coinage of silver at the present rate, soon be left with silver alone. Even Mr.

BURCHARD is not prepared to face that contingency, and we trust that Congress will speedily put a stop to the present unreasonable effort to force two millions per month of "legal-tender" silver dollars upon the unwilling country. According to the rumors which appear pretty well formed upon fact, the Secretary of the Treasury will throw the weight of his opinion into the scales, indorsing the recommendations of Mr. BURCHARD.

THE TARIFF CONVENTION.

The Tariff Convention, the advent of which was heralded with so much clamor, was held in this city on the 29th and 30th ult. For a long time, the country has been entertained with promises of what this gathering would accomplish, and there was much bustle in securing "a fairly representative body" of delegates of the various shipping, manufacturing, mining, agricultural, and commercial interests, to give expression to their views concerning our present tariff. We may say at the beginning that, so far as the agricultural and commercial interests were concerned, the latter were practically ruled out; while, so far as the former were affected, only those branches were represented which have every inducement to adhere tenaciously to the present status of the tariff. The mining industry of our country sent a small number of delegates, who were supposed to be authorized to speak for the proprietors of iron, coal, and precious metal mines, the far West having comparatively a very small representation. On the other hand, the iron and steel men of Pennsylvania and other States were out in full force, and other manufacturing interests, like the copper and brass trade, appeared in strong delegations.

The movement was intended to enlist the co-operation of all branches of trade and manufactures which desired that any action taken by Congress in a revision of the tariff be so regulated that American industries be fully and adequately protected against foreign producers. The broad foundation upon which rest the hopes of protectionists of all shades is the undoubted popularity in this country of the principle that, by levying duties upon imports of manufactures entering our ports from abroad, we aid the development and maintain the pre-eminence of our own industries. Whatever may be the efforts of free-traders to convince the body of our people, it is a fact that on a tariff issue their party would be overwhelmingly defeated. The growing industrial development of the South and West is pushing those sections to the same conviction; and if any change of opinion on the subject may be expected, it is rather in the direction of a gain of free-trade views among Eastern manufacturers. Their rivals in the West, and at a future period possibly in the South, are not only supplying the increased demand due to growth of population in those sections, but they have in the past, and will in the future, make serious inroads into the business of Eastern producers in those sections. In many instances, Western and Southern manufacturers have raw materials and market both near at hand, and the cost of freight of the former to the East, and of the finished product from the East to the West, is practically clear profit. To this it must be added that the cost of living of the laborers is smaller in the West and South, and the price of labor is therefore lower. With growing competition in the West and South, and a sharp struggle for Eastern business, it is not surprising that some of our manufacturers along the Atlantic coast are beginning to look to foreign markets, and that they will soon urge a reduction of the tariff on raw materials, or call for a reasonable drawback system on the export of goods manufactured from imported raw materials.

Public opinion, while indorsing the general principle of protection, is, however, strongly adverse to the continuance of the present system. The great good which the Tariff Convention could have done was to outline in what manner and to what extent a revision could be carried out, with due regard to the many and complex interests involved. This, we regret to say, was not done, the convention apparently being in the hands of a body of men who enjoy exceptional and undue protection, and who wish to attempt to bully all manufacturing interests in the country into helping them to uphold the present state of affairs, so far as it is convenient to them. Noting that the tactics adopted by free-traders to make heavy attacks upon isolated or particularly highly-protected industries have been in a measure successful, they decided to forestall any further efforts in that direction by a "revision" of the tariff. The plan hinted at by them during the recent convention is not calculated to do them or the cause much good.

The reforms proposed may be grouped under three distinct heads: the one being a reduction of the internal taxes; the second, the appointment of a commission to revise the tariff; and the third, encouragement to American shipping. The convention recommended the abolition of all internal taxes except those on malt liquors, spirituous liquors, and tobacco, a measure which ought to meet with the approval of the country. The urgency with which the convention took up this question is explained by the desire to make the government more dependent upon the income derived from customs duties. The principal issue presented was

that concerning a revision of the tariff; and during the course of the four meetings held, a number of prolix "papers" were read, while others submitted were referred for publication. From the tenor of these contributions, and from the drift of what little discussion there was, the purposes of the majority of the active members were pretty clearly defined. The great mass of evidence presented was intended to prove how much good protection had done not alone to certain interests, but to the country at large. That theme has been harped upon by the same class of men for many years, and presents nothing new. The only point worth knowing in connection with it is, whether or not the good derived by the people at large has been in proportion to the undoubted benefits conferred on the few. Unless the representatives of such trades can prove that they have not been the principal gainers, and that any change would cause losses to the country in general, they will have to be content to see the duties reduced. No attempt to furnish such evidence has been made, the policy adopted being strictly aggressive. The attacks were chiefly directed against abuses which have grown out of the present system, against cases of evident injury done to American industries by a strictly legal interpretation of the law; and it appears that the only thing demanded from Congress is, that these wrongs be righted. Practically, it is asked that a commission of business men be appointed to inquire into the present state of our manufacturing and other industries, for the purpose of gathering and submitting facts upon which a revision of the tariff may be based. We suppose that it is before this commission that the facts are to be given which are to convince the country that the present duties ought to be disturbed as little as possible, and that only where they are not high enough they should be changed. It was not expected that the Tariff Convention would frame new tariff laws in a day or two; but it was reasonable to believe that its leading members would be shrewd enough to recognize the fact that the majority of the business men of the United States do not propose to allow the present exorbitant rates to be perpetuated. They may believe that it is time enough to make concessions when there is no hope of avoiding them, and that their chances of keeping a goodly share of what they now have are increased by vehemently insisting upon all of it. By usurping the leadership, they probably expect to shape and control the policy of the party. In this they will be mistaken, as they underrate the popularity of a cause in which they are only prominent as a small but noisy faction. Their tactics in the recent convention have not been such as to inspire the majority with confidence in them as leaders. Backed by public opinion, the majority of protectionists will not be much impressed by the argument that any excessive duty must receive the sanction and support of all for the sake of "harmony." To what lengths some of those who were prominent in the convention will go to secure "help" is evidenced by the manner in which bait was thrown out to our Western mining industries by insisting upon the continuance of compulsory coinage of silver dollars for the purpose of "protecting" the silver mining industry.

Much, of course, will depend upon the composition of the commission, and in what spirit its report will be received by Congress; and the very fact that ultra-protectionists are now clamoring for it, suggests that they must have good grounds to hope much from it. Still the proposal that an inquiry into the present state of our industries, as affected by the tariff, ought to be made by business men, and not by politicians, is a good one. Experience with legislative committees sitting on such matters, in France, for instance, has fully shown how easily they can be led into making huge blunders, and the qualifications of an average congressman for such work do not inspire the hope that the result would be much better here.

On the whole, the Tariff Convention has been a great disappointment, and it has only done good in showing that a certain class of our manufacturers proposes to take a stand on the tariff question which will alienate from it the body of thoughtful business men.

MAN'S ORIGIN AND DESTINY.*

Sixteen years ago, Professor LESLEY delivered at the Lowell Institute the lectures which form the substance of this book. In 1867, the first edition of the book was published, containing eleven lectures. The present edition contains ten of these lectures (the eleventh having been expunged) and six new ones on the Destiny of Man, the former series having been devoted especially to the origin and history of the race. It is a fascinating if not a satisfactory book. The lapse of time since the first part of it was written has rendered that part less complete as a report of the state of scientific inquiry, while it has perhaps weakened the plausibility of some of the author's peculiar theories. On the other hand, there are excellencies here which time can not diminish—eloquence, rising into poetry; a bewildering affluence of learning; clearness of

* MAN'S ORIGIN AND DESTINY, *Sketched from the Platform of the Physical Sciences.* By J. P. LESLEY. BOSTON: George H. Ellis. 1881. 8vo, pp. 442. (Indexed.)

statement, and ingenuity of argument. Professor LESLEY's force of style so great that he seems often to be triumphantly proving what he is only audaciously assuming. This is a striking and unexpected peculiarity of the lectures: they exhibit to us in the attitude of a daring and dogmatic propounder of theories the very man whose work in his special professional field has been notably characterized by caution, candor, and a certain disinclination to adopt theories. We know of nothing which Professor LESLEY has advanced in geology as revolutionary and as unqualified as his entire archaeological argument as to architecture and language in this volume. "Architecture began," he says, "in attempts to build pyramids like Ararat, and to place upon their summits shrines of worship and houses of God symbolical of the ark." The form of the Egyptian proylon indicates to his eyes a mountain with an ark on it; and he thinks it, with kindred forms in other lands, was invented by ancient priesthoods, to commemorate or set forth some great historic fact like NOAH's flood. This slender foundation is made to bear afterward a vast structure of "Arkite" illustration and interpretation, comprising even the forms of the alphabet. We almost forget to inquire, as the brilliant theorist spreads before us both diagrams and epigrams, what basis there is for his very first assumption. A careful examination of the flood-legends of the ancient world has, we believe, failed to show that the Egyptians possessed the tradition in any form. Their myths, connected with the Nile and the ocean, are not true deluge-stories, and require neither ark nor Ararat. DIODORUS, writing about 100 B.C., says the Egyptians, knowing that in other countries a flood was believed in, claimed that their own had been exempt from it. His testimony is not conclusive; but it is not contradicted; and the assumption, in the face of it, that Egyptian architecture symbolizes a deluge, seems to lack probability. Moreover, we think there are simpler and sufficient explanations of the architectural forms.

We cite this example as a specimen of the least conservative parts of the book. In fact, this character belongs to the parts that deal with language and the history of culture, and to the prophecies of social, political, financial, and religious progress. The moment Professor LESLEY touches on the physical sciences, he begins to be more guarded and reserved. He gives no definite estimate of the antiquity of man; he is not quite sure as to Darwinism, though inclined to accept the origin of species by descent; yet he can not believe that the human races belong to one species; in short, on those matters concerning which his opinion would be most authoritative, his conclusions are least positive. But he is quite sure that the story of the children of Israel is not historical, and that the dynasties of MANETHO are trustworthy. In like manner, his prophecies of physical progress are extremely moderate, consisting rather in the gradual perfection of the sciences and processes which we now have than in the revelation of startling novelties. It is on finance, religion, politics, and legislation that he permits to his imagination free flight. We can not undertake to follow his wide circuits, even so far as to express our dissent from his views and hopes. They certainly do not necessarily follow from the present state of the physical sciences. In this respect, the book might better be entitled, "From the Stand-point of Professor LESLEY." Yet we need not say that, even when most eccentric and extreme, he is profoundly interesting and stimulating. He flashes with a keen perception and glows with a noble enthusiasm. These qualities, we think, rather than the power of continued argument or the comprehensiveness of general survey, will cause the book to be read and prized. It is delightful to "dip into," but hard to follow as a whole. Its best passages are digressions.

We notice on page 139 an allusion to gun-cotton as made by dipping cotton in sulphuric acid—a slip of the pen which should not have been permitted to survive a second edition. *

THE PENNSYLVANIA SURVEY REPORTS.*

Another batch of the neat volumes of the Pennsylvania reports lies before us, to be noticed as we can find time to glance over the pages which we would fain linger to study with care.

The interest of Professor WHITE's report on Erie and Crawford counties is mainly confined to two subjects: First, the light it throws upon the area and occurrence of our mineral oil and gas deposits; and second, the glacial history of Lake Erie, and its drainage system. The former of these is economical, and the latter theoretical and speculative in character.

In his introductory letter, Professor LESLEY makes the following pertinent remarks on the petroleum question:

"So many wells have been sunk in Crawford and Erie counties, from none of which large quantities of oil have been obtained, that the whole region is looked upon as lying outside of the oil regions; the oil sands of Venango, Butler,

Clarion, and Warren being supposed to exist only in the southeastern part of Clearfield, and to fine out and disappear in Erie County.

"Mr. White's survey seems to show that this is not, strictly speaking, the fact. The sands are certainly not coarse, thick, persistent, largely oil-producing deposits as in the oil 'belts' farther east and south. But they exist, nevertheless, as deposits, in regular place and order among the rocks, and spread beneath the whole of Crawford and half of Erie County. The upper sands are unimportant; but the lower or *Third Sand* not only crops out in a line across the region, but is everywhere charged with a sufficient quantity of petroleum to produce oil-springs and pools of asphalt upon the surface of the ground.

"The time is sure to come when that vast production of petroleum to which the markets of the world have grown accustomed; on which large refining establishments are founded; on which railroad companies, pipe-line companies, and ship-owners build up fortunes; on which, in a word, Pennsylvania prides herself as the source of light-fuel to the civilized world—will dwindle to moderate dimensions and take its place among the marvels of a past history. Nothing in the shape of a natural history or geological fact can be more clearly demonstrated than this statement. Although the date of the decline can not be predicted, and may be postponed for ten or twenty or thirty years, the day is sure to come when our oil-fields will be exhausted of their enormous ancient accumulations, and there will only remain what may be called the leavings and drainings.

"The fatal day may be put still further off by the discovery of oil-producing belts underlying Forest, Elk, Cameron, Clearfield, Jefferson, and Indiana counties. But as yet we have no very reliable reason for expecting this, and some good reasons for not expecting it; at least, so far as the Venango sands are concerned. The Bradford shales may be productive anywhere, for all we know, but at a great depth; and great depth seems hostile to petroleum.

"There will come a time when the old oil-fields will be unoccupied, and 'dry country' receive attention—attention impossible so long as the great flow lasts. The production of oil will then become a systematic and quiet industry, spread over wide areas, and regulated on a different system from that in vogue. When that time comes, Crawford and Erie counties will be re-tested; and small quantities of petroleum will probably be obtained at various places from Venango sands which are now considered worthless.

"The value of this report will then be recognized, as offering data for determining the areas and depth of the oil-sands throughout the district. The mistake of drilling at and beneath the outcrop of the *Third Sand* to strike the Venango sands can not again be made by intelligent readers of this report.

"The cost of the survey has been justified merely by one result (setting aside the rest), namely, the determination by sufficient evidence that the *Third Oil Sand* of Venango County is the *Quarry-rock* of Erie County, and that this deposit, in crossing Erie County, changes its character from a muddy sandstone in the western townships, to a coarse gravel rock east of Le Boeuf Creek, becoming the *Panama Conglomerate* in the State of New York, everywhere charged with a peculiar group of fossil shells and sea-weed; and with petroleum which has evidently resulted from their decomposition."

Evidently Professor LESLEY does not altogether agree with Mr. WHITE's stratigraphical determination and nomenclature. It seems to be left uncertain whether the Venango group, containing the oil-sands, is of Chemung or Catskill age, or of a new age coming between them; but this matter is not seriously important.

On the subject of glacial erosion, Professor LESLEY has taken the step, somewhat unusual for him, of modifying Mr. WHITE's report by removing from it the expression of what he considers ultra views of the power of moving ice to excavate valleys. The facts observed undoubtedly indicate extensive glacial action, "such as the crushing up of small patches of coal, and even of quarry rock, on high summits by the Canadian ice, and their subsequent concealment under many feet of moraine matter, even at a height of more than 1700 feet above the present level of the sea." The different directions taken by the moving glacier can be traced, and ancient valleys have been found buried under several hundred feet of glacial drift deposits. Mr. CARLL has given great attention to this subject in his Report I., in which he asserts that the present valley system was not formed, but only slightly modified by the attrition of the ice; but it was, on the other hand, topographically changed by the dumping of moraine matter into the channels, thus forming dams, lakes, and new outlets cut by water and not by ice. In this way he thinks the drainage of French Creek and Alleghany River, which was formerly north into the basin of Lake Erie, was utterly cut off and reversed, the water now flowing in the other direction. Mr. WHITE has a theory which attributes to ice a greater power of erosion than Professor LESLEY can admit. He is disposed to consider most of the thorough-cut valleys of his district as the work of a moving glacier.

In an appendix to the volume before us is given a paper by Dr. J. W. SPENCER, Professor of Geology in King's College, Windsor, Nova Scotia, which describes the discovery of the pre-glacial outlet of the Lake Erie basin, showing that a submerged valley-bed crosses Lake Erie transversely, and was formerly the channel for the combined streams of the Pennsylvania highlands; flowing northward and turning at a right angle to enter Lake Ontario near Toronto. The filling of this river channel with glacial drift caused the accumulation of water in the basin of Lake Erie and brought Niagara Falls into existence. Dr. SPENCER's paper gives a very clear account of the evidence and conclusions in the case, and, taken together with Professor LESLEY's vigorous interjectory comments, constitutes scientific reading of a lively variety. We quote Professor LESLEY's statement of his own views on the subject of erosion:

"With regard to Dr. SPENCER's theory of the river erosion of Lake Ontario and Lake Erie, I have only to say, that it is too narrow to satisfy all the demands made upon it. For a number of years past, I have been urging upon geologists, especially those addicted to glacial hypotheses of erosion, the strict analogy existing between the submerged valleys of Lakes Michigan, Huron, and Erie, and the whole series of *dry* Appalachian 'Valleys of VIII,' stretching from the Hudson River to Alabama; also, of Green Bay, Lake Ontario, and Lake Champlain with all the *dry* 'Valleys of II. and III.' One single law of topography governs the erosion of them all, without exception, whether at present traversed by small streams or great rivers, or occupied by sheets of water; the only agency or method of erosion common to all being that by rain-water; not in the form

* SECOND GEOLOGICAL SURVEY OF PENNSYLVANIA: Report of Progress, 1879. QQQQ. THE GEOLOGY OF ERIE AND CRAWFORD COUNTIES. By I. C. WHITE. With two Colored Geological County Maps; 107 Vertical Sections; Tables of Barometric Heights in each Township; an Index of Names of Persons and Places; and Notes on the Place of the Sharon Conglomerate in the Paleozoic Series.—DISCOVERY OF THE PRE-GLACIAL OUTLET OF LAKE ERIE. By J. W. SPENCER, Ph.D. With two Maps of the Lake Region. Harrisburg, 1881. 8vo, 406 pages.

of a great river, because many of them neither are now nor ever have been great water-ways.

"As a consequence of their absolute similarity of geological position, general form, and common genesis, their *age* must be one and the same. The sea has had nothing to do with their production; for it has never permanently invaded some of them, nor even temporarily others. Ice has had nothing to do with their production; for those in the glacial region differ in no respect from those nearest the Gulf of Mexico.

"I also, long ago, urged on theorists the necessity for taking into account as a prime factor the underground solution of limestone strata, and the subsequent aqueous removal of the fallen *débris* of overlying strata, the roofings of caverns, and the steepness of cliffs. In regard to this I have pointed to the horizontal Niagara limestone which floors the three middle lakes, and the Trenton limestone which floors the two lower lakes and Green and Georgian bays. A curious present illustration of what has been the state of things is offered for the examination of geologists by the peninsula of Yucatan, on the surface of which are no streams of water, the drainage of the whole country being underground.

"It is needless to repeat the oft-told demonstration; but it is well, now that Dr. SPENCER has disembarassed us of the chief difficulty of our last pre-recent water system of the north, to remind the admirers of his great discovery that his new-found ancient Grand River did its work not only with the constant assistance, from the beginning to the end, of millions of smaller rivers, creeks, runs, and rills, but also in such subordination to them as a general acknowledges to his troops, or a contractor to his army of navvies.

"No great river can be looked upon as a principal eroding agent. *Rain-water erodes in the direct ratio of the number of its threads; and in the inverse ratio of the volume of their united floods.* The rill, the cascade, the rivulet, have the highest proportional erosive power. Small rivers act vigorously so long as they descend steep slopes, but lose their power gradually as they enter plains. Large rivers are *constructive* rather than *destructive*. Lakes with outlets to the ocean are merely large rivers of great breadth with exceedingly sluggish currents and an erosion-force reduced to a minimum. The oceans are merely exaggerated and connected lakes traversed by still larger currents, with the minimum erosive power reduced to nearly zero.

"Therefore our Great Lake basins, although traversed by a great river, were not excavated by it; but by the universal vertical descent of rain-water upon their areas, lowering their surfaces gradually and nearly equally at all points, while at the same time mining it throughout the whole extent of its limestone under-floor; the material being removed in the ordinary way, by rills, rivulets, and the great river, to the sea."

We take leave to doubt the accuracy of the law above stated in italics. It seems to us that the velocity and grade of streams are more directly conditions of their erosive force than their volume. But there is force in the general conclusion, and ingenuity in the hypothesis of subterranean erosion.

LETTERS FROM THE WEST.—I.

Special Correspondence of the Engineering and Mining Journal.

ROCKY MOUNTAIN RAILROADS.

Only two days distant from Atlantic tide-water, and what a wealth of mineral and agricultural resources we have passed! On the Alleghanies, and their eastern and western slopes, iron furnaces and shops, coal mines and coke-ovens were elements in every landscape; while nature has been so prolific of her gifts farther West that fields of coal of undetermined extent can be seen cropping out in many a ravine underlying the rich fields of corn—coal which may some day serve a beneficial political purpose; for by preventing the devotion of the people of the West to exclusively agricultural pursuits, it may check the growth of that sectional spirit which is one of the greatest national dangers ahead.

And now we are slowly ascending the plains from the Missouri to the Rocky Mountains, passing from the zone of agricultural into that of grazing lands, if not over mineral treasures over recent rocks which have preserved the fossil remains of the immediate progenitors of existing species in such abundance and in such excellent preservation that the paleontologist esteems them of greater interest than the most highly mineralized strata of the mountain.

While thus without effort rolling on and up, one naturally reverts to the day, still so near that it seems but yesterday, when the stage and the emigrant team sprinkled the vast territory between the Missouri and the Pacific with a few reckless miners and enthusiastic zealots; who, if ever men felt the awe of being alone with nature, must have experienced that intimate sympathy with the earth and skies as their only companions in the presence of God, which we in our artificial life can not realize. Once having entered into fellowship with nature, the fellowship of man evidently becomes distasteful, and therefore the pioneer farmer and ranch-man shrinks away from the advancing stream of population, and the prospector wanders solitary—unless for the company of his donkey—over the mountains from British Columbia into Sonora, in search, he thinks, of wealth, but really because he shuns the restraints of human intercourse. It is strange how readily civilized man, when placed under conditions favorable to retrogression, relapses toward the savage state! But as the railroad has driven away the buffalo and the red man, so will it soon extirpate these wanderers of the mountains; for, if the present rate of railroad construction be maintained, in a few years every pass of the Rocky Mountains and the Sierra Nevada will be occupied by the iron rails.

Not only are the old trans-continental railroad schemes, which have been competing for public favor and public lands during the last fifteen years, pushing toward fruition, but several of the Eastern lines terminating on the Missouri seem ambitious to lay their tracks up to and over the mountains; and the old lines which have heretofore worked in harmony and agreed to share the earnings from through freight are bent on finding independent outlets to the East and to the West.

This intense activity, no matter whether it be the result of personal ambition, corporate bravado, or a real need, or whether it will repay the investor or not, can not but influence most advantageously the interests of the miner and the metallurgist. Regions hitherto practically inaccessible are being brought through railroad communication within range of systematic mining, as distinguished from mere prospect mining; and ores too poor or too refractory to be benefited in the localities where found can, through railroad transportation, be carried to more favorable localities for metallurgical treatment. Thanks, therefore, to the inter-

vention of the iron horse, the miner will be taken to the ores, and the ores and the fuel to reduce them will be brought together; and thus during the next decade will take place an extension of mining and improvements and modifications of metallurgical processes, due to cheapening of fuel and mixture of ores, which may result in progress greater than that made during even the past decade, extraordinary as that has been.

In 1870, the Union and Central Pacific roads, having met at Ogden in May of the previous year, were already beginning to demonstrate the influence which the railroad was about to exert in peopling the mountains and unearthing their treasure. Denver and Salt Lake City were that year bound to the main line by branches. The Kansas Pacific Railroad that year formed a second line between the Missouri and the mountains, and the Denver Pacific connected Denver with Golden. The Virginia & Truckee Railroad was opened between Carson City and Virginia City, but did not make connection with Reno on the Central Pacific till 1873. The Denver & Rio Grande existed only on paper and in the brain of General Palmer and his friends. Ground was not broken on that dauntless enterprise until March of the following year. The Atchison, Topeka & Santa Fé was a mere agricultural road dependent on a fat land-grant, whose promoters may have contemplated extending it westward out of the valley of the Arkansas, but who could never have dreamed of girdling the mountain and branching westward and southwestward and recklessly rushing into Mexico, with no guarantee for repayment but the traffic they themselves would create. General Scott and the Southern Construction Company were concocting a vast scheme of opposition to the united roads in a route (conceived before the war) through Texas, New Mexico, Arizona, and Lower Colorado to San Diego; but instead of building, they were trying to secure concessions and a land-grant from Congress, and had not in 1870 obtained even an act of incorporation. In the North, somewhat more progress had been made toward the realization of a trans-continental road; but the Northern Pacific had not passed beyond the limits of civilization, and the Canadian Pacific was still in the fertile fancy of Sir John Macdonald. Altogether, there were at the end of 1870 only 3000 miles subsidiary to mining, the important ones being:

| | |
|---|--------------|
| Main Line of Union Pacific & Central Pacific..... | 1,866 miles. |
| Kansas Pacific..... | 689 " |
| Denver Pacific..... | 106 " |
| Colorado Central..... | 15 " |
| Utah Southern..... | 36 " |
| Virginia & Truckee..... | 21 " |
| | 2,733 miles. |

Although the financial crash of 1873 paralyzed all railroad enterprises, even it could not altogether arrest the growth of existing Western roads; and with the revival of trade has sprung up what seems so like a frenzy for railroad building that only ultimate success can justify it.

When we look at the railroad map now, only eleven years after the date of the above enumeration, we find that—

The Union Pacific has now another line between Cheyenne and Denver through the foot-hills, to give egress to the mineral of Boulder County; and has continued the old Colorado Central from Golden up Clear Creek Cañon, and thence by two branches to Central City and Georgetown, thus bringing within the circle of rapid communication and transport the old and permanent mines of Gilpin and Clear Creek counties. And the same great corporation has run a line from Denver (the Denver, South Park & Pacific), skirting the edge of the South Park to Buena Vista, where it branches—the northern branch running through Leadville to the Eagle River District, the western branch crossing the continental divide into the valley of the Gunnison. There it throws out feeders to Lake City and Ouray and the anthracite field near Ruby City, and to every point to which the miner wishes to go, and from which he promises to send back mineral, apparently with as little heed to cost as if the road were a wagon-trail over the prairies, instead of a railed tramway, laid on a graded bed, which must be built on terraces, piled up against the sides of steep cañons, or tunneled out of the heart of the mountain.

But out of rivalry and in the race for traffic, the Union Pacific is obliged to compete for the trade of this vast but empty region (for the Utes have just been removed and the prospector is only going in) by the Denver & Rio Grande—the narrow-gauge road whose first sod was turned at Denver in March, 1871—whose original programme of running southward even into Mexico is being manfully carried out, but which is diverted like all these roads through the demands of off-lying districts from the direct fulfillment of its original plan. During these ten years, it has, however, built 900 miles of good road, most of it through cañons and over passes which might well have been deemed foolish to encumber at such great expense with an iron road, considering how scanty is the population that inhabits them. But the miner is not to be compared with ordinary mortals in his taste for travel. The wealthy idler who travels to drive away *ennui* does not compass so many miles a year as the miner rushing from camp to camp at the call of every inflated rumor, and spending all his earnings between the gaming-table and the ticket-office.

The Denver & Rio Grande runs along the base of the mountains from Denver to El Morro and its coal-fields and coke-ovens. It passes through Pueblo, which, when this railroad was born, was a very ailing infant of a town, but has been nourished by it into healthy existence; and at Cucharas the main line leaves the plains and pursues its course over the Veta Pass, 9300 feet above the sea, and then southward over the elevated mesa in which the Rio Grande has cut its channel, descending into the valley of that river at Embuda, and along its banks to Española, a twenty miles from Santa Fé. But on its way thither, it throws off westward at Antonita, a branch that almost ascends into the clouds at Silverton and in the San Juan country, and by giving access to this most inhospitable region will enable its mines to fulfill the promise they gave ten years ago, when San Juan was the goal which every miner strove to reach and so many sacrificed all in attaining, only to find cold and snow and penury.

From Pueblo another important feeder is thrown off, which ascends the Arkansas to Cañon City, where it taps the Cañon coal-field with its wonderful free-burning lignite, and then ascends through the Royal Gorge to Leadville, throwing off a branch in competition with the Denver, South Park & Pacific, through, rather than across, the continental divide into the Gunnison country. From Leadville onward toward Kokomo, Breckenridge, and Lincoln districts, as well as toward Red Cliff, the two roads are running parallel lines with funds which it would

appear might be better applied to distinct rather than competing enterprises—in laying rails in an opposite rather than in the same direction. This district seems to be more within the province of the Union Pacific than the Denver & Rio Grande; for the former is carrying its Georgetown branch, via Bakerville, westward, and is starting a branch from Boulder, via Caribou, to connect with the northern extension of the Denver & Southern Pacific at Hot Sulphur Springs, whereby this whole section of Northeastern Colorado will be covered with a network of lines, reaching almost every mining camp of this elevated region which has heretofore languished by reason of cold and inaccessibility. It would appear to common sense most reasonable that the Denver & Rio Grande should devote its means and energies to conferring like benefit on the southeastern section of the State, more especially as every mile laid there assists the efforts of this narrow gauge to win a share of the freight of the great valley from the Union Pacific—an aim that might be supposed enough to occupy the energies of any ordinary corporation. But an ordinary corporation it is not. Before another year expires, Salt Lake City will, through this channel, have another outlet to Denver and the East. During the past summer, it laid a track through a pass of the Wahsatch Mountains from Pravo, on Utah Lake, to the north fork of the Price River, and graded thence to Green River, leaving not more than another summer's work between this point and the end of its Gunnison branch. And before this year terminates, Pravo will be united to Salt Lake City by a second line of rails. Nor does the Denver & Rio Grande propose to content itself with the through traffic of the great valley only. It has already quietly and cleverly occupied several traffic points of strategic importance which nothing but a dangerous sense of security on the part of the Union Pacific would have allowed them to leave open to the enemy.

J. D., JR.
UNION PACIFIC RAILROAD, October, 1881.

DOLOMITE FOR THE MANUFACTURE OF MAGNESIA.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Let me, as a constant reader of your valuable journal, call your attention to the practically inexhaustible deposits of dolomitic stone within forty miles of this city, on the Hudson. The one from which came the subject of the inclosed analytical report contains over 1,700,000 cubic yards, above high-water mark, of the material, which, if it has not too much silica, would appear to be suitable for treatment to extract *magnesia*. Yours truly, EDWARD SWAIN.

NEW YORK, Dec. 2, 1881.

The following is the analysis referred to by our correspondent:

| | | |
|---------------------------|-------|-----------|
| Lime | 31.10 | per cent. |
| Magnesia | 17.09 | " |
| Carbonic acid | 43.45 | " |
| Silica | 5.81 | " |
| Alumina and oxide of iron | 1.53 | " |
| Alkaline chlorides | .26 | " |
| Organic matter | .16 | " |
| Moisture | .09 | " |
| Sulphuric acid, | | traces. |
| Phosphoric acid, | | " |

[We print the above because it appears that our remarks, in a recent issue, concerning a suitable raw material for the manufacture of *magnesia* were not fully understood. We have in this country numerous deposits of *dolomite*, which, like the above, would be well fitted for the Scheibler process: but we do not know of any deposits of *magnesite* like that of the island of Euboea, an analysis of which we printed in our issue of November 26th, page 356. *Magnesite* is almost pure carbonate of *magnesia*, from which the *magnesia* can be obtained simply by calcination. It is with this material that silica is objectionable, because the whole of it goes into the refractory brick. With the Scheibler process applied to *magnesian limestone*, or *dolomite*, the silica remains behind, and theoretically would not cause any trouble whatever.—ED. E. AND M. J.]

THE BASIC BESSEMER PROCESS AT WITKOWITZ.*

By Franz Kapelwieser.

With reference to the products manufactured from ingot metal produced by the basic process, the experience at Witkowitz has been as follows: (1.) Boiler plates made from the basic material are at least equal to the best-known brands in quality. As compared with plates made of welded iron, the homogeneity of the new material, as well as its freedom from blow-holes, and the remarkable ease with which it is worked, whether hot or cold, is much approved. (2.) Plates to the number of many thousands have been delivered to a German tube-rolling mill for the purpose of the manufacture of welded locomotive tubes, and have been proved equal to those made from the best Swedish material. I exhibit some specimens which show the excellence of the welding. These were manufactured in the tube-rolling mills of Messrs. S. Huldchinsky & Sons, of Gleiwitz (Prussian Silesia), to whom we regularly supply large quantities of our basic iron, and by whom our material is held in the highest esteem. Especially remarkable are those tests in which the absolute tensile strength at the line of weld is shown by the introduction into the cold tube of a tube-expander, so as to produce, without splitting the weld, an expansion from 0.36 inch to 0.68 inch on 1.92 inch of original diameter, equal to an extension of 20 to 36 per cent of the material in the periphery. The tubes can be flanged with perfect ease, whether hot or cold, and bent over without cracking. All these points are illustrated by the samples before you. The ease with which dephosphorized ingot iron can be welded is proved by the fact that the plate-shearings are regularly piled and rolled into rods forming an excellent rivet iron. The plate scrap when piled with mill bars and rolled into plates also yields iron (*schweiseseisen*) plates, which in tensile strength and elongation are superior to the best plates of this kind that are manufactured. Thin sheets from our dephosphorized ingot iron are employed for the manufacture of stamped ware. The softest kinds of dephosphorized ingot iron approach to the absolute maximum of conductivity of pure iron, the almost total absence of the metalloids minimizing the resistance

offered by wires of this material to the electric current. The data that have been furnished to me show that the conductivity of the basic ingot iron exceeds that of Swedish iron, since the former gave 14 ohms, the latter only 12 and 13 ohms. The following series of tests gives an idea of the raw material used and the product made from it, No. 1 being of a moderately hard steel; No. 2 of steel for plates, axles, angle iron, and rivets; and No. 3 of the softest ingot iron for telegraph wire and stamped ware:

| MECHANICAL TESTS. | | | | | | |
|---|------------------|--|------------------|--|------------------|--|
| | 1. | | 2. | | 3. | |
| Tensile strength in lbs. per square inch. | 83,068 to 89,753 | | 64,008 to 71,120 | | 51,206 to 55,474 | |
| Contraction per cent. | 51.5 to 36.9 | | 64 to 55 | | 77 to 72 | |
| Elongation on 100.... | 20 to 20.5 | | 25 to 20 | | 37 to 33 | |

| CHEMICAL COMPOSITION OF STEEL. | | | | | | |
|--------------------------------|--------|------|--------|------|--------|-------|
| | No. 1. | | No. 2. | | No. 3. | |
| Carbon..... | 0.45 | 0.19 | 0.06 | 0.04 | 0.04 | 0.02 |
| Manganese..... | 0.34 | 0.30 | 0.06 | 0.06 | 0.04 | 0.03 |
| Silicon..... | trace | 0.00 | 0.00 | 0.20 | 0.20 | ..... |

| CHEMICAL COMPOSITION OF PIG USED. | | | | | | |
|-----------------------------------|------|------|------|-------|-------|-------|
| | 1. | | 2. | | 3. | |
| Silicon..... | 0.54 | 0.11 | 0.62 | 0.23 | 0.09 | 0.08 |
| Manganese..... | 1.00 | 1.16 | 1.38 | 0.06 | 0.20 | 0.09 |
| Phosphorus..... | 1.95 | 3.46 | 2.00 | ..... | ..... | ..... |

| RECARBURIZING ADDITIONS USED. | | | |
|-------------------------------|-----------|--------------------|------------------|
| | a. | b. | c. |
| | Spiegel. | Gray Bessemer pig. | Ferro-manganese. |
| | Per cent. | Per cent. | Per cent. |
| Silicon..... | 0.18 | 1.43 | ..... |
| Manganese..... | 13.80 | 2.51 | 7.3 |
| Phosphorus..... | 0.11 | 0.15 | ..... |

Of spiegel, 0.6 per cent was used; of Bessemer pig, 7.5 per cent is employed, instead of spiegel, for rail steel, when the charge contains over 1 per cent of manganese, 0.6 per cent being added in that case. Additions used in No. 2, 1 per cent of 50 per cent ferro-manganese.

| COMPOSITION OF SLAG. | | | | | |
|--------------------------|----------------------|-----------|----------------------|-----------|-----------|
| | 1. | | 2. | | |
| | Before the addition. | Per cent. | Before the addition. | Per cent. | Per cent. |
| Silica..... | 7.00 | 4.75 | Magnesia..... | 0.78 | 0.76 |
| Protoxide of iron..... | 17.44 | 18.04 | Phosphoric acid..... | 16.83 | 22.00 |
| Alumina..... | trace | trace | (Phosphorus.....) | 7.30 | [9.54] |
| Manganese protoxide..... | 3.33 | 4.70 | Sulphur..... | 0.72 | ..... |
| Lime..... | 53.32 | 50.06 | | | |

| CHEMICAL COMPOSITION OF INGOT IRON AFTER THE DISAPPEARANCE OF THE LINE OF THE SPECTRUM. | | | |
|---|-----------|--------------|------|
| | Per cent. | Per cent. | |
| Silicon..... | trace | Copper..... | 0.20 |
| Manganese..... | 0.18 | Sulphur..... | 0.09 |
| Phosphorus..... | 2.82 | Carbon..... | 0.16 |

In order to produce a sufficiently hot steel, we have a rule that the sum of the silicon and phosphorus in the pig should amount to at least 2½ per cent. I may mention, however, that pig-iron deviating very materially from the above type has been used successfully. With regard to the lining material, good results have been obtained with limestone as a raw material, as well as with dolomite. I am of opinion, however, that the lining material should contain only a small proportion of silica. The lining material at Witkowitz is made with limestone with from 1 to 1½ per cent of silica. As to the refractory material, the following may be added: The bricks which we use for lining our converters and making our bottoms consist mainly of lime with a little *magnesia*, and about 2½ to 3 per cent of silica. The basic bricks made by us are used in several steel-works in competition with bricks made by German and English makers, the good quality of our bricks securing them a preference. The bottoms made from these bricks last for thirty charges and over, if the tuyeres are changed after five or eight charges and fresh basic material is added around the tuyeres. For this object, the bottom is separated from the converter. The removal of the bottoms, the knocking out of the old tuyeres, the insertion of new ones, and the ramming of fresh material around them, occupy from one to three hours, so that the repaired bottom can be used after this short interval. The tuyeres used are siliceous, and last for from five to eight charges. We believe that when good basic tuyeres are made, this method of working, which we find already successful, will be preferred in other places to the methods hitherto employed. The complete renewal of the bottoms takes place on an average after they have undergone repairs four or five times. Six bottoms are sufficient for an uninterrupted run of 150 to 200 charges, or as many charges as can be ordinarily got out of two converters without changing the lining. It follows from this that for very large makes by the basic process four converters are necessary. It is found, as I have before mentioned, that the waste in the converting process is larger than in the acid process, varying from 15 to 17 per cent, the higher figure being obtained when a very soft high quality is sought for. The larger waste being in this case comparatively unimportant, it is the practice to use more lime than is actually necessary. For rail steel, less lime is used, and the waste is smaller, the after-blow being shorter. I mentioned before that we have, as a commencement, added to our old Bessemer plant two converters which have been built with a special regard to the peculiarities of the Thomas-Gilchrist process. These two converters, which constitute only the first half of the proposed additions, have been in operation since the spring of this year. The vessels are egg-shaped in form, and perfectly symmetrical, with the mouth at the apex when placed in a vertical position. Perpendicularly over the mouth is placed a movable chimney to carry off the products of combustion issuing from the converter. The plant is arranged so that the vessels can pour their contents on either side. It is known that by the action of the refractory basic slag the belly on which the metal rests in the inclined converter after the after-blow is continually getting narrower by the accumulation of slag, while the upper side of the converter opposite the belly undergoes a considerable amount of wear. By the alternate use of the two bellies, a greater durability of the lining is secured, while the throat remains perfectly clean. This arrangement has answered its purpose perfectly. In consequence of this peculiarity of construction, a double-acting steam-engine for turning the converters is used. The casting

* Abstract of a paper read before the Iron and Steel Institute.

arrangement is likewise peculiar. Each converter has a long casting-pit on each side of it, in the direction of its axis. On the edge of these pits run rails which connect the pits on opposite sides of the converters with each other. Instead of employing a center crane, the ladle, which is carried on a car, is brought into the position for receiving the steel by raising and lowering the track on which it runs. For this purpose a hydraulic piston is placed under the converter; the piston carries a cross-piece, on which rest the ends of the two tracks that converge from either casting-pit, but are not connected together. Each of these tracks is carried on strong girders for a distance of six meters from each side of the converter. Now if the ends of the track which are under the converter be raised by means of the piston, the other ends being supported on pivots at a distance of 6 meters from the converter, the track assumes an inclined position. Thus the car bearing the ladle is brought into position under the mouth of the converter by the movement upward of the car track when the converter is to be emptied. And as the sloping track is lowered, with the turning of the vessel, the ladle is not only lowered, but moves in a horizontal direction, so as to keep its position under the throat of the vessel till the emptying of the vessel is finished. The taking off and replacing of the changeable bottoms on the car standing over the hydraulic piston is also effected by the same arrangement, two of the wheels of the car resting at the same distance from the center on each movable track. On this track, running under the converters, special cars are run for receiving the slag poured out of the converter before the addition of the spiegel, and the slag is carried on them directly to the blast furnace to be used over again. The steel ladle is run backward and forward, the slag is removed, the ingot is stripped, and finally the change of bottoms is effected on the same track. A small ten horse-power locomotive is employed to do all this work. The new plant contains other peculiar arrangements and details, which I propose to pass over, as they do not meet any special peculiarity of the basic process. The slag produced in the basic process, of which I have given analyses above, is employed over again in the blast-furnaces, since we are thus enabled by means of the phosphorus present in it to raise the content of phosphorus in our pig-iron. The small amount of silica and high content of lime in the slag, as well as the iron and manganese oxides contained in it, indicate its value as a fluxing material.

I must here mention a circumstance which renders the production of the very softest qualities somewhat difficult and comparatively expensive. It is the unquiet casting of the softest qualities of ingot metal. The lively evolution of gas from the softest qualities, while cooling in the mold, causes at present, even with the most careful pouring, considerable loss in bad heads. This scrap, although it forms an excellent pure material for the Siemens-Martin process, nevertheless considerably enhances the loss in the manufacture of the softest qualities. Lately we have succeeded very well in overcoming this drawback to a considerable degree; but our experiments have not yet proceeded far enough to allow me to place them before you at present.

BERTHA ZINC ORE AND SPELTER.

Prof. F. P. Dunnington, of the University of Virginia, has addressed to Major Jed Hotchkiss, of the *Virginias*, a letter containing the following data of interest:

The zinc ore from the Bertha mine, Wythe County, which is worked by the Bertha Zinc Company, at Martin's Station, Pulaski County, is, in the main, a silicate of zinc. A pure white specimen of this ore was analyzed in this laboratory in 1873, by the late Dr. J. R. McD. Irby. It consists of—

| | |
|-----------------|-------|
| Silica..... | 25.95 |
| Zinc oxide..... | 67.88 |
| Water..... | 8.13 |
| | 99.96 |

The semi-bituminous coal of the Altoona mine is brought directly from the mine, by railroad, to the works at Martin's Station, and is there sifted. The zinc ore is crushed to a coarse powder and mixed with the dust, sifted from the coal, and then thrown into the retorts and distilled. The metal which is thus obtained is very pure, and by analysis gives the following composition in 100 parts:

| | |
|--------------------------|---------|
| Iron..... | .0140 |
| Carbon..... | .0580 |
| Silica..... | .0360 |
| Arsenic..... | .0001 |
| Lead..... | .0500 |
| Zinc, by difference..... | 99.8419 |

When this metal was re-cast into small bars, the carbon was largely removed, and then, in employing it in an analytical method for the estimation of iron by potassium permanganate, the solution and residue obtained from 10 grams of the zinc in sulphuric acid reacted, immediately only to an extent corresponding to .0014 gram of iron, and, on standing thirty minutes, to .0006 gram additional. Through the kindness of the Superintendent, Mr. T. Jones, a portion of the commercial zinc was redistilled, at the works, to determine whether or not it could thus be made of even higher purity. The metal thus obtained had the following composition in 100 parts:

| | |
|--------------------------|-----------------------|
| Iron..... | .010 |
| Carbon..... | trace, not determined |
| Silica..... | .006 |
| Arsenic..... | none |
| Lead..... | .035 |
| Zinc, by difference..... | 99.949 |

When this metal was re-cast and employed for the above analytical use, 10 grams of the zinc reacted to the extent of .0007 gram of iron, and, on standing thirty minutes, to .0002 gram additional. It therefore appears that the "pure spelter," as sold in commerce, is, after being re-cast, rendered sufficiently pure for use in determining iron by potassium permanganate, and that a redistillation of this metal diminishes to a very slight extent the minute amount of iron and lead which are present.

THE DISTRIBUTION OF ELEMENTS IN STEEL INGOTS.

At the meeting of the Iron and Steel Institute in London, Mr. G. J. Snelus gave some analyses made to test the question whether a redistribution of elements takes place during solidification of steel ingots, thus destroying their homogeneity. In order to give the elements every chance of redistributing themselves, Mr. Snelus had a large ingot 7 feet long and 19 by 19 inches cast in molding-sand; and so as to have sufficient impurities to look for, he added a portion of cinder-pig to an ordinary charge, by which the phosphorus and sulphur were somewhat increased. After the addition of spiegeleisen, the vessel was turned up and the blast sent through for nearly a minute, to insure thorough admixture. The ingot was then allowed to cool very gradually. He had two slices of the ingot cut off, one 21 inches from the top, and another 4 inches from the bottom. Drillings from each were then analyzed separately, with the following results:

| | | |
|----------------------|---------|---------|
| | Top. | Bottom. |
| Iron..... | 98.504 | 99.038 |
| Combined carbon..... | .760 | .350 |
| Silicon..... | trace | trace |
| Sulphur..... | .187 | .044 |
| Phosphorus..... | .191 | .044 |
| Manganese..... | .558 | .514 |
| | 100.000 | 99.900 |

In order that there might be no possibility of error, Mr. Parry had a second set of drillings, and, marking them A and B, sent half of each to Mr. Pattinson, while Mr. Ernest Burrows analyzed the other portions. The results were as follows:

| | | | | |
|-----------------------|------------|----------|------------|----------|
| | A. Top. | | B. Bottom. | |
| | Pattinson. | Burrows. | Pattinson. | Burrows. |
| Iron..... | 98.200 | 98.224 | 99.060 | 99.060 |
| Combined carbon..... | .620 | .660 | .370 | .370 |
| Graphitic carbon..... | .095 | ..... | .037 | ..... |
| Manganese..... | .694 | .696 | .535 | .468 |
| Copper..... | .004 | ..... | .004 | ..... |
| Silicon..... | .028 | trace | .024 | trace |
| Sulphur..... | .129 | .160 | .049 | .032 |
| Phosphorus..... | .163 | .142 | .063 | .052 |
| | 99.933 | 99.852 | 100.061 | 99.982 |

In order to trace this redistribution still further, borings were taken from each section along a diagonal line from one corner to the center, and numbered from 1 to 6 respectively, commencing from the outside edge. The results of these analyses are given below for carbon, sulphur, and phosphorus:

| | | | | | | | | |
|--------|----------|------|---------|-------|----------|------|---------|-------|
| | Top. | | | | Bottom. | | | |
| | C. Carb. | | Phosph. | | C. Carb. | | Phosph. | |
| 1..... | .44 | .032 | .044 | ..... | .44 | .048 | .060 | ..... |
| 2..... | .54 | .048 | .060 | ..... | .42 | .056 | .062 | ..... |
| 3..... | .57 | .080 | .086 | ..... | .41 | .048 | .054 | ..... |
| 4..... | .61 | .096 | .097 | ..... | .40 | .048 | .054 | ..... |
| 5..... | .68 | .120 | .111 | ..... | .38 | .048 | .058 | ..... |
| 6..... | .77 | .187 | .142 | ..... | .37 | .044 | .052 | ..... |

These results confirm the molecular interchange discovered by Mr. Stubbs in large ingots, and show that carbon, sulphur, and silicon become concentrated in those portions of the ingot which remain fluid the longest, leaving iron and manganese in excess in the portions from which they have liquidated. As there was then no doubt about this redistribution in very large ingots solidifying slowly, it became important to see how far the action affected ordinary plate and rail ingots. These were cast in ordinary cast-iron ingot molds, and therefore set much more rapidly than the large one. The plate steel ingot (made by the Siemens process, was, however, of large size, being 3 feet 6 inches long, 21 by 17 inches at the top, and 21 1/4 by 17 1/4 inches at bottom. It was a good solid ingot, as will be seen from the sections on the table. Slices as before were cut from the ingot 10 inches from the top and 4 inches from the bottom, and the analyses gave:

| | | |
|----------------------|--------|---------|
| | Top. | Bottom. |
| Iron..... | 99.324 | 99.356 |
| Combined carbon..... | .210 | .190 |
| Silicon..... | nil | nil |
| Sulphur..... | .056 | .044 |
| Phosphorus..... | .068 | .058 |
| Manganese..... | .342 | .360 |

An ordinary Bessemer rail ingot, 4 feet long, by 11 1/2 inches at top and 18 inches at bottom, was sliced 12 inches from top and 3 1/2 inches from the bottom. These gave the following analyses:

| | | |
|----------------------|---------|---------|
| | Top. | Bottom. |
| Iron..... | 98.723 | 98.759 |
| Combined carbon..... | .420 | .420 |
| Silicon..... | trace | trace |
| Sulphur..... | .046 | .039 |
| Phosphorus..... | .056 | .044 |
| Manganese..... | .755 | .738 |
| | 100.000 | 100.000 |

The results in these cases are so nearly alike (each of the comparative determinations being nearly within the limits of errors of observation) that few chemists would assert positively that there was any real practical difference in the steel at the two points; and yet it is remarkable that, looking at the results as a whole, the probability of redistribution having taken place to an extremely small extent is possible. The differences, however, are so slight that they can not seriously affect the quality of the steel; and as the samples were taken from points most likely to yield divergent results, it may fairly be assumed that ordinary ingots are not seriously affected by this redistribution. It is clear, however, that the action can not be neglected in making large castings and forgings; and it accounts, in all probability, for the mysterious fractures which have occurred to many such articles. To elucidate this matter still further, I had samples cut from the center of the large ingot, 22 inches from the top and 5 inches from the bottom, forged into bars, and re-tested mechanically. The difference in hardness was most marked, rendering it difficult to cut the top slice near the center, while the bottom cut quite easily.

COLORADO'S PROSPERITY.

The returns of the Census Bureau well illustrate the present prosperity of Colorado. The following table shows the assessed valuation of property and the indebtedness of some of its cities:

| Towns of less than 7500 inhabitants. | Assessed valuation in 1880. | Total indebtedness in 1880. | Towns of less than 7500 inhabitants. | Assessed valuation in 1880. | Total indebtedness in 1880. |
|--------------------------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------------|-----------------------------|
| Alma | \$60,000 | ..... | Kokomo | \$700,000 | ..... |
| Animas City | 63,653 | ..... | Lake City | 325,905 | \$5,500 |
| Black Hawk City | 547,320 | 7,352 | Longmont | 203,070 | 689 |
| Boulder | 903,245 | 68,000 | Manitou | 209,000 | ..... |
| Central City | 995,554 | 8,233 | Nevadaville | 350,000 | ..... |
| Colorado Springs | 1,500,000 | 87,300 | Ouray | 156,373 | 1,000 |
| Crested Butte | 262,005 | ..... | Saguache | 124,853 | 715 |
| Del Norte | 172,500 | 10,000 | Pueblo | 1,083,482 | 130,000 |
| Evans | 80,000 | ..... | Silver Cliff | 230,000 | 4,436 |
| Georgetown | 1,103,458 | 4,000 | South Pueblo | 443,255 | 13,000 |
| Golden City | 700,000 | 62,000 | Trinidad | 750,000 | ..... |
| Greeley | 501,880 | 1,500 | | | |
| Gunnison | 250,000 | ..... | Total | \$12,025,523 | \$403,525 |
| Iaho Springs | 250,000 | ..... |  |  |  |

For Denver and Leadville the following figures are given:

| | Denver. | Leadville. | Total. |
|--|--------------|-------------|--------------|
| Population, 1860 | 4,749 | None | 4,749 |
| Population, 1870 | 4,759 | None | 4,759 |
| Population, 1880 | 35,630 | 14,820 | 50,450 |
| Total assessed value of real and personal property | \$16,194,092 | \$2,433,327 | \$18,627,419 |
| Estimated true value of real estate | 25,989,648 | 2,252,212 | 28,241,860 |
| Total estimated true value of real and personal property | 34,652,864 | 3,002,949 | 37,655,813 |
| Taxation, total levy | 607,278 | 89,335 | 696,613 |
| Total debt | 20,000 | 112,000 | 132,000 |

THE WORK OF THE MINTS.

From the forthcoming annual report of the Director of the Mint, Hon. H. C. Burchard, Washington correspondents of the daily press have gathered the following data: The gold and silver received and operated upon by all the mints and assay offices, exceeding by more than \$50,000,000 the receipts of any previous year, amounted to \$226,225,522.46, of which \$193,371,101.01 was gold and \$32,854,421.45 silver. This large increase was due to a continued influx of gold from abroad, over \$95,000,000 deposited being from that source alone. The coinage facilities of the mints have been tested to their fullest extent in converting this bullion into coin. The gold coinage amounted to \$78,733,864, of which \$15,345,520 was in double-eagles, and the remainder in coins of lesser denominations. The coinage of silver was confined to the minimum value of silver bullion required to be coined by the law authorizing the coinage of the standard silver dollar, \$27,637,955 of which were struck, or an average of about \$2,300,000 a month. Of subsidiary coins, only \$12,011.75 were coined; and of base metal or minor coins, \$405,109.95. In addition to the coinage, the mints and assay offices manufactured fine, standard, sterling, and unparted bars to the amount of \$100,750,649.94 in gold and \$6,542,232.35 in silver. In the refineries, 11,449,704.19 ounces of gold and silver bullion were refined, producing 1,295,443.25 ounces of standard gold and 9,774,730.86 ounces of standard silver. The purchases of silver bullion for the coinage of the silver dollar amounted to 22,136,920.39 ounces standard, at a cost of \$22,578,911.72. This was obtained by direct purchase or in settlement for silver parted from gold and that received in payment of charges on silver deposited for return in bars. Of the coinage of dollars during the year, \$17,706,924 were transmitted and distributed. The total coinage of dollars since the passage of the act for their coinage has been, up to November 1st, \$100,672,705, of which \$34,096,327 are in active circulation, and \$58,833,770 held by the Treasury for payment of outstanding silver certificates, leaving \$7,737,608 for disbursement by the Treasury in ordinary payments. The usual examinations and settlements were made at the close of the year. The magnitude and importance of these are made evident when it is known that they covered transactions and actual transfers between the superintendents and operative officers of gold and silver bullion to the value of over \$600,000,000, and that bullion and funds amounting to over \$128,000,000 were examined, weighed, or counted at the time of settlement, and their value ascertained.

From data received at the Mint Bureau, the Director estimates the production of the United States during the last fiscal year to have been, of gold, \$36,500,000, and of silver, at its coining value, \$42,100,000—a total of \$78,600,000. The inquiries heretofore instituted in regard to the annual consumption of gold and silver in the arts and manufactures have been continued, and with gratifying results. Manufacturers of jewelry and other articles and materials of gold and silver reported a consumption of over \$10,000,000 in gold and nearly \$3,500,000 in silver. Of the gold used, \$3,300,000 was reported as United States coin melted. The Assay Office at New York delivered to the manufacturers during the year \$5,700,000 of gold in bars, and \$5,100,000 in silver. Taken together, they appear to indicate a consumption of at least \$11,000,000 in gold and \$6,000,000 in silver, which would probably have been confirmed had all manufacturers that were addressed promptly responded.

The wastages of the operative offices of all the mints and assay offices were found to be in all cases within the legal limit; and the total wastage, considering the amount received and worked, was much less than that of the preceding year. The apparent wastage amounted to \$45,343.97; but this was partially offset by \$8406.12 recovered during the year from the deposit melting-rooms and \$24,733.24 surplus bullion returned on settlement by the melter and refiner of the assay office at New York, making the net actual loss to the government on the immense amount operated upon during the year only \$12,204.16. Director Burchard says: "Loss of metal in melting, separating, refining, and coining is unavoidable, and is contemplated and provided for by law, which limits the amount of wastage in the operations of the melters and refiners to one thousandth of the gold and one and a half thousandths of the silver delivered to them, and for the coiners one half thousandth of gold and one thousandth of silver."

The Director continues his estimates of specie circulation in the United

States. Taking as a basis the estimate of the amount on June 30th, 1880, and adding the net gain by import and coinage, and deducting the loss from the consumption in the manufactures, he estimates that at the close of the fiscal year the gold coin circulation amounted to \$440,000,000, and of silver coin \$171,500,000. These amounts were further increased up to the 1st of November, and at that date the amount of specie, including bullion in the mints and assay offices, available for and awaiting coinage, was \$563,000,000 of gold and \$186,000,000 of silver—a total of \$749,000,000.

THE HEBERLE MILL.

We had occasion some time since to call attention to one instance of the growing use of mills for crushing rock in German concentration-works, and may now give the leading features of another construction, which appears to be very successful, to judge from the results printed by Herr E. Heberle, of Kalk, in recent issues of the *Berg- und Hüttenmännische Zeitung*. Those who thoroughly understand the principles of ore-dressing—and probably none have approached the Germans in this respect—have an aversion amounting almost to abhorrence of the stamp-mill, and it is becoming almost a principle in modern German practice to substitute grinding mills of some kind for it. We may note that there is in this country, too, a growing conviction among the most advanced engineers that every effort ought to be made to restrict the domain of the stamp-mill, and we believe that there are signs that that feeling will, at an early date, take the form of definite proposals. The great perfection which, comparatively, that class of machinery has attained, and other circumstances which strongly favor its retention, will tend to render changes in that direction slow in this country. Still it will be of interest closely to follow developments abroad, with due regard to the fact that the attending circumstances here and there differ widely.

We can not now enter into a detailed description of the Heberle mill. Suffice it to say, that the grinding surfaces are mounted vertically, and that two styles, a single and a double mill, are made, the grinding surfaces of both consisting of chilled castings. The first style is used particularly for sizes ranging below 0.16 inch, while the other is employed for 0.32-inch stuff. Rolls are used for larger grain. The grinders rotate at a speed ranging from 250 to 300 revolutions per minute. The record of the following two tests will clearly show what advantages the use of the mill possesses over stamps, by permitting a yield of concentrates from coarser stuff. In the first case, a lot of 9810 kilograms, or about 10 tons, of poor middlings from jigger lead ores, were worked, the size of the grain being 0.16. The stuff was ground in a Heberle mill, and the product was classified by a screen and by *Spitzkasten*. As will be seen by the following table, a portion of the material was jigged, another part treated on percussion-tables, and the rest on a rotary buddle.

| | Dry weight Kilograms. | CONTENTS IN LEAD. | | CONTENTS IN SILVER. | |
|---|-----------------------|-------------------|--------|---------------------|--------------|
| | | Per cent. | Kilos. | Gr. p. 100 kilos. | Total grams. |
| Material ground | 9,810 | 9.75 | 956.47 | 47.05 | 4615.60 |
| Obtained: | | | | | |
| Concentrates from jigs I. | 556 | 75.60 | 420.34 | 464.00 | 2579.84 |
| " " II. | 128 | 75.40 | 96.51 | 373.00 | 477.44 |
| Concentrates from Rittinger percussion table. | 117 | 78.20 | 91.39 | 348.00 | 407.16 |
| Concentrates from Salzburg percussion-table. | 83 | 53.30 | 44.24 | 237.00 | 196.71 |
| Concentrates from rotary buddle. | 76 | 79.30 | 60.27 | 314.00 | 238.64 |
| Total concentrates | 960 | 74.25 | 712.85 | 406.22 | 3899.79 |
| Middlings | 507 | 11.30 | 57.29 | 53.80 | 272.77 |
| Tailings | 8,343 | 2.23 | 183.33 | 5.31 | 443.04 |

Neglecting the middlings, it will be noticed that the percentage of lead saved in very clean products, as the assay shows, was 74.53 per cent, while the returns of the silver were 84.49 per cent.

A second lot of 19,217 kilograms of ore consisted of so close a mixture of galena, blende, and pyrites that hand-sorting could do no good. The material contained 4.9 per cent of lead, 12.27 per cent of zinc, and 8.6 grams of silver per 100 kilograms of ore. The whole lot was put through a crusher, was passed through rollers, and ground in the Heberle mill, set so as to reduce it to 0.224 inch. This was jigged in sizes from 0.224 to 0.16 inch, and yielded only 54 kilograms, or 0.29 per cent, of concentrates, fit for smelting. It was then decided to reduce the whole to 0.08-inch maximum. This was treated on fine sand jigs, on Rittinger and Salzburg percussion-tables and rotary buddles, with the following results, the percentage of zinc in the blende products being too low to pay for smelting:

| | Dry weight Kilograms. | CONTENTS IN LEAD. | | CONTENTS IN SILVER. | |
|----------------------------|-----------------------|-------------------|--------|---------------------|--------------|
| | | Per cent. | Kilos. | Gr. p. 100 kilos. | Total grams. |
| Ore | 19,217 | 4.9 | 941.60 | 8.6 | 1,652.66 |
| Obtained: | | | | | |
| Jigged stuff, 0.29 inch | 14 | 60.4 | 8.46 | 94.3 | 13.20 |
| " " 0.16 " | 22 | 72.6 | 15.97 | 112.0 | 24.64 |
| " " 0.11 " | 11 | 70.0 | 7.70 | 109.6 | 12.60 |
| " " 0.08 " | 7 | 74.1 | 5.19 | 118.0 | 8.26 |
| " sand I. | 711 | 66.6 | 473.33 | 115.0 | 817.65 |
| " " II. | 210 | 27.0 | 56.70 | 45.2 | 94.92 |
| Percussion concentrates I. | 208 | 61.4 | 127.71 | 101.5 | 211.12 |
| " " II. | 124 | 41.5 | 51.46 | 66.0 | 81.84 |
| Rotary buddle C. | 100 | 46.8 | 46.80 | 67.6 | 67.60 |
| Total concentrates | 1,407 | 56.4 | 793.52 | 91.77 | 1,291.29 |
| Middlings | 300 | 5.3 | 15.90 | 9.5 | 28.50 |
| Tailings | 17,510 | 0.75 | 132.18 | 1.9 | 332.87 |

From this summary it will be seen that 84.27 per cent of the lead and 78.13 per cent of the silver were concentrated in 7.32 per cent of the weight of the original ore—a very good result when it is considered that almost all of it had to be ground down to dust.

We may add some of the results obtained with the Heberle mill on a

large scale. At Ammeberg, in Sweden, one double mill ground about 1 ton of 0.1 to 0.16-inch material, consisting of galena, zinc-blende, quartz, graywacke, and hornblende, to 0.04-inch size, using 40 liters (10 gallons) per minute. While formerly certain classes of middlings could not be concentrated beyond 20 per cent of zinc, a product holding 44 per cent is now obtained from them. The mill ground 2756 metric tons in 396 twelve-hour shifts, using 5 pairs of cast-steel grinders, which weigh per pair 714 kilograms, and are worn down to 56 kilograms.

PROGRESS IN SCIENCE AND THE ARTS.

Blasting under Water.—Herr J. Deutsch has reported to the Austrian Society of Engineers the results of an investigation made by him as a member of a jury appointed to examine into the merits of the Lauer system of blasting under water. That method consists simply in moving obstructions of rocks in river-beds by firing with electricity dynamite cartridges laid on the river bottom. The cartridge is fastened to a length of a gas-pipe attached to the end of two booms running out from the deck of a scow. The trials were made in the Danube, at Krems, where the bottom consists of gneiss with many stringers of quartz. The depth of water ranged from 10 to 11 feet, the velocity of the current being nearly 11 feet. In nine days, working 60.6 hours, an average of 350 soundings was made, and 72 shots fired per day of 10 hours. In all, 399 shots were fired, requiring 295 pounds of dynamite, about 1175 cubic feet of rock being removed. The saving is estimated at 60 per cent.

Petroleum in Iron-Making.—Mr. W. K. McClees, Secretary of the Poughkeepsie Iron and Steel Company, has written the following letter to the editor of the *Bulletin*: Some time ago, you requested a brief reference as to our success at Poughkeepsie, New York, in making iron directly from the ore with crude petroleum for fuel. We have two deoxidizers, each over a puddling-furnace: they were finished only last week. They were both immediately filled with pulverized magnetic ore and pulverized charcoal. Each deoxidizer has twelve retorts, say twenty feet high. As it requires about twelve hours to deoxidize the ore, the furnaces were both charged with scrap-iron, in order to get the heat utilized, and make bar while waiting on the ore. The petroleum was turned on from a half-inch pipe which entered a blast tuyere, atomizing the oil completely as it entered the combustion-chamber of the furnace. A half-shovelful of burning charcoal ignited it in ten seconds after entering, when a blast near by carried the flame over the bridge upon the iron, passing on through the deoxidizer, then through the boiler. The rapidity of melting scrap astonished old iron-makers, and the quality of the bar, considering the quality of the scrap, was also astonishing. The flame could have been blown fifty feet. The granulated ore is carried to the top of the retorts by elevator buckets. The deoxidation of the ore is continuous. The ore is charged at the top in quantities to replace that drawn into the furnace.

Recalculation of the Atomic Weights.—The following table gives the results of Mr. F. W. Clarke's labors during the past three years in recalculating all the atomic weight determinations which have been published from the time of Berzelius's earlier investigations down to the present date. Mr. Clarke has attempted to reduce all similar series of experiments to common standards; to calculate the probable error of each series; to combine the results into general means; and then to deduce the atomic weights in such a way that each value should represent a fair average of all the trustworthy estimations. "In other words, I have sought to bring together all the vast number of scattered details, and to derive from them a more consistent table of atomic weights than has hitherto been found in chemical literature." The atomic weight values are tabulated in two columns: one, containing numbers referred to hydrogen as unity; the other, with figures comparable with oxygen as equal to 16.

| | H = 1. | O = 16. | | H = 1. | O = 16. |
|-----------------------------|----------|----------|----------------------------|---------|---------|
| Aluminium..... | 27.009 | 27.075 | Manganese..... | 53.906 | 54.029 |
| Antimony..... | 119.955 | 120.231 | Mercury..... | 199.712 | 200.171 |
| Arsenic..... | 74.918 | 75.090 | Molybdenum..... | 95.527 | 95.747 |
| Barium..... | 136.763 | 137.007 | Nickel..... | 57.928 | 58.062 |
| Bismuth..... | 207.523 | 208.001 | Nitrogen..... | 14.021 | 14.029 |
| Boron..... | 10.941 | 10.936 | Osmium..... | 198.494 | 198.451 |
| Bromine..... | 79.951 | 79.951 | Oxygen..... | 15.965 | 16.000 |
| Cadmium..... | 112.770 | 112.921 | Palladium..... | 105.757 | 105.981 |
| Cæsium..... | 132.583 | 132.918 | Phosphorus..... | 30.958 | 31.029 |
| Calcium..... | 39.990 | 40.082 | Platinum..... | 194.415 | 194.967 |
| Carbon..... | 11.974 | 12.001 | Potassium (or Kalium)..... | 39.019 | 39.100 |
| Cerium..... | 140.424 | 140.747 | Rhodium..... | 104.055 | 104.285 |
| Chlorine..... | 35.370 | 35.451 | Rubidium..... | 85.251 | 85.529 |
| Chromium..... | 52.009 | 52.129 | Ruthenium..... | 104.217 | 104.457 |
| Cobalt..... | 58.887 | 59.023 | Scandium..... | 43.980 | 44.081 |
| Columbium (or Niobium)..... | Ab't 94. | Ab't 94. | Selenium..... | 78.797 | 78.978 |
| Copper..... | 63.173 | 63.318 | Silicon..... | 28.195 | 28.260 |
| Didymium..... | 144.573 | 144.906 | Silver..... | 107.675 | 107.923 |
| Erbium..... | 165.891 | 166.273 | Sodium (or Natrium)..... | 22.998 | 23.051 |
| Fluorine..... | 18.984 | 19.027 | Strontium..... | 87.374 | 87.575 |
| Gallium..... | 68.854 | 68.963 | Sulphur..... | 31.984 | 32.074 |
| Glucium (or Beryllium)..... | 9.085 | 9.106 | Tantalum..... | 182.144 | 182.562 |
| Gold..... | 196.155 | 196.606 | Tellurium..... | 127.600 | 128.254 |
| Hydrogen..... | 1.000 | 1.000 | Thallium..... | 203.715 | 204.183 |
| Iodine..... | 126.557 | 126.848 | Thorium..... | 233.114 | 233.951 |
| Indium..... | 113.398 | 113.659 | Tin..... | 117.698 | 117.968 |
| Iodine..... | 126.557 | 126.848 | Titanium..... | 49.846 | 49.961 |
| Iridium..... | 192.651 | 193.094 | Tungsten..... | 183.610 | 184.032 |
| Iron..... | 55.913 | 56.042 | Uranium..... | 238.482 | 239.030 |
| Lanthanum..... | 138.526 | 138.844 | Vanadium..... | 51.256 | 51.373 |
| Lead..... | 206.471 | 206.840 | Ytterbium..... | 172.761 | 173.158 |
| Lithium..... | 7.007 | 7.023 | Yttrium..... | 89.816 | 90.023 |
| Magnesium..... | 23.959 | 24.014 | Zinc..... | 64.905 | 65.054 |
| | | | Zirconium..... | 89.367 | 89.573 |

"Here we have sixty-six elements, or, rejecting columbium as too vaguely determined, sixty-five. Such elements as phillipium, decipium, thulium, samarium, etc., are not yet sufficiently well known to be considered in this connection." The summary of Mr. Clarke's methods and conclusions may be found in the October number of the *American Chemical Journal*.

IRON ORE IN CUBA.—The *Revista Minera*, of Madrid, Spain, reports that a large deposit of magnetite has been discovered in the Santiago Mountains, Cuba.

THE Ligonía Rolling-Mill at Portland, Me., which has been idle for some time, has been sold to H. N. Jose and others, who intend to start it up at once. It will be known as the Portland Rolling-Mill.

STANDARD SHAPES OF IRON AND STEEL.—A German commission of experts has recently published a report of standard shapes for angles, single and double tees and other forms. Professors Heinzerling and Ihle of Aix-la-Chapelle, have drawn up the report.

THE STANDARD OIL COMPANY'S PECULIAR METHODS.—The *New York Sun* says: The resources that the big monopolies can bring to bear in a contest are not always measured carefully by those who undertake to wage war upon them. The grocers in Columbus, Ohio, wanted to buy oil on better terms than the Standard Oil Company would supply them, and purchased of other refiners. The Standard Company immediately undersold the market. Failing thus to bring the grocers to deal with them, the oil company started in the grocery business and sold goods at cost. This state of things continues. The grocers stand firm, and, with public sympathy on their side, promise to make a hard fight. The temptation to buy cheap groceries in these hard times of high prices, however, is likely to prove too much for the average householder of Columbus, and we fear that the grocers will find that the odiousness of the monopoly will not prevent their customers from getting their flour and sugar where they can buy cheapest. But Ohio would seem to be a good missionary field for the Anti-Monopoly party.

THE HARDIE COMPRESSED-AIR LOCOMOTIVE.—The experiments now being conducted on the Second Avenue Elevated Railroad with the Hardie locomotive, built at the Baldwin Works, are of considerable importance, especially to coal mines, as the use of steam underground is troublesome, while compressed air would be beneficial. Experiments with it were tried a little more than two years ago on a horse-car line in this city; but though the results were reported to be successful, they were abandoned for some unknown reason. The principal feature of the engine is, that the compressed air is heated to about 240 degrees Fahrenheit previous to going to the two cylinders. The air at a pressure of 600 pounds per square inch is stored in four reservoirs having a capacity of 460 cubic feet. Before it enters the valve-chest, it is passed through a reducing valve, which brings it down to the working pressure of about 125 pounds. Taking a train of three cars over the elevated road in the regular time over a distance of nine miles, and making all stops, the pressure in the reservoirs was brought down from 600 to 150 pounds.

THE KOERNER FIRE-DAMP BURNER.

From time to time, paragraphs have gone the rounds of the press concerning an apparatus invented by Herr Guido Koerner, of Freiberg, Germany, for preventing explosions of fire-damp by consuming or decomposing that gas as fast as it accumulates in coal mines. We understand that it is received with favor in Germany, Belgium, and England; and as details of practical, well-authenticated tests are now available, it deserves a closer attention than is generally accorded to inventions whose chief merit is their ingenuity. Herr Koerner, finding that finely-divided palladium, a metal of the platinum group, possessed the property of causing the burning of marsh-gas to carbonic acid and water at low temperatures, hit upon the idea of using this fact for destroying fire-damp. By keeping finely divided palladium at a temperature of about 482 degrees Fahrenheit, the action of that metal is most vigorous, while there is no danger of an actual ignition of the fire-damp. Many eminent authorities testify to this fact, that the temperature needed to cause actual ignition or explosion must be considerably higher than that above given. Frankland states that marsh-gas can not be ignited under the most favorable circumstances at temperatures lower than that sufficient to keep iron at a bright red at daylight in a well-lighted locality. Schilling and Winkler give evidence to the same effect, and Koerner's own researches confirm their views. It is apparent, therefore, that it is safe to use special means to keep palladium at a temperature where its maximum effect in inducing the combustion of fire-damp is obtained. As at present constructed, the apparatus consists of an oil-reservoir on which five small burners are mounted. The upper end of each of them carries an iron plate, to which a shell of asbestos, impregnated with platinum and palladium, is attached, so that, as their action is one depending merely upon surface, as large an extent of the latter as possible may be obtained. Fine wire netting between the oil-reservoir and the shells is intended to counteract the heating of the oil and prevent the possibility of any overheating of the palladium-asbestos shells. A perforation through the top of the asbestos shells in which the combustion of the oil actually takes place permits the air to pass in for the burning of the oil. The upper part of the shell is filled with palladium-asbestos, so that no unconsumed oil can escape.

At the Schader colliery, near Zwickau, Saxony, in an uprising, fire-damp was continually accumulating, notwithstanding the fact that its face was only 30 feet from the heading, and four men were at work in it, which it was hoped would tend to dissipate it. As no gas could be detected by the safety-lamp at a distance of about seven feet from the face, it was considered certain that the gas came directly from the freshly opened surface of the coal. A Koerner apparatus with five burners was placed within three feet of the face, and during six hours no fire-damp could be detected. After its removal, about 60 cubic feet of fire-damp accumulated in less than thirty minutes, although nine lamps were kept continually burning. At the Ernst Julius colliery, Bruckenberg, Germany, an experiment, into the details of which we can not enter, 4550 cubic feet of excavation were cleared of fire-damp in 54 minutes. At the Caroline colliery, Langendreer, Westphalia, an uprising was driving 20 feet in a 4.5-foot seam. It was filled with a mixture which, by the safety-lamp, gave proof of the presence of fire-damp. The officers of the colliery put in the Koerner apparatus, which cleared the place in seven minutes, so that an open lamp could be used in it. The air was not, however, as good as it was before; probably because it was charged with carbonic acid, one of the products of the combustion of the fire-damp. In a report, the officers of the mine referred to state that, in their opinion, the apparatus is capable of destroying fire-damp at the rate of 35 cubic feet a minute.

THE MINING OF ANTHRACITE COAL AND ITS DISTRIBUTION.—I.

Great as the interests involved in the mining, transportation, and distribution of anthracite have been in the past, the development which they have acquired in the past twelve months has been such as to approach the predictions of those who were by general accord adjudged to be too sanguine. As the range of its field of consumption extends, the interest in the questions involved in the anthracite mining industry and the trade becomes a more general one. It is with a view of presenting data that will allow the general reader to obtain an insight into our resources of that precious fuel, and the details of mining, preparation for market, and shipping, that we propose to print a series of articles on the subjects connected with the mining of anthracite and its distribution. Necessarily we shall be forced to go over much ground that has been well covered before; but it is believed that a full presentation of so important a subject is a sufficient justification of that course, and that much information which has not hitherto been available will render our series of interest to those who are more intimately conversant with the trade.

With the exception of a small and unimportant field in Rhode Island and Massachusetts, the only deposits of anthracite are those of Pennsylvania, which has therefore practically a monopoly of that fuel, which is unexcelled for domestic purposes, for which its cleanliness, and the absence of smoke or soot, make it particularly well adapted. Its hardness is such that it can be transported over great distances and can be frequently handled without much loss or breakage. The harder varieties of the coal have a conchoidal fracture, while the softer kinds show some tendency to lamination. Anthracite does not kindle readily; but when once properly ignited, burns with an intense heat. Chemically, its characteristics are a high percentage of carbon, ranging from 85 to 93 per cent, its average percentage of volatile matter being about 6 per cent, and going as high as 7.5 per cent. In the extreme west ends of the basins, however, a semi-anthracite is found, containing as much as 10 to 15 per cent of volatile matter. In treating of the various fields in succession, we shall take occasion to give fuller details concerning chemical composition and physical structure, and may for the present content ourselves with these general remarks. The variations, though not great, affect the uses to which the coal is put, and have a bearing upon other practical questions.

Of the five sub-formations into which Professor Rogers has divided the coal formation of Pennsylvania, we have to deal with two only, the seral conglomerate, which overlies the higher Devonian rocks, and the anthracite coal measures proper, which, passing upward, follow after the conglomerate. The latter, which is the most wide-spread of the whole coal series, consists in the anthracite coal regions of an extremely coarse and massive rock, in which pebbles of all sizes up to that of a hen's egg are firmly cemented, of coarse gray sandstones, sandy shales, and coal slates. This formation underlies all the various coal basins; and the fact that it shows a steady diminution of the size of the pebbles of which it is composed, and of its thickness as it passes westward, is proof of the common origin of all the various basins of the anthracite coal-fields. The thickness ranges from 1400 feet at Tamaqua and 1031 feet at Pottsville to 800 feet at Girardville, 700 feet at Shamokin Gap, 300 feet at Nanticoke, and 200 feet at Beech Grove. The thickness of the coal measures proper varies widely, and its estimation is not an easy matter, owing to the extensive dislocations which intersect the formation and the contortions of the strata. It is not, according to Rogers, possible to assign a well-defined, permanent horizon of separation between the conglomerate and the lower coal measures, an arbitrary boundary being placed at the bottom of the first or lowest considerable coal seam. The anthracite coal measures embrace the following classes of strata: 1. Coarse gray micaceous sandstones, with a few massive beds of conglomerates near their lower limits. 2. Gray and bluish argillaceous sandstone. 3. Compact blue slate, frequently covering the coal-beds, and also occurring in independent strata. 4. Blue compact shale of rather fine texture, having frequently an irregular and splintery fracture—a somewhat coarse or siliceous fire-clay, which is the prevailing floor of the seams of coal; and 5. beds of anthracite coal. It is a striking fact, noted by Rogers, that in all the anthracite basins, there is not one bed, however thin, of true limestone.

The flexure of the strata and the extended action of erosion have created a series of nearly parallel belts, the internal structure of which is extremely intricate in some cases. These Pennsylvania geologists have grouped in four great subdivisions which, together with some outlying basins, in the aggregate represent a coal area of 480 square miles, small in comparison with the great development of some of our bituminous coal-fields. Macfarlane, in his *Coal Regions of America*, gives a general description of the various coal-fields, which we briefly summarize:

The *First or Southern Coal-Field*, extending from the Lehigh to the Susquehanna River in an east and west direction, inclining a little toward the southwest. It has an extreme length of 73 miles and a maximum width of five miles, the average being two miles. The basin is irregular in its configuration and structure, and for convenience it has been divided into a number of districts, going westward from the Lehigh River. Bounded on the south by Sharp Mountain and on the north by Locust Mountain, the basin extends as far as Tuscarora and Middleport, about 19 miles, forming what is called the Lehigh and Little Schuylkill District. Then an abrupt widening marks the beginning of Rogers's second division, the Schuylkill and Swatara District, which extends for twenty-two miles to the forks of the basin north of Pine Grove, at Lorberry Creek. The northern boundary of the field here is Mine Hill, which separates it from a detached basin bearing the same name. This portion of the Southern coal-field is also famous as the Pottsville region. It is followed westward by the Wiconisco Basin, nearly 17 miles long, which forms the most northern of two prongs which form the western end of the main coal-field. The southern fork, about 27 miles long, is called the Dauphin basin, the total area of the entire field being estimated at 146 square miles. The structure of the coal measures of this field is too complex to admit of a summary of its general features. We must therefore reserve a description until more elaborate details are presented.

The *Second or Middle Coal-Field* is currently divided into two portions, of which the eastern is called the Mahanoy and the western the

Shamokin region, the confining ridges being Head Mountain on the north and Broad Mountain on the south. The former is 25 miles in length, with a mean breadth of less than two miles, the area being about 41 square miles, and is richly supplied with coal. The western portion, or the Shamokin basin, is 20 miles in length, with a mean breadth of 2.5 miles and an area of 50 square miles. According to Rogers, it consists of three subdivisions, while the section made by Daddow would indicate a greater number. It is not a simple trough, but possesses quite a complicated structure, from the presence within it of undulations.

Between the first and second coal-fields are two detached basins of minor importance, which have been named the New Boston basins. In the second coal-field, the thickness of the coal measures is less than in the first, but it holds some very thick and pure seams.

The *Lehigh Coal-Fields* consist of seven narrow basins lying contiguous to each other, separated by anticlinical folds of conglomerate, and, where this has been carried away, by narrow valleys of red shale. Taking this complicated coal-field as a whole, it may be regarded as a series of six leading troughs separated from one another by chains of ridges, which are not, however, simple continuous flexures. The first or most southern of the basins thus formed by the Primrose and Catawissa ridges is the Beaver Meadow, which is about seven miles long and has an average width of about one mile. This is followed by a second, the North Beaver Meadow, of little importance; and this in turn is succeeded by the well-known Hazleton basin, lying between Council Ridge and Buck Mountain, westward. It is divided into two forks by a ridge of conglomerate. It is five and a half miles long and about three quarters of a mile wide. Detached from it to the west is the small Tomhicken basin, while it is followed north by the Big Black Crest basin, which is reported by Daddow to be twelve miles long. In close connection with it is the Little Black Creek basin, while west of it is the Lower Black Creek basin. North of the Big and Little Black Creek basins lies the Green Mountain basin; and to the northwest of the Lower Black Creek basin, in a detached position, is the McCauley Mountain basin.

The *Third or Wyoming Lackawanna Field* is the largest, being an elongated, crescent-shaped basin nearly fifty miles long, but not more than five miles broad at its widest part. Rogers describes it as a wide and shallow trough, somewhat deeper in the middle than at the sides, yet descending so gradually as to be approximately flat toward the center. Within the general basin there are a great number of nearly parallel lesser troughs or basins. The same coal-seams and other strata are repeated within certain limits from one wave to another, so as to maintain, despite the local steepness of the dip, one average uniformity in the depth of the coal-field at any given cross-section. These waves in the strata are remarkable for their approximate although not absolute parallelism, irrespective of the crescent shape of the basin. A further general fact connected with these undulations of the coal measures of the third district is the curious declining gradation in the sharpness of the successive undulations proceeding southwest to northeast. From Beech Grove at the southwest end, to Nanticoke farther east, the inclinations are as high as 45 degrees; between Nanticoke and Wilkes-Barre, they exceed 30 degrees; while between the latter city and Pittston, the average ranges from 20 to 25. Beyond Pittston, in the Lackawanna division of the basin, the waving of the rocks becomes feeble and feebler, until, passing Scranton into the district between it and Archibald, the regular undulations become almost imperceptible. Another general feature in the individual waves is a progressive increase of flexure as they advance from the mountain-sides, where they originate, out into the central tracts of the valleys to near their termination, where they are comparatively abrupt.

THE FORMATION OF COAL.

All attempts to explain satisfactorily the formation of coal have thus far proved unsuccessful, though it is generally understood that it is the product of the decomposition of vegetable matter. Just how that decomposition has been brought about chemically is a matter which chemists have not as yet been able to solve. The principal difficulty has been that it has been impossible to obtain a clear insight into the chemical constitution of coal. It has been thought hitherto, and this is still the popular belief, that coal is in the main pure carbon, mixed with varying quantities of bituminous substances. It has been generally believed that, as the product of the distillation of coal is principally carbon, it would be safe to conclude that free carbon actually does exist in coal. The fact that sugar, starch, etc., under similar circumstances, leave a residuum consisting of carbon has never been considered a proof that that element existed in these bodies in a free state. It is well known that coals which may have the same percentage of carbon, hydrogen, and oxygen do not by any means, in coking, yield the same products of distillation, and we have a complete analogy for this in the behavior of cellulose and starch when subjected to distillation. Evidence points to the conclusion that coal is a mixture of many and complex compounds; and the difficulty, amounting almost to an impossibility, of separating these compounds has much to do in rendering a chemical solution of the questions involved in the formation of coal a very arduous task. The production of coal by artificial means is met by great obstacles, among which the absence of all knowledge concerning the conditions under which that process actually took place is the principal one. The question whether the vegetable matter to which our coal-veins owe their origin was amassed by drifting or was carbonized *in situ*, has been much debated, and there has been much discussion on the point whether it was obtained from water or from land plants. Dr. Muck, of Bochum, in a recent work to which we shall refer at greater length in the future, takes up the theory that algae have mainly contributed to the formation of coal. It is urged that the remains of marine plants are rarely found in coal-veins, and that shells, etc., are not often met with. Dr. Muck calls attention to the fact that marine plants decompose easily and completely, losing their form entirely; and that the disappearance of the calcareous remains of mollusks is readily explained by the formation of large quantities of carbonic acid gas during the process of carbonization. In accepting the marine origin of coal it is not necessary

to resort to the assumption of immense pressure and high temperatures to explain decomposition and the total destruction of the structure of the original substance. Dr. Muck combats Frémy's bog theory at length. His views are well supported by recent investigations made by Herr P. F. Reinsch, who has examined 1200 sections of coal, coming to the conclusion that that mineral substance has not been formed by the alteration of accumulated land plants. Herr Reinsch claims to have discovered that coal consists of microscopical organic forms of a low order of protoplasm; and though he carefully examined the cells and other remains of plants of a higher order, he computed that they have contributed only a fraction of the matter of the coal-veins, however numerous they may be in some instances.

VENTILATION IN ENGLISH COLLIERIES.

In Great Britain, the proprietor of coal lands leases the right to work them for coal to operators for a time varying from 19 to 30 years in Scotland, and as much as 90 years in other parts of the country, the land-owner receiving a royalty. The extent of these tracts varies widely, those of 500 to 1250 acres being the most frequent, 3700 being rare, and 6300 exceptional. In Staffordshire and Scotland, the estates are smallest; in the Black Country, between Birmingham, Wolverhampton, and Dudley, 50 acres being an important colliery; while in Scotland from 125 to 250 acres are generally the average. In Yorkshire and Durham, the largest are found. With the exception of the latter basin, very large tracts are only given by the land-owners when their mineral wealth is involved in doubt, and he has an interest in attracting the operator. The royalty varies widely in the various coal-fields. It is sometimes based upon the number of tons hoisted, as is generally the case in Wales, in the Durham District, or in Scotland, a different royalty being paid for lump and for smalls. Sometimes, as in Yorkshire, Lancashire, and South Staffordshire, the royalty is based upon the average of coal mined during the year; and sometimes this is modified so as to be made a certain sum per acre and per foot of thickness of coal actually removed. In some collieries, as in South Staffordshire, the royalty is one third of the selling price and one half of the excess above a certain figure. Whatever the basis for the royalty may be, the sum paid by the operator to the land-owner is equal to a charge per ton of as high as 8 to 12 pence, though usually it varies between 5 and 6 pence. Almost always, a specified minimum sum must be paid every year, whatever the output may have been, an arrangement which forces the operator to hoist a quantity of coal corresponding at least to that minimum.

In a recent report to the French government, Messrs. A. Pernolet and L. Aguilon have admirably summed the results which these arrangements lead to in the planning and working of collieries in England, notably so far as ventilation is concerned; and as their statement is calculated to explain many points in connection with the English system, which may otherwise seem difficult for Americans to understand, we give a few points. The surface boundaries of the lands may cause the limits of the underground workings to be peculiarly outlined, and lead to the adoption of exceptional measures to get at odd parts of the workings. When the land is owned by many proprietors and is cut up into small parcels, as, for instance, in Scotland, the number of shafts in a given territory may be disadvantageously large. The fact that the holding of the operator is only a temporary one generally leads him to work his territory, however large it may be, from only one point. It is true that the law requires him to sink two shafts; but in order to reduce the cost of sinking, sections of ground are operated from them which are two or three miles away from the shafts. To those parts of the mine, the fresh air must be taken through miles of galleries, while the vitiated air must be carried back a like distance. This is undoubtedly one of the principal reasons why the fire-damp explosions which occur every year in England are so disastrous. This tenant system of holding coal lands in England induces operators to work only those veins cut by their shafts which are most advantageous by reason of facility in getting the coal, or of specially good quality of the fuel. Thus they often work simultaneously, without paying any attention to proper succession, a number of veins arbitrarily chosen among those opened by their shafts. This may lead to movements in the ground above or below the vein worked, which cause those "sudden outbursts" of fire-damp which are so disastrous to life and property. This absence of any system, too, may lead to the formation of large openings in the ground which act as reservoirs of gas. When suddenly tapped by any accident, they, too, may be the cause of serious trouble.

In general, it may be said that unless breaks in the formation require more than one set of shafts, there is only one double pit for every parcel of coal lands. In Scotland, a single operator often has in the territory leased by him a considerable number of shafts, because the lands belong to different owners, to each of whom he is pledged to pay a minimum rental per year. This naturally soon brings about underground communications between the various mines, and the ventilation of each is not so distinctly independent as if the collieries were isolated. In the case of an explosion, the loss of life is greater; and it is claimed that at the Blantyre accident on October 22d, 1877, when 207 men were killed, at least 100 less would have perished if there had been no communication with other mines.

The regularity of the coal-measures in Great Britain, and the slight dip of the veins, make it possible to place the shafts at any point within the limits of the property, as it is almost certain that the same facilities for underground working will be offered at any point struck. Considerations of that kind affect the choice of a locality for sinking very little, and the shafts are placed where the necessary space is best available above ground, where facilities for shipping are greatest, and where labor is most accessible. Considerations of this kind are allowed to outweigh any connected with the safety of the men, and the shafts are often placed near the boundary-line of the territory. This has led to the immense development of the underground workings, through which air and coal must travel great distances, and has done much to make underground haulage by wire rope so general and so popular in England. As an instance of the distances, it may be stated that in the Thrybergh Hall colliery, in Yorkshire, the workings extend nearly 8000 feet from the shafts in one

direction and fully 10,000 feet in the other, the distances being little less in the Hoyland colliery; while at Epbleton, working in one direction, a maximum of 13,000 feet is reached.

It will be easily understood why this is the case. An operator will seek to make the largest profits in the shortest time by taking out the most profitable seam with the smallest amount of dead-work. He will, therefore, reduce as much as possible the expense of a shaft, in which the greatest cost is the sinking proper. Instead of many shafts, he uses underground machinery working in headings run in the vein itself, thus practically paying for themselves. He carries his coal from distant workings by cable haulage to the shaft. The flatness of the veins encourages him in this method; so that, notwithstanding the fact that comparatively little rock work has been done, he can reach a very great output. The principal inconvenience of this enormous development of the workings from two shafts generally very close to one another is, that it forces the return of the air-current to the point of its departure. Aside from the fact that the distance through which the air must pass is very great, a general plan of the ventilation can only be carried out by making many "crossings," the resistance of which in the case of an explosion is very doubtful. When such a crossing has given way, as it almost inevitably will, the disastrous consequences of an explosion are extended far beyond the territory which they would affect if the ventilation of the various parts of the mine were more independent.

A NOVEL METHOD OF CHARGING DRILL-HOLES.

Some experiments have been made recently at collieries at St. Etienne, France, to determine whether a new method of charging drill-holes, proposed by M. Lagot, would increase the work of shots. M. Laur has given an account of these tests at a recent meeting of the Société de l'Industrie Minérale. Two cylinders of lead were cast 17.7 inches high and 5.9 inches in diameter. Into these, 1.5-inch holes, 15.75 inches deep, were drilled, and both were charged with a powder cartridge weighing 0.22 pound. One was charged according to M. Lagot's plan, a spring being introduced into the bottom of the cartridge, thus diminishing the length of hole to be tamped. The other hole was loaded with an ordinary cartridge; but in order to make both equal, an amount of clay was rammed into it sufficient to take the room which the spring occupied in the first hole. Both holes were then tamped in the usual manner, and were closed by a 0.2 plug of lead, that the expansive force of the gases might show well in deforming the lead. The firing of the shot led to the ejection of the plug and to an enlargement of the holes in the lead. This enlargement was measured by filling the holes with water and weighing it, with the following results:

| | Lagot system. | Ordinary system. |
|-------------------------------------|---------------|------------------|
| Volume of hole after explosion..... | 1109.50 c.c. | 967.00 c.c. |
| " " before "..... | 453.41 " | 453.41 " |
| Enlargement by explosion..... | 656.09 c.c. | 513.59 c.c. |

There was therefore a difference in favor of M. Lagot's plan of 142.50, equal to an increase of 27.80 per cent. Should trials on a working scale bear out the indications of this experiment, the advantages secured by this simple expedient would be considerable.

COAL TRADE REPORTS.

We print the following special reports from our correspondents, on the coal trade of various sections of the country:

Baltimore.

Nov. 29.

This has been an eventful month in the history of the trade in this market. The conditions that obtained at the close of October remain the same, except that perhaps the supply of cars is, if possible, shorter than at that time. We have heard for several months past that the companies had not enough cars to move the coal; but latterly they say it is because they are short of locomotives. It is said, however, that the company's shops at Altoona are turning out two locomotives a week. If this be so, we can not see why we should not get more than one fourth as much coal as we did during the summer months. The railroad yards are bare, and the receipts from Wilkes-Barre do not average eight cars per day for the whole city. The shipments from Shamokin have not been more than the above during the month, and from the Lykens Valley region, much less. There are no stocks, except on the wharves. Free-burning coals are not plenty, the demand at this season of the year being quite strong. The demand during the month has been good, and the tone of the market firm. Prices for December are not yet announced, but it is thought there will be no change. Shipments by canal are closed for the season, except from Columbia. They will continue to load boats from that port until closed by colder weather.

ANTHROS.

Buffalo.

Nov. 29.

[Specially reported by Messrs. LEE & LOOMIS.]

Our local market for anthracite remains good, and for the past month has been quite active, prices being unchanged. The action of the companies in not advancing prices for December, although much pressure was brought to bear upon them looking to that end, meets with general commendation. The demand for the West remains good, and if cars could be obtained, something over circular could be charged, and would be paid for immediate shipment. The demand is mainly for nut and stove sizes. Freights have advanced from here to the West; \$1.75 per ton having been paid to Chicago and 75 cents to Detroit and Toledo by lake. These rates mean dear coal for the consumers in the West. In bituminous coals for steam, and also for house use, an advance has taken place; the former, on the 1st of November; and the latter on the 14th of October. For the Brier Hill there has been a lack of cars to transport Eastward, the Lake Shore being especially deficient in transportation. There does not seem to be any lack of the coal or of miners. We give revised prices below. Coke remains steady and prices the same. Every thing points to a steady demand for the winter months. In reference to the purchase of lands

by the Lehigh Valley Company in this city, we may say that the price stated by the newspapers is not far from correct, namely, between \$275,000 and \$290,000, and the tract comprises about 400 acres of flat land to the south of the city proper, lying along the creek, and touching in some parts the lake. Between the old stage-road and the lake is a broad stretch of sandy beach, low and flat, which, within the writer's memory, was covered with a dense growth of trees. The cupidity of man, many years since, cleared these away for fire-wood, and soon the lake made a breach over into the meadows, and many a time has the whole tract been submerged. It is not many years since that one of our prominent citizens was drowned, together with his horse, upon this very tract, which was then overflowed from the lake. By extending the present Blackwell Canal up along the shore, and using the earth excavated for an embankment, two objects will be accomplished; the one barring the lake out, and the other obtaining dock room for coal chutes, now becoming scarce. Two miles of dock room can in this way be made at an expense not to exceed \$175,000, or not to exceed \$20 per foot front, while in no other way can the same frontage be obtained so cheaply. We quote, per ton of 2000 pounds:

| | Lump. | Run. of Mine. | Nut. | Slack. |
|-------------------------|--------|---------------|--------|--------|
| Connellsville Coke..... | \$5.35 | ..... | ..... | ..... |
| Brookfield Coal..... | 4.25 | ..... | ..... | ..... |
| Brier Hill..... | 4.00 | ..... | ..... | ..... |
| Youghiogheny..... | 3.75 | ..... | ..... | ..... |
| Monterey..... | 3.00 | \$2.75 | \$2.00 | \$2.25 |
| Sterling Cannel..... | 4.75 | ..... | ..... | ..... |

Chicago. Nov. 29.

[Specially reported by Messrs. RENO & LITTLE.]

The receipts by lake of anthracite coal for the month of November are heavy, and the stocks of coal upon the docks are large for this time of the year; but should the shipments of coal by rail from the East to the country West and North of Chicago for the next three months be as light as for the past two months, many thousands of tons of coal now on the docks here will be required to supply the demand from the country; and therefore dealers do not think this market now overstocked. The attempt to advance the prices of anthracite and Erie and Brier Hill coal may not succeed. Contracts are sometimes made in summer by the agents here of Eastern shippers with the so-called little dealers, to sell them coal at the then prices, and one half the advance during the year. No money is generally paid. The price of the coal is advanced say 50 cents a ton. The so-called little dealer pays 25 cents more for the coal, and the dock-man retails at the old price. Taken altogether, the market is well supplied with all kinds of coal, and demand good.

Chicago. Nov. 28.

[Specially reported by Mr. G. MERRYWEATHER.]

Receipts by lake, with exception of a few cargoes yet out (wind-bound), have virtually ceased, and attention is now turned to the prospect of a supply by rail. Cars appear to be a little easier, but the country draught upon city stocks has already depleted the piles of chestnut, with indications of a short supply also of stove. The city retail prices were advanced Saturday by the Coal Exchange fifty cents per ton.

Cincinnati. Nov. 27.

[Specially reported by the CONSOLIDATED COAL AND MINING COMPANY.]

The coal market here has been relieved by the arrival of a fleet of Pittsburg coal, the first since the early part of July. The run was a large one; but all the markets on the river, including New Orleans, being nearly bare of coal, the shippers were able to obtain their own prices for the coal. Less than four million bushels stopped at this point; the remainder, over six millions, went to points below. The coal here was sold at 12 cents per bushel afloat. If the winter should be an open one, as is generally expected, this market will be safe from famine, and prices will probably continue about as they are. Anthracite is steady at last month's prices, except for chestnut size, which has become scarce, most yards being emptied of this size. Quotations of all kinds are as follows:

| | Afloat. Per bushel. Cents. | Delivered to consumers. Per bushel. Cents. |
|---------------------|----------------------------|--|
| Youghiogheny..... | — @ 12 | — @ 17 |
| Kanawha River..... | 11 @ 12 | 16 @ 17 |
| Ohio River..... | 9 @ — | 14 @ — |
| Hocking Valley..... | 13 @ — | 15 @ — |
| Anthracite..... | | Per ton. \$8.50 |

Indianapolis. Nov. 28.

[Specially reported by Messrs. COBB & BRANHAM.]

Owing to great scarcity of cars, the demand for all kinds of coal is equal to the supply. There has been no change of prices. The following are the retail figures:

| | Per ton. | Highland..... | Per ton. |
|-------------------|----------|---------------------------|----------|
| Block..... | \$1.00 | | \$3.50 |
| Pittsburg..... | 5.50 | Coke..... per bushel..... | 0.15 |
| Raymond City..... | 5.25 | Crushed coke..... | 0.17 |
| Piedmont..... | 6.50 | Oven coke..... | 0.15 |
| Blossburg..... | 6.50 | Connellsville coke.. | 0.17 |
| Anthracite..... | 8.00 | | |

Hamilton, Ont. Dec. 1.

[Specially reported by Mr. H. BARNARD.]

Notwithstanding the fact that trade has fallen of somewhat during the last two weeks, there is a firmness in this market that is really creditable. Prices have advanced 25 cents; and the coal trade, which has looked decidedly black for the last few years, has begun to assume a more encouraging and respectable appearance. Should the winter prove to be a cold one, a considerable quantity of domestic coal will find its way in by rail, although it can not be said that rail shipments to this point are increasing in popularity—rather the contrary, in consequence of a lack of confidence on the part of some of the largest shippers as to fair treatment at the hands of the railroad company. Coal for manufacturing purposes continues in steady demand, and the busy time among

our manufacturers assures that part of the trade for the rest of the season. Prices are as follows:

| PER TON OF 2000 LBS., DELIVERED. | |
|----------------------------------|--------|
| Grate..... | \$6.75 |
| Egg..... | 6.75 |
| Stove..... | 7.00 |
| Nut..... | 7.00 |
| Lehigh lump..... | 8.00 |
| egg and grate..... | 7.50 |
| stove..... | 7.50 |
| Lehigh nut..... | \$7.50 |
| Brier Hill No. 1..... | 7.00 |
| " " 2..... | 6.75 |
| Reynoldsville lump..... | 5.25 |
| " mine run..... | 4.80 |
| " nut..... | 4.50 |
| Blossburg..... | 6.00 |

Louisville. Nov. 28.

[Specially reported by Messrs. BYRNE & SPEED.]

The run of coal from Pittsburg is just in; and as the supply of coal here was about exhausted, it is probable that the demand will be very brisk for a month to come, even if there is no cold weather. Prices are as follows:

| WHOLESALE. | |
|-----------------|------------------|
| Pittsburg..... | 12c. per bushel. |
| Kentucky..... | 9c. per bushel. |
| RETAIL. | |
| Pittsburg..... | 16c. per bushel. |
| Kentucky..... | 12c. per bushel. |
| Anthracite..... | \$9 per ton. |

Milwaukee. Nov. 29.

[Specially reported by Messrs. R. P. ELMORE & CO.]

The supply in the West is not now equal to the demand, particularly in chestnut size. An advance in price has been substained both in this and the Chicago market. The car facilities have improved, and coal is going forward more rapidly. We quote now as follows:

| | Per ton. |
|--------------------------|-----------|
| Blossburg..... | \$5.50 |
| Cumberland..... | 6.00 |
| Lehigh Lump..... | 9.50 |
| Prepared all sizes..... | 8.50 |
| Brier Hill (grate)..... | 7.00 |
| Straitsville, steam..... | 5.50@6.00 |
| Illinois..... | 4.25 |

Retail—cash on delivery.

Richmond. Nov. 28.

[Specially reported by Mr. S. H. HAWES.]

No change in quotations. There is on this market a pretty fair stock of West Virginia coal, but only a small quantity of Cumberland coal. Our stock of anthracite is quite good. Prices of coal are firm. A new mine has been opened near the line of the Richmond & Alleghany Railroad by the Henrico Coal Company. The coal is bituminous. Those interested assert that it will rival West Virginia and Cumberland for smiths' and steam purposes. The output will be about 1000 tons per week.

Toledo. Nov. 30.

[Specially reported by Messrs. GOSLINE & BARBOUR.]

The season for lake shipments is practically closed, and the demand for car coal of all grades is much in advance of the supply. The call for anthracite, prepared sizes, comes from the entire West, and scarcely an inland city or village is supplied. Many consumers will go unsupplied, and be obliged to burn some other fuel. All this is the result of deferring purchases until the short supply of cars prevents the movement of the coal. We quote:

| ANTHRACITE, WHOLESALE, ON CARS AT TOLEDO. | |
|---|--------------|
| Grate, per net ton..... | \$5.50 |
| Egg..... | 5.71 |
| Stove and chestnut, per net ton..... | 6.03 |
| Retail, delivered, all sizes net ton..... | 7.50 |
| BITUMINOUS, WHOLESALE, ON CARS AT TOLEDO | |
| Shawnee and Hocking, per net ton..... | Lump. \$3.15 |
| Massillon, per net ton..... | Nut. \$2.40 |
| | 3.40 |
| RETAIL, DELIVERED. | |
| Shawnee and Hocking, per net ton..... | Lump. \$4.50 |
| Massillon, per net ton..... | Nut. 4.00 |
| | 4.75 |

COAL TRADE NOTES.

PENNSYLVANIA.

ANTHRACITE.

Oxford shaft, at Hyde Park, Lackawanna County, the property of the Susquehanna Coal Company, which has been idle for seven years, is to be put in operation again. The mine will have a capacity of from 600 to 700 tons per day. The shaft has been newly timbered, and in a few weeks the work of sinking the shaft to the next vein will begin.

Diamond-drill at work on the new shaft for Coxz Brothers & Co., at Tomhicken, cut through the rock last week, a distance of seventy-eight feet, and cut two seams of coal, the lower one being nine feet six inches in thickness. This is the Buck Mountain vein, and the new breaker at Tomhicken, which is already well under way, will be pushed forward at once.

The Alliance Coal Company is making quite a place of New Philadelphia, Schuylkill County. All the old workings abandoned years ago by individual operators are to be opened again. The company intends to spend \$700,000 in improvements. These improvements will consist of a new shaft and breaker, besides a number of other arrangements necessary for the shipment of a large quantity of coal. From this shaft, tunnels will be driven to catch every vein in the valley. At present, the company is shipping only about forty cars a day, but its capacity is yet limited. It is estimated that when all the contemplated arrangements are made, 150 cars a day will leave the works.

BITUMINOUS.

The Mount Pleasant Journal gives the following account of the manner in which crushed coke is prepared at the new crusher near that town: The supply of coke is hauled on truck-wagon from the Standard mines a few yards distant. After being weighed, it is hoisted to the top of the tower, a distance of about a hundred feet. The wagon is dumped by machinery, and the coke falls on metal bars below. All that is already fine enough falls between these bars, while the rest rolls over the bars into the first pair of metal rollers, where it is partially crushed. Here another set of bars separates the fine coke from the coarse, which passes between a second set of rollers. The crushed coke enters two large iron revolving screens. Here the dust and dirt are first taken out. Next is the nut or smaller size of coke, next the small stove size, next stove size, and lastly all that passes out at the end of the screen is called the egg size. Thus four sizes of crushed coke are obtained. There are in all three screens, two for the crushed

coke and one for the coke that is fine enough without passing through the crusher, and is separated by the iron bars spoken of before. This separation of the coke already fine enough is to save waste from the coke being ground more or less into dust. This crushed coke, it is claimed, is better for domestic purposes and even for manufacturing purposes than the anthracite coal.

Under date of November 25th, the *Keystone Courier* says: The copious rains of Friday and Saturday started the Monongahela and Youghiogheny rivers on the rise, and by noon of the latter day there was a sufficient stage of water to let out the long-imprisoned coal tows. Half a million bushels were started off Saturday afternoon, and the total shipments during the past week aggregate nearly ten million bushels.

Eighty-eight new ovens will be built at the Chicago & Connellsville Works. These works now consist of 200 ovens.

One half of the new ovens at the Standard mines are completed and fired. The second block of 200 will be finished in a short time, and with their completion these works will be the largest in the Connellsville region.

The special correspondent of the *Pittsburg Telegraph* gives the following concerning the mines and coal works of the vicinity of Latrobe:

During the past year, the Monastery Coke-Works have made many improvements and additions to their works, among them the building of 100 new coke-ovens, a new crusher and washer, besides extending the capacity of their mines. They have now 210 ovens. The mine is reached by a slope 300 feet in length. The coal averages about six feet.

The Latrobe Coal and Coke-Works have built new chutes, put up new machinery and built sixteen coke-ovens, in which they coke all the slack and ship the coal, averaging at present about ten cars daily. The underground workings are reached by a slope 150 feet in length. The coal runs from 7 to 8 feet.

The mine of Saxman's works at present has a drift entrance, and the coal is brought forward and hauled up quite a steep grade on to their chutes. The coal will average about 7 feet. Last year, they built and put in operation 30 coke-ovens, to which 30 more new ovens have recently been added, having now in blast 60 ovens. A large amount of coal is also shipped daily from the mine. A shaft is sinking to the coal alongside of the ovens, from which the coal will be hoisted in the future. It will be 70 feet to the coal. Hoisting-machinery, etc., will be erected as soon as the shaft is completed.

The Loyalhanna Coal and Coke-Works have built 100 additional ovens, giving them a total of 240 ovens, 140 of which have been in blast. The new ovens are now lighting up. The mine is entered by a shaft 146 feet deep. The coal averages 7 feet. Besides manufacturing coke, they have their chutes built for coal engines on the Pennsylvania road, and supply considerable coal for that purpose.

The Ridgeview works have made a drift opening into a fine piece of coal, averaging from six and a half to eight feet in thickness. They are shipping and manufacturing coke, having now thirty ovens in blast, and are grading for a plant of eighty more. They are shipping about ten cars of coal daily to Philadelphia for steam purposes, and will increase the output as fast as openings are made.

The St. Clair Works, a new opening, have 50 coke-ovens up, 30 of which are in blast, and work is doing on a contract of 20 more. Their mine is entered by a slope, the coal averaging from six and a half to seven and a half feet. They will also ship coal.

The Millwood Coal and Coke Company is seven miles east of Latrobe. The mine is back about three miles from the road, and is reached by a tram-road over which a small locomotive brings the coal. The underground works are reached by a shaft 200 feet deep. They have experienced considerable trouble with water and faults, causing heavy expense; but they have now got the workings throughout. A large pump is placed near the bottom of the shaft that will throw 300 gallons of water per minute. The works are kept running steadily, and just at present are well supplied with orders, shipping coal to Philadelphia. They also supply the locomotives on the Pennsylvania road.

The State Department at Harrisburg has issued a charter to the Rochester & Pittsburg Coal and Iron Company, with a capital stock of \$4,000,000. The main business office of the firm will be located at Brookville, Jefferson County, in which county the company will carry on its operations.

OHIO.

At the Leadville shaft, near Youngstown, mining has again commenced, and 150 tons of coal per day are brought to the surface.

A correspondent of the *Pittsburg Telegraph* has given quite an elaborate report of the mines of the Tuscarawas Valley. Besides the Pittsburg, Fort Wayne & Chicago, the Tuscarawas Valley & Wheeling, the New York, Pennsylvania & Ohio, and the Cleveland & Mount Vernon railroads, coal will soon be shipped also by the new Wheeling & Lake Erie Railroad and the narrow-gauge Connotton Valley Railroad.

The Sippo Coal Company has a slope opening into its mine, about one mile and a half back from Massillon, to which a branch is run from the Tuscarawas Valley road. This mine was opened something over a year ago under the supervision of Mr. George Phillips. The company has taken out a large amount of excellent coal during the year, but run into a fault, which checked for a while its large production. It has now got through the fault, and is driving entries into a fine piece of coal, turning rooms, and enlarging the works as rapidly as possible.

The mine of the Massillon City Coal Company, better known as the Foltz slope, is about two and a half miles from Massillon. The coal is brought forward over a tram-road, with a Porter locomotive, to its chutes in town. This has been a good producing mine, but will be finished during this year. The underground works are reached by a slope 300 feet in length. This company is also operating the new slope made during the year by the Windsor Coal Company, a short distance from the Foltz slope. It is expected to open up more extensively if the field will hold out as well as is expected. It has already met with difficulties, but hopes to get through them into good coal. It is also operating a drift opening into the No. 6 vein near New Philadelphia, Tuscarawas County.

The Rhodes Coal Company is operating and is interested in some different works near Massillon. The largest is the Mountain shaft, in which the coal is reached by a shaft 133 feet deep. From the Wilcox Bank No. 3, better known as the Groundhog, the coal is shipped by canal during the summer, and by rail in the winter. It will likely be worked out this winter. The Willow shaft and Willow slope, which have been in operation many years, were finished last week and the machinery taken out. The Willow No. 5 is a new slope opening just made, about a quarter of a mile from the Mountain bank. A new tram-road is building to the old chutes. Three miles below Massillon are the two shafts, known as the Warmington and Grove mines. The former has been a good mine, yielding a fine quality of furnace coal, but will be finished during the year. In the Grove, many bad faults have been met with, making the work very expensive.

The fine works of the Massillon Pigeon Run Company are located about three miles southeast of Massillon. The coal is reached by a shaft 180 feet deep. The mine has been kept running pretty steadily, and a large amount of coal has been hoisted from it.

The mine of the O. Young Coal Company, known as the Camp Creek shaft, is located about one mile back from Pigeon Run, on a branch running from Navarre station. The coal here averages about five feet. It is reached by a shaft 177 feet in depth. This company has just sunk and is about ready to commence operating a new shaft three quarters of a mile west of Navarre. The shaft is 113 feet deep, opening into coal four feet four inches in thickness. The machinery is all in position, ready for operation. The company is now driving entries, and will add men as fast as room can be made.

The Fox Lake Coal Company has a new opening made during the year into four and a half foot coal at a depth of 95 feet.

The large mines of the Silver Creek Mining Company are located about a mile from Doylestown, in Wayne County. It is now operating two mines and sinking a new shaft into a new field of coal near Wadsworth, being now down within fifteen feet of the coal. The old drift at Peacock mine is nearly worked out, and it will no doubt be finished during next year. The Silver Creek shaft has been one of the good mines of the valley, producing a large quantity of coal. The underground work is reached by a shaft 85 feet deep. The coal averages about five feet. The mine has run steadily the year round, shipping the coal over the Tuscarawas Valley road.

The Diamond Coal-Works has one of the old mines of the valley, known as the Humphry Slope. The works are entered by a slope 210 feet in length. The coal will average about four and a half feet. The mine having been opened a long time, the workings are consequently a long distance back from the foot of the slope. They are operated steadily, and are good for a long run yet.

Among the new mines opening in the Tuscarawas Valley are the two shafts of the Sugar Creek Coal Company, at Justice, eight miles south of Massillon; the Brewster Coal Company, opposite the Weaver chutes; and the Excelsior Coal Company, which has just begun shipping.

ILLINOIS.

Recently the bed of Prairie Creek broke through into one of the mines of the Chicago, Wilmington & Vermilion Coal Company at Streator. The bed of the stream at the point where the break was made is only 8 or 9 inches above a bed of some 28 feet of quicksand, and the rains of Friday caused pressure enough to break through the bed and the quicksand into the mine. The hole thus made is about 200 by 400 feet. Only four men were working in the mine when the break occurred, and all of them escaped. Most of the implements, and all but two of the mules employed in the shaft, were got out. The loss to the company is estimated at \$100,000. It will require four or five weeks to pump out the mine and repair the break.

KENTUCKY.

The *Ashland Independent* says that the new coal-works built by Lysle, Bailey & Co., in the second pool, Monongahela River, are now completed and ready for business.

On the line of the proposed Paris, Georgetown & Frankfort Railroad is a number of mines. The veins run from three and a half to six feet in thickness, and are located above the beds of the streams of water, which renders it less expensive to mine. The road will penetrate the coal region within 150 miles of Louisville, and it is said that the coal can be placed upon the market at twelve cents a bushel.

MARYLAND.

The Midlothian mine has started again, after lying idle for nearly a year. The recent report of the operations of the Baltimore & Ohio Railroad during its fiscal year 1881 may be quoted as showing how great, relatively, is the importance of coal transportation as compared with that of grain. It is true that the latter is carried greater distances; still, as the following returns will show, the coal trade can fully bear comparison with the grain trade. In order to arrive at an easy basis for comparison, we have assumed grain to weigh 50 lbs. per bushel:

| | 1877-78. | 1878-79. | 1879-80. | 1880-81. |
|---|-----------|-----------|-----------|-----------|
| | Tons. | Tons. | Tons. | Tons. |
| Through merchandise, east and west..... | 1,149,499 | 1,425,629 | 1,980,397 | 2,014,110 |
| Coal and coke carried: | | | | |
| On main stem..... | 1,483,076 | 1,596,004 | 2,255,146 | 2,180,608 |
| Of which for company's use..... | 353,689 | 382,792 | 423,256 | 424,521 |
| On Pittsburg Division..... | 1,363,061 | 1,599,695 | 1,821,256 | 1,980,102 |
| On Trans-Ohio Division..... | 216,998 | 195,278 | 312,454 | 378,917 |
| Total coal..... | 3,063,135 | 3,390,975 | 4,388,856 | 4,539,627 |
| Grain..... | 520,000 | 750,000 | 655,000 | 515,000 |

NEW MEXICO.

Although crippled for lack of miners, the Raton Coal and Coke Company, of Raton, has opened up both the Blossburg and Savage mines, and the daily output is increasing. As soon as all the arrangements are perfected, the erection of coking-ovens will be commenced.

The following details of the Blossburg mines are given by the *Raton News and Press*:

Colliery No. 1 is located on the north side of Dillon Cañon. The vein averages 3 feet 9 inches thick. The main entry is 141 yards long. There is room for ten rooms; only working four now, for lack of miners.

In colliery No. 2, located on the south side of the cañon, the same vein is worked in seven rooms, the main entry being in 115 yards. In No. 3, which is 400 yards east of No. 2, and is opened by a main entry of 147 feet, no work is done, as there are not miners enough. Nos. 4, 5, 6, 8, 9, and 10 are partially opened. In No. 7, in Dunlap Cañon, a 6-foot vein is opening.

The Savage mines, in Raton Cañon, belong to the same concern. No. 1 colliery is located on the west side of the valley, and two miles from the famous Raton railroad tunnel. The vein is 3 feet 9 inches thick, coal being soft, bituminous, clean, and free from sulphur. No powder is needed. The main entry is 150 yards, one side entry 75 yards, another 100 yards long. Twenty rooms have been opened out, all of them working. The daily output is 100 drift cars, an average of nine railroad cars. The difficulty of securing miners is not so great as at Blossburg, as any one who has ever mined can work in this colliery. A branch coal road five eighths of a mile in length, connecting with the main line of the Atchison, Topeka & Santa Fé Railroad, is now operating. No. 2 colliery, opposite No. 1, is soon to be opened.

NEVADA.

Green River coal has been received at Virginia City.

TENNESSEE.

The Dayton Coal and Iron Company, employing much English capital, and having about 38,000 acres of land on the Cincinnati Southern Railroad, thirty-six miles north of Chattanooga, is about to make extensive improvements in its property, one of the first of which will be the erection of fifty coke-ovens.

UTAH.

A correspondent of the *Salt Lake Herald* reports from St. George that coal fit for domestic purposes has been found ten miles from that locality.

The Home Coal Company is taking out about 100 tons of coal daily from its Wabsatch and Crismon mines, and this coal is going to Park City, to all intervening points, and to different parts of Morgan County. Quite a number of teams are engaged in hauling coal, and steady work has to be maintained in the mine to supply the demand. The Utah Eastern is extending a branch line from Coalville to the Home Coal Company's mines, a distance of two and a half miles. Grading is completed and track-laying will probably begin soon.

WEST VIRGINIA.

The Staunton *Virginias* learns from a reliable source that H. C. Frick, with one or more associates, has purchased, after a careful and thorough exploration, the Loup Creek tract of coal land, about 35,000 acres, in Fayette County, West

Virginia. The *Virginias* thinks it surprising that bituminous coal lands in Pennsylvania, containing but two or three beds of workable coal, and remote from transportation and from market, should sell for hundreds of dollars per acre, when lands with four times as much workable coal, equally good in quality and greater in variety, all lying above water-level, on and near the Great Kanawha, an important navigable river, where one line of trunk railroad is completed and another is in progress, and two hundred miles nearer western markets, can be bought at from twenty-five to fifty dollars per acre.

A vein of cannel coal, four feet four inches in thickness, has been discovered on the farm of S. W. Boyd, just west of Bridgeport.

VIRGINIA.

The Henrico Coal Company, of which Hon. W. H. Barnum, of Connecticut, is president, has built a line of road six and a half miles long from its mines at Deep Run, in Henrico County, to Lorraine station, on the Richmond & Alleghany Railroad.

WYOMING.

A correspondent of the *Salt Lake Tribune*, writing from Cheyenne, announces that a forty-foot vein of bituminous coal is opening within one mile of that city. Arrangements are making for transportation by the Union Pacific Railroad.

CANADA.

CAPE BRETON.

Mr. Robert Bellone, of the International & Blockhouse coal mines, Cape Breton, in an interview, stated that the output from Cape Breton mines this year would amount in round figures to 450,000 tons, 70,000 tons more than last season.

COLORADO.

The *Denver Republican* prints the following: That Denver is in immediate danger of a coal famine is an unpleasant fact to contemplate. It is nevertheless true that forty-eight hours of severe cold weather, such as may come upon us any day, would precipitate upon us a real want of fuel. In order to examine thoroughly into this important matter, a *Republican* reporter spent a day among the coal dealers of the city. The result of his inquiries may be stated as follows: First. There is no coal in stock. Dealers have never laid in large stocks of coal because our soft coals can not be stored in large quantities without great loss. Second. The mines are now working to their full capacity, and in many cases their capacity is double what it was last year. In addition to this, many new mines have been opened and are shipping coal this winter that never did before. Third. The railroads are now taxed to their full capacity, furnishing all the coal they can carry, using box-cars as well as flats. Notwithstanding this fact, dealers are short, are compelled to turn away orders every day in many cases, are limiting their customers to a half, or even one quarter of what they order, are compelled to help one another out on their orders, and yet fail to supply the legitimate demand.

LABOR NOTES.

At Grape Creek, Ill., the miners of the Coal Creek, Grape Creek, and Ellsworth mines are still out. A few have gone to work at 80 cents a ton.

The men employed at the Pond Creek mines, Luzerne County, Pa., are on a strike.

The strike at Starkville, Colorado, is ended, and the men have been successful in getting an advance of 20 per cent. Wages, 60 cents per ton for mining, and \$3 per day for company work, etc.

The trouble at the Cannelton (West Virginia) coal mines has subsided. The State militia have returned to their homes. The 400 strikers have disbanded, many of them returning to work.

The strike of the Coal Valley (West Virginia) miners continues. They want 75 cents per ton for mining.

The price paid for mining coal at the works near Latrobe, Pa., ranges from 35 to 40 cents per wagon for run of mine.

One price for mining prevails throughout the Tuscarawas Valley, being 95 cents per ton over an inch and an eighth screen, and 85 cents weighed in the mine wagon, 2100 pounds to the ton, allowing the 100 for slack. Four-foot coal is the standard, and for every three inches under the standard five cents per ton are added to the mining price.

The following are the wages paid by the Raton Coal and Coke Company at the Raton mines, New Mexico: Miners, \$1 per car, of about 1600 pounds; day work, \$2.50 per day; yardage, \$1 to \$9 per yard; laborers, \$2 per day; some skilled laborers, \$2.50. Average amount earned by miners and laborers each, above expenses, excepting board, during October, \$66.67. Board, \$4.50 to \$5 per week.

The miners of the Wellston and Jackson collieries are governed by the Hocking Valley prices, receiving 80 cents a ton. On the Springfield Southern Railroad, 85 cents is paid per ton.

GENERAL MINING NEWS.

ARIZONA.

DOS CABEZAS DISTRICT.

CINCINNATI & PITTSBURG.—The new 20-stamp mill is nearly ready for operations. The company owns several promising mines in the district, and proposes to do custom work.

COMMONWEALTH.—Work is pushed vigorously at this company's mines. A large force is at work upon the Bear Cave mine, which is said to show a large body of rich ore.

GLOBE DISTRICT.

OLD DOMINION.—The officers report that the new strike in the New York mine, belonging to the company, is a parallel ledge south of the main tunnel. This ledge was struck in cross-cutting. It is over six feet wide, and is solid, so that there will be no waste or low-grade ore. Average assays yield 30 to 45 per cent copper.

HOOSIER.—This copper mine, says the *Silver Belt*, is looking well, and producing ore steadily. The amount of openings in ore reaches nearly 200 feet. The seam varies in width from 8 to 20 feet. The latest development is in the working tunnel, which has reached the iron capping overlying the vein. This proves the vein at a depth of 250 feet from the top working. There are 650 tons of ore on the dump, averaging 18 per cent.

WARREN DISTRICT.

COPPER QUEEN.—The *Tombstone Epitaph* says: The third level has been connected with the incline, and will, in about 25 or 30 feet farther, have penetrated the great ore-body with the incline, which will thence be connected at the same angle (45 degrees) indefinitely into or through the ore, should that body retain its present dip into the mountain. Every thing in and about the mine and works is running along prosperously.

NEPTUNE.—The superintendent reports that the smelter at Hereford turned out 30,000 pounds of copper in a three days' run. The smelter has been shut down on account of lack of water in the well. The company has put a dam in the San Pedro, and by a ditch turned a large flow from the river into the well, the surplus being again turned into the stream through a sluice-way below the works.

PIONEER DISTRICT.

GEM.—The mill will start shortly. Most of the defective machinery, which caused so much delay, has been replaced.

CALIFORNIA.

THE BODIE DISTRICT.

There have been but few features of interest developed in the mines of this district, the reports for the week ending the 19th ult., consisting mainly, as for some time past, of "great expectations." The Bodie Consolidated is sending out about 100 tons of ore per week, and the yield for the week ending the 19th inst. was \$6035.54. The usual progress has been made in the underground workings, without showing up anything new. The north drift of the Lent shaft—sunk jointly by this company and Mono—is in favorable formation. Bulwer Consolidated presents its stereotyped report of progress. Standard Consolidated shipped during the week ending the 19th bullion valued at \$36,631.41. The shaft of the Goodshaw is sinking; only one shift of men is at work, on account of the flow of water. Below will be found reports in detail of some of the more important mines of the district for the week ending November 19th:

BODIE CONSOLIDATED.—Winze No. 13 has been sunk 15 feet along the line of contact of the Fortuna with the red vein, and the winze is in good ore. The north drift from winze No. 9 is now in 24 feet, and the opposite south drift is 26 feet in length. In neither drift is there very essential change since last report. From winze No. 6, the north drift has been advanced 5 feet, through hard rock. This drift will probably be connected with that south from No. 9 winze by to-morrow. The new stopes opened south from uprise winze No. 14 are in excellent ore, as are those above the main north drift, 6th level; but in all of the present stopes the vein is narrow.

BULWER CONSOLIDATED.—The west cross-cut from the south drift on the 500-foot level of the Standard mine is in 212 feet; progress since last report, 11 feet. The west cross-cut from the 1000-foot level of the Standard shaft is in 348 feet from the shaft; progress for the week, 10 feet.

NOONDAY.—The east cross-cut from No. 1 vein, 512-foot level, is out 120 feet. Quartz continues to be found in bunches and stringers. An uprise has been started between the 512 and 412-foot levels in the east prong of No. 1 vein, which is up 10 feet and in fair grade milling ore. Ore is stoped and milled from the 212, 312, 412, and 512-foot levels.

STANDARD CONSOLIDATED.—An accident prevented sinking in the shaft during the first part of the week; consequently only 6 feet were added to its depth. The rock in the bottom is very hard. The east cross-cut, 1000-foot level, has been run since last report 10 feet; total length, 434 feet. There is no change to note. The west cross-cut is in 348 feet; progress, 10 feet. The face is in hard blasting rock. The west cross-cut from the south drift, 500-foot level, is in 212 feet. The rock is hard. The usual progress was made in the other drifts. The uprise on the Cook ledge is up 60 feet. The vein carries good ore. All of the stopes look well and are yielding good ore.

TIOGA.—For the week, the measurements were as follows: 982-foot level, north lateral drift east of the shaft, has been advanced 13 feet; total length, 444 feet. There is no change to report in this drift since last writing. The rock continues very hard. The north lateral drift from the same level, west of the shaft, has been extended 11 feet, making a total length of 144 feet. The greatest flow of water has been from the east cross-cut, but it has of late been receding very perceptibly.

GREENVILLE DISTRICT.

GREEN MOUNTAIN.—The superintendent reports that the uprise through the sulphuret ledge is still holding its great strength, showing immense reserves of ore in this chimney, exclusive of the main ore-body of the mine. The new ledge averages the same in quality as far as the rise has tested it. The plant is in perfect order, and every thing is running well.

RISEING SUN.—The report of the superintendent of this mine states that excellent ore is now opening out in the western part of the mine. These reserves were prospected some time ago, but the drift and winze development is just reaching them, and stoping will be pushed rapidly. The expenses of the mine have been reduced and every thing is in first-class order.

CANADA.

PROVINCE OF QUEBEC.

The excitement of phosphate mining in the county of Ottawa is on the increase. It is stated that the High Rock mine in Portland is going to employ 500 men this winter if they can get them. The Tommo Lake mines are worked extensively by the French Company and Mr. Haycock. They will employ 200 teams this winter in hauling ore to the railroad, and bringing back supplies. Several of the Templeton mines are opening, and large forces of men are at work. The Canada mine and the McFarlane mine have been opened quite recently with good prospects. Mining operations will be conducted on a much more extensive basis next spring when the snow goes, if this winter's work turns out to be profitable.

NOVA SCOTIA.

An official dispatch from Halifax to the New York office of the Hall-Anderson Gold Mining Company says: Ship you gold brick, \$1760. Mill running regularly. Serpent lode better than ever. Will raise 30 tons from it next week.

COLORADO.

BOULDER COUNTY.

The *Denver Republican* says: The present yield of the free-milling ore from some of the mines in Boulder County is assuming considerable proportions and attracting the attention of capitalists. The old Ni-Wot mine is reported to be turning out enough ore to supply fifty stamps constantly, with the promise of an increasing and permanent production, and several other lodes which have for some time been idle are producing ore of good grade and in paying quantities. There is no good reason why this district in Boulder County should not yield a large share of the gold product of the State. In former days, a great deal of gold was cleaned up from its various leads and placers, and though the latter have been pretty generally worked out, the leads are as rich and promising as ever. Many of them would be yielding richly to-day if they had milling facilities equal to those existing in Gilpin County. We heard some time ago that a new mill was projected at or near Gold Hill, and hope that by another season it may be in operation, though the report is, that the necessary capital has not yet been raised. Although the mines of this gold belt are not as numerous as those of the Gilpin County belt, there are some which have yielded ore as rich as any ever mined in the State. The contract for 10,000 tons of low-grade ore from the Prussians, for concentration, marks an important advance in the interests of the section. Hundreds of thousands of tons of low-grade material are now on the dumps there; and if they can be made available by concentration, even though at a small margin, the effect will soon appear in greatly increased activity. It seems highly probable that the result of the present operations will be a season of marked prosperity in the district.

CLEAR CREEK COUNTY.

PAY ROCK.—The product of this mine has slightly increased, and there are now 64 lessees and 18 contractors at work in the mine. Fourteen men are at work on the lowest level, drifting, stoping, and cross-cutting, and taking out good ore. The royalties of the lessees range from 20 to 35 per cent.

PELICOAN-DIVES.—The *Georgetown Courier* says that work in staking the

Pelican-Dives main shaft has been suspended for about three weeks, on account of the flow of water being so strong that a pump will be necessary to keep the shaft clear while sinking is progressing. The shaft is 850 feet deep; and after water was encountered a level was started west about 25 feet from the bottom, which now has been driven over 30 feet, and a cross-cut has been started from it which will be driven to the north wall of the lode. Nothing new of importance has yet been developed in the lower workings. There are over 60 men employed in the mine, from 40 to 50 of them being lessees.

LAKE COUNTY.

The Leadville *Chronicle* thinks that should the recent discovery of ore in and below the lime in the Iron mine extend to other mines on Iron and Carbonate hill, the old scheme for tunneling those hills from a point somewhere near Leadville or California Gulch will probably be revived. Such a tunnel would not only serve the purpose of draining the mountain of water—which deep workings are sure to strike—but would afford a cheaper scheme for working the mines than the present system of working by shafts and tunnels high up on the hillsides. There are many who believe that ultimately the California & Colorado tunnel will be extended under both Carbonate and Iron hills, and connected by cross-cuts with all the great mines.

AMIE.—The drill on this property has reached a depth of 460 feet. No mineral has yet been struck by the drill.

EVENING STAR.—The production has been increased to about 80 tons a day. The grade is good, and the underground workings are reported to be in first-class condition.

IRON.—The Rock and Dome mines belonging to this group are showing up well and sending out considerable ore. Of the Iron mine the Leadville *Herald* says: The Iron mine has from its earliest infancy—and that dates back to the days when Leadville was unknown—been among the very prominent mines of Lake County. It has been a constant producer at all times and under all circumstances, and has afforded employment to more men than any mine in the Carbonate camp. At present, the mine is looking better than at any time before, and from information learned from one who has recently visited it, is capable of the present large production for an indefinite time in the future. The shipments are at present about 220 tons daily, coming from the different shafts and inclines on the entire property. In conversation with a smelting man who is purchasing and has purchased a large amount of iron ore, it was learned that the net value of the ore over and above smelting charges is about \$18 to \$20 a ton. The charge for hauling is say \$1 a ton, and the expenses of mining \$5. It would thus be seen a net profit is derived over all expenses, at a low estimate, of fully \$12 a ton. This would yield a net profit to the company of \$2500 a day, or say \$65,000 a month.

LA PLATA.—This mine has a sixty days' supply of ore on hand at the smelters, and is shipping on an average 50 tons of ore per day. The Montgomery shaft on the opposite side of the gulch from the mine was leased a short time ago, and the lessees have struck a promising body of ore.

ROBERT E. LEE.—The new machinery on the new shaft of this mine was started up on the 23d ult., and the lower levels of the mine can now be worked to good advantage, without further trouble from the water. During the last few months, when work in the lower part of the mines was impossible, the company has been taking out ore from the upper levels, and, it is said, has realized handsomely from it. The Leadville *Democrat* says of the recent strike: The drift had been driven in sixteen feet when an immense body of almost pure chlorides was struck. The entire extent of the ore-body is five feet, all of which is pay mineral, while three feet of it runs 6000 ounces of silver to the ton. This is the result at a distance of only sixteen feet from the mouth of the drift, and the ore is improving as the work advances. No. 5, due east from the old workings, has always been supposed to be barren ground, but recent developments have proved that this supposition was a great mistake. A rich body of mineral six feet in extent has just been struck in these workings, five feet of which runs 984 ounces of silver to the ton, the lowest assay in the whole body being 200 ounces. Above the old workings, and running south from the Matchless line, another body of rich mineral has been struck, running 360 ounces of silver to the ton.

SUMMIT COUNTY.

GOLD PARK.—The superintendent of the Gold Park mine, Summit County, Colo., writes, under date of November 11th, as follows: Have finished the Pelican hoisting-works, and am now trimming down the shaft. I expect to start sinking the shaft next week. The ore is about 7 feet wide, and most all of it is high grade. I shall sink the shaft 50 feet, and shall then drift on the vein east and west. When this is done we can expect our best returns, as the Pelican ore is richer than any of the other mines we are working. The Mollie lower tunnel still continues to look well at present. I can not give the width of the ore-body, as it is wider than the drift (5 feet wide). My last assay from the end of drift was \$64 a share; had many much higher. I am sinking the Mollie shaft to connect with this drift. When that is completed, I shall be able to produce enough ore from this mine alone to supply 40 stamps.

DAKOTA.

A company has been incorporated to work the Celia and Alice mica mines, on the south side of Grizzly Gulch, about three miles from the town of Harney.

FATHER DE SMET.—The superintendent reports for the week ending November 23d that 1000 tons of ore were extracted from the first level, 800 tons from second level and 30 tons from third level. During the week, 1930 tons of ore were milled. The north-end tunnel is in 302 feet, and the south header, Golden Gate, is in 28 feet.

IDAHO.

BOSTON.—The *Avalanche* of the 19th ult. says: At the mines of the Boston Company, work is progressing favorably, with no particular change to report, except that the vein in the eighth-level drift of the War Eagle is improving as progress is made. The ore-body has been fairly encountered, and shows up much better than in the seventh level. The mill dropped its stamps Thursday, and will turn out some bullion within the next few weeks.

PHILADELPHIA MINING AND SMELTING COMPANY.—The works of this company, at Ketchum, during its three weeks' run, turned out bullion valued at \$80,000.

MICHIGAN.

IRON ORE SHIPMENTS.—The following table exhibits, in gross tons, the total lake shipments of iron ore the present season, up to and including November 23d, together with the amount shipped during the corresponding period last year:

| Where from. | 1880. | 1881. |
|----------------|-----------|-----------|
| Escanaba..... | ..... | 1,438,042 |
| Marquette..... | ..... | 707,772 |
| L'Anse..... | ..... | 53,963 |
| Total..... | 1,850,615 | 2,199,477 |

An increase of 348,852 gross tons.

MONTANA.

ALTA-MONTANA.—A report states that this company has found in the winze sunk in the Bonanza cross-cut from the Cole Saunders tunnel of the Alta mine the largest and richest body of ore ever found in the mine. Seven feet average over 100 ounces silver per ton and 50 per cent lead.

LEGAL TENDER.—The recent strike in this mine continues good.

BUTTE DISTRICT.

From the Butte *Miner* we condense the following:

ANSELMO.—No sinking has been done for some time past, but work has pro-

gressed steadily in all the levels. Since the shaft reached the depth of 350 feet, development has been going on, prosecuting east and west drifts of the 350-foot level, while stoping has continued vigorously from the upper levels down. The east drift on the 350-foot level is in 200 feet from the west shaft, showing a three-foot body of ore, which averages 100 ounces. About a week ago, the ore-body was struck at a distance of about 170 feet east from the west shaft, and has been followed steadily ever since. On the 300-foot level, stoping is going busily on, and a great deal of ore is taken out, averaging 100 ounces.

BELLE OF BUTTE.—A rich ore-body has been struck on the 160-foot level in the south cross-cut, some six or eight feet from the shaft. The vein has already been cut into the depth of six feet at this point, showing a continuous body of most promising ore, with the other wall not yet in sight. A station is now being put in at the 160-foot level.

MAGNA CHARTA.—A rich development has been made. About 20 tons of high-grade ore have been taken out from the 300-foot level. The shaft is now down 310 feet. In the cross-cut south on the 200-foot level a five-foot vein was uncovered about 80 feet from the shaft. This ore is first-class, and is part of the same vein which was struck on the 300-foot level. The Howland pulverizer has not been in operation for several days, on account of a deficiency of water for its pans and settlers. It will require a good deal of pipe, and considerable time and trouble to bring water over from the Alice.

STEVENS.—Sinking has been begun in the old west shaft, in which work was stopped on account of water some six weeks ago. On the 200-foot level, in the shaft, a drift will be run east to meet the west drift on the 200-foot level in the main shaft.

NEVADA.

NEVADA SODA BEDS.—Twenty miles south of Wadsworth, says the Reno *Gazette*, lies a supply of soda that is extensively worked. There are two lakes, with a ridge a quarter of a mile between them. The water is pumped into vats and evaporated, and then the soda is scraped up and spread out under a shed for the water to dry out before it is shipped. There are a good many hundred tons piled up there now.

COMSTOCK LODGE.

The Gold Hill *News* of the 23d ult. thus summarizes the situation on the Comstock:

The north end mines are doing the usual work. Nothing new need be looked for in that direction until connection is made by the drifts from the Union shafts and the joint Union Consolidated and Sierra Nevada winze. That connection will give plenty of air, do away with the necessity of pumping water 200 feet by compressed air—which is a costly process—and enable work to be done to advantage. The connection will be made inside of a month. A new drift was started to-day at the Gould & Curry and Best & Belcher shaft, to connect with the Consolidated Virginia 2300 level. The drift will run northwest and will cross the ledge, therefore it is really cross-cutting. Work is progressing well in the middle mines. Monday next, the Savage drift from the Combination shaft will be under the incline, the water will be immediately drained off by a drill, and an uprise started to connect the two. When connection is made between the Savage drift and the incline, the Chollar and Potosi will then be worked again. Work in them is but suspended so as to furnish the necessary air to the men in the Savage drift. The work in the Yellow Jacket is about the same as heretofore reported. There is a slight increase of water in the north lateral drift on the 3,000 level. The Alpha and Imperial are placing larger air-pipes in the incline down to the 2000 level, that they may have plenty of air when work is resumed.

NEW MEXICO.

An official dispatch from the Bremen mine, Silver City, November 26th, says: In north end have found large quartz vein; average assay to-day, \$1000 per ton.

UTAH.

The Silver Reef *Miner* of November 19th reports upon the mines of that district as follows:

BARBEE & WALKER.—The late strike of ore in the winze driven from the fourth north level has steadily improved, and is yielding handsomely. The main incline is driven down with eight-hour shifts, and will be sunk 100 feet from the present station. The mine throughout is looking well.

CHRISTY.—In the California, the ore-bodies are all showing well, especially in the third and fourth levels north, in which splendid developments have recently been made. At the Maggie and Silver Flat, work continues, with the usual flattering results. In shaft No. 4, on Tecumseh ground, good-grade ore has been encountered in the south and east drifts from the bottom. The new hoisting-works at the Maggie will be completed by the first of January.

GOLD BASIN MILL.—The Silver Reef *Miner* states that the experimental ten days' run of Messrs. Davis, Ridenour & Co.'s three-stamp mill at Gold Basin cleaned up \$2052.94 from 60 tons of ore from the Patterson mine. Every thing is reported running smoothly, and a continuous product may be looked for from this source in future.

LEEDS.—The ore from the Bonanza shaft is proving of much better grade than that previously taken from the east incline, and will help to increase the mill product very considerably.

STORMONT.—As the fourth south level from the Savage shaft has advanced, the ore has improved very considerably, and now shows a strong four-foot vein of characteristic Buckeye ore in the face. This is considered of more than ordinary importance, from the fact that the same character of ore was encountered above, and in each of which the grade improved with depth. In the north developments the showing continues favorable. Winze 15, from third to fourth levels, is in ore, and driven down as rapidly as possible.

WYOMING.

Mining prospects in the vicinity of Laramie and Cummins cities are, according to the *Boomerang*, very encouraging. The Jehu Mountain Mining Company is preparing to work several of its claims. There are also indications that the oil-lands in the western part of the territory will shortly be opened up. In noticing the return of several gentlemen who were examining the land, the Cheyenne *Leader* says: It is understood that their work was eminently satisfactory, and the prospects sufficiently promising to warrant an investment which will be made, and Wyoming will soon take its place as one of the oil-producing regions of the country.

ASSAY DEPARTMENT OF THE ENGINEERING AND MINING JOURNAL.

This department is opened for the benefit of miners, prospectors, and others interested in minerals.

Replies will be made in these columns, and *without charge*, to questions asked regarding the nature and commercial value of minerals, and of samples sent.

Assays, determining the actual composition and value of ores, will be made at the following rates. All assays are made with the utmost care by the most experienced and competent assayers:

| | | | | | |
|------------------------|--------|-----------------------|--------|---------------------|--------|
| Assay for gold..... | \$3.50 | Assay for copper..... | \$3.00 | Assay for iron..... | \$4.00 |
| " silver..... | 3.00 | " lead (wet)..... | 3.00 | " nickel and | |
| " gold and silver 5.00 | | " zinc..... | 5.00 | " cobalt..... | 10.00 |

The amount should invariably accompany the order, and expressage or postage must always be prepaid.

Communications, samples, etc., to be addressed to

ENGINEERING AND MINING JOURNAL, 27 Park Place, New York
(P.O. Box 3381,

FINANCIAL.

Gold and Silver Stocks.

New York, Friday Evening, Dec. 2, 1881.

The business of the past week has been extraordinarily large, aggregating 1,303,285 shares. The tone of the market has been great demoralization. There seems to have been a stop to the decline to-day. How long the upward tendency will continue it is difficult to say. With the treatment the public has had in the last six months, it is strange that there is a market for any mining stock. That new crops of fools are constantly coming up is verified by the mining stock markets of several years past.

The Tuscarora stocks have been very quiet, and as usual of late, without a feature worthy of note.

The Bodie stocks have been fairly active. Bodie, under sales of 1340 shares, has ranged between \$4 1/4 @ \$4 1/2. Standard has been more active under its Christmas present dividend, but does not improve much; the sales aggregate 2535 shares at \$22 @ \$23 1/2. Boston Consolidated has sold to the extent of 53,900 shares at 28 @ 45c. Bulwer has been unusually active and strong, advancing from \$2 @ \$3.05, with sales of 4195 shares. The other stocks are without feature.

The Comstock shares show a very fair business and quite an improvement. The dispatches from San Francisco indicate that the milking is to be again resumed. California record sales of 9525 shares at 48 @ 65c. Consolidated Virginia advanced from \$1.70 @ \$2, with sales of 15,530 shares. Consolidated Imperial ranged between 8 @ 14c, with a business of 5700 shares. Leviathan, a stock not worth the value of the paper upon which it is printed, sold at 20 @ 35c. a share. Union has been the leading feature, advancing from \$10 1/2 @ \$16. The rest of the list has had fair dealings at advancing prices.

Alice joins in the general demoralization, and has declined from \$5 1/2 @ \$3.95, with sales of 2900 shares. Chrysolite has had a moderate business at \$5 1/2 @ \$4.45. Green Mountain sold at \$2.75 on Saturday and \$3 1/2 to-day, with transactions for the week of 4700 shares. Horn-Silver has declined from \$16 @ \$15, on sales of 1115 shares. Amie sold down to 15c. to-day. Iron Silver has been active and one of the strongest stocks on the list; the sales amount to 13,950 shares at \$2 @ \$2.15. Leadville has been fairly active and steady at \$1.30 @ \$1.15. Little Pittsburg has declined to \$1.75. Robinson Consolidated still continues to be the feature of the dealings, declining from \$8 1/2 @ \$3.90, and selling back to \$6 1/4, the aggregate of transactions being 311,561 shares.

Barcelona has been quite active, the sales aggregating 37,400 shares at 42 @ 16c. Bradshaw has been active and irregular, advancing from 49 @ 80c., and declining to 69c.; the sales aggregate 77,900 shares. Central Arizona has been quiet, at one time touching 75c., and reacting again to \$1.35. North State declined from 45 @ 24c., with sales of 14,500 shares. Oriental & Miller has been active and irregular, the sales amounting to 56,500 shares at 49 @ 29 @ 40c. Silver Cliff has been exceedingly strong and active; the sales aggregate 25,400 shares at \$2 @ \$3.88. Silver Nugget, new, declined from 15 @ 5c., with sales of 34,400 shares. South Pacific has been very active, irregular, and weak. The sales amount to 54,750 shares at \$8 @ \$10 @ \$3.75. All of our investigations, however, lead us to the belief that the transactions reported are in most cases mere "washes." We have been as yet unable to discover a legitimate holder of the stock outside of the insiders. The State Lines continue to receive the same attention as heretofore. Nos. 1 and 4, with sales of 35,200 shares, declined from 39 @ 22c. Nos. 2 and 3 declined from \$1.65 @ 90c. with sales of 309,800 shares. Sutro Tunnel has been fairly active within the range of \$1 @ \$1.25, the sales aggregating 27,500 shares.

When Robinson Consolidated was selling at about \$10 per share, we informed the public that it was not worth that figure, and we did what we could to prevent the impending "deal" and the immense losses it would entail to outsiders. The management became indignant at what was termed an unjustifiable attack, and the secretary, being interviewed, contradicted the statements which we then made.

We quote the following from the Tribune, which finds no contradiction, simply because the deal has been successful:

LEADVILLE, COLO., Nov. 30.—Henry Wolcott, manager of

DIVIDEND-PAYING MINES.

Table with columns: NAME AND LOCATION OF COMPANY, SHARES, ASSESSMENTS, DIVIDENDS, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE. Rows include Alice, Amie, Bodie, Comstock, etc.

* Non-assessable. † The Deadwood mine paid in dividends, previous to the consolidation, \$275,000, and the Golden Terra paid \$75,000.

SALES.—Alice, 2900; Amie Consolidated, 7300; Belle Isle, 100; Bodie Consolidated, 1340; California, 9525; Carbon, 500; Chrysolite, 7508; Climax, 3700; Consolidated Virginia, 15,500; Copper Knob, 12,500; Dunkin, 20; Eureka Consolidated, 4700; Excelsior, 100; Father de Smet, 225; Findley, 100; Gold Stripe, 1900; Green Mountain, 1200; Hibernia, 600; Homestake, 950; Horn-Silver, 1115; Hukill, 803; Iron Silver, 13,950; La Plata, 290; Leadville Consolidated, 4650; Little Chief, 1300; Little Pittsburg, 100; Navajo, 160; New York & Colorado, 200; Northern Belle, 240; North Belle Isle, 80; Ophir, 141; Quicksilver, Preferred, 400; Common, 500; Rising Sun, 2100; Robinson Consolidated, 311,561; Sierra Nevada, 615; Spring Valley, 100; Standard, 2633; Stormont, 600; Tip-Top, 59; Yellow Jacket, 100. Dividend shares sold, 449,555.

the Boston & Colorado Smelting-Works at Denver, is now here. He states that his smelter loaned the Robinson Consolidated Mining Company \$90,000 to pay the last dividend, and that at present there still over \$30,000 due over and above the value of all the ore delivered. The company has also \$32,000 more to pay on the 1st of December to settle the Jacque compromise. A party just arrived from Robinson states that fifty men were discharged to-day, leaving only a small prospecting force, and shipments will be cut down to very little. All the valuable ore seems to have been taken from the mine.

Robinson Consolidated was the chief topic of conversation at the mining exchanges yesterday, and brokers as well as shareholders were evidently anxious over the situation, as the failure of the mine in the face of recent favorable reports from Manager Ewing and others will tend to destroy what little confidence the public still retains in the mining business and those connected with it.

The officers of the company offered no new theories concerning the decline in the stock; but while awaiting the explanations which are promised from the late manager, Thomas Ewing, express their confidence in Ashburner's report that the 51,000 tons of ore now in sight will yield over \$2,000,000 net. On the other hand are the statements contained in the Leadville dispatch to the Tribune, published yesterday. That the trustees of the company will decide to pass the December dividend at their meeting to-day seems to be a foregone conclusion, as it was openly stated by the officers yesterday that the necessary funds were not at their command for its payment. The situation seems to be an exceedingly grave one, and, as President Ives remarked last evening: "There has been a good deal of pretty tall lying going on somewhere."

Brayton Ives, President of the Robinson Consolidated Mining Company, yesterday received the following dispatch from Manager Stevens, at the mine:

Shipped at once three days' 334 tons ore; assays eighty ounces silver. Mine does not look encouraging. Manager Stevens was instructed by telegraph to explain the meaning of his dispatch, and to state how many miners, if any, had been discharged from the mine and the reasons therefor. The trustees, at their meeting yesterday afternoon, examined the accounts in the New York office, and after informally discussing the situation, adjourned without declaring the December dividend.

The mining market to-day is one where men of reputation cover themselves with the reports of men of but little or no standing, get up "deals," sell the stock to the public, and then in the most innocent way say that they have been deceived. They do not, however, say that they were so wise as to fear that something might happen, and had therefore unloaded and pocketed a handsome profit. The Eastern public to-day is submitting to treatment from the majority of mining superintendents which, if practiced on a Western people, would result in a tree, a rope, and a man attached.

To-night's Graphic says:

William A. Farish, General Manager of the State Line mines, came before the officers and directors of the company at their office, No. 39 Broadway, this morning, to read his report. One of the directors made a statement in substance as follows concerning the report and the proceedings: "The report stated that Mr. Alley, President of the companies, had told Mr. Farish that he would buy and put in the name of Farish a large block of the stock if he found, on getting to the mines, that the ore was

NON-DIVIDEND PAYING MINES.

Table with columns: NAME AND LOCATION OF COMPANY, NUMBER OF SHARES, Par., ASSESMENTS, Date and amount of last, HIGHEST AND LOWEST PRICES PER SHARE AT WHICH SALES WERE MADE (Nov. 26, Nov. 28, Nov. 29, Nov. 30, Dec. 1, Dec. 2).

VALUATION.—Altoz, 31; Barstow, 37.40; Best & Bole, 61; By, 10; ... Total shares sold at all the exchanges, 1,363,235.

valuable. Farish was further strongly advised by a friend of his named Davis, a great expert that the mines were very good, and he should get the superintendency if he could.

present adverse report was in the face of thirty-two favorable statements, and that therefore they did not believe that the ore is so poor.

appointed. There are nearly 3000 tons on the dump at the mines, which will be immediately milled, and then only can the stockholders know where they stand.

The World says: At a recent meeting of the directors of the Homestake Mining Company, a resolution was passed recommending a consolidation of that company with the Giant & Old Abe Mining Company.

UNLISTED QUOTATIONS. Mr. L. V. DeForest, No. 70 Broadway, under date of December 2d, 3 P.M., reports the current quotations of unlisted stocks as follows:

The Barclay Coal Company has declared its usual dividend.

The Leadville Consolidated Mining Company has declared a dividend of 5c. per share, payable December 15th.

The Morning Star Consolidated Mining Company has declared a dividend (No. 2) of 2 1/2 per cent on the capital stock, payable December 8th.

The Spring Mountain Coal Company has declared a semi-annual dividend of 3 1/2 per cent, payable December 10th.

The Standard Consolidated Mining Company has declared its regular monthly dividend of 75c. per share; also an extra dividend of 75c. per share; both payable on the 12th inst.

The St. Joseph Lead Company has declared the regular quarterly dividend of 2 per cent upon its capital stock, payable December 6th.

The Tombstone Mill and Mining Company has declared the regular monthly dividend of 10c. per share, payable December 15th.

REVIEW OF THE SAN FRANCISCO MARKET. A slight improvement has taken place in a few of the San Francisco stocks, notably Union Consolidated and Sierra Nevada.

Recent telegraphic advices state that the drill running on the 2500 level of Mexican is in ore which yields high assays. Eighty tons of ore are extracted from the Savage mine daily.

It is stated that the ventilation of mines from the Consolidated Virginia northward is steadily improving, in some degree owing to the cold weather.

Copper and Silver Stocks. Reported by C. H. Smith, 15 Congress street, Boston, Stock Broker and Member of the Boston Mining and Stock Exchanges.

The market for copper stocks the past week shows a decided improvement over the past two months, and it looks as if the long-expected boom in this class of stock

value, the following figures, where they relate to silver bullion, should be diminished by about 13 3/4 per cent to arrive at actual value

Table with columns: MINERS, States, For the week, Month of November, Year from Jan. 1st, 1881. Lists various mines and their production values.

Total amount of shipments to date. \$22,894,392

Bullion Receipts at New York.—The bullion received from the mines at the various offices in this city during the week ending December 2d, as compiled from various sources, amounted to \$491,763.28, as against \$160,950.59 reported for the previous week.

Exports of Gold and Silver from New York. Week ending December 26th. Corresponding week last year. Since January 1st. Corresponding period last year.

Gold from Australia.—The steamer Zealandia, which arrived at San Francisco November 28th, from Australia, brought in gold bars and sovereigns \$1,400,000, which will go into the Mint here.

United States Mint.—The coinage at the United States Mint in Philadelphia during the month of November aggregated 7,285,000 pieces, valued at \$7,693,400.

Imports of Gold and Silver Coin and Bullion.—The Chief of the Bureau of Statistics, in his fourth monthly statement for the current fiscal year, says: The excess of imports of gold and silver coin and bullion was as follows:

Table with columns: Month ended, Amount. Lists monthly import values for gold and silver.

METALS.

NEW YORK, Friday Evening, Dec. 2.

The general situation has but little changed since our last.

Copper.—The strength in this metal continues, and while sales have been on a limited scale only, from 19 1/2 @ 19 1/4c, the higher figure is now generally asked, while for futures 19 1/4c is demanded. Balti-

more copper, which is reported to be scarce, commands the same prices as Lake.

We have the following mail advices from London:

Nov. 11th. Holders of Chili Bars are firm at £63 3/4 for g. o. bs. cash, at which they effected moderate sales to-day, and were open to accept further orders at same figure at close of second 'Change.

Nov. 14th. Chili Charters came to hand this morning, comprising 500 tons Bars and Ingots for England, 200 tons Bars for France.

Table with columns: Charters, Tons, 1881, 1879, 1878. Lists charter statistics for various periods.

Price of Bars at Valparaiso on 11th inst. was \$18.55, Exchange, 34d., which, with steamer freight of 60s., is equal to £64 1/2 Liverpool, without commission to merchants on either side.

Nov. 15th. Chili Bars show a further improvement and a brisk trade doing, while orders are difficult to execute at the quotations nominally ruling.

Nov. 16th. The demand for Chili Bars continues active, and we note large sales again to-day, accompanied by a rise of from 10@15s. per ton in market values.

Nov. 17th. Chili Bars opened quietly, but a renewed demand soon sprang up, and we closed with a strong market, there being perhaps rather buyers than sellers at top rates.

The monthly returns of the Bureau of Statistics carry the figures forward to the close of September, thus embracing nine months, in pounds:

Table with columns: Imports, Re-exports, Net imports, Exports. Lists monthly trade statistics.

We may add that, during the first nine months of the year, about 4000 tons of ore were imported, which probably were chiefly Canadian pyrites, running between 8 to 10 per cent of copper.

Tin.—Since the report that the sale of 23,300 slabs of Banca tin by the Netherland Trading Society had realized high prices, the market here has developed additional firmness, which the statistical position of the metal would seem to warrant.

From London our mail advices are as follows: Nov. 11th. A very excited market, accompanied by large transactions, both in spot and forward metal.

Business was done as follows: Sharp cash, 98 3/4 @ 99 1/8s.; fourteen days, 98 3/4 @ 99 1/4s.; one month, 99 1/4 @ 99 1/2s.;

The Dutch Trading Company has declared 23,300 slabs of Banca for sale on the 30th inst. Nov. 14th. Is also higher in price, with an active trade taking place daily.

Nov. 15th. Speculation for the rise continues, a good business being reported as follows: Sharp cash, 101 1/4 @ 102 1/4s.;

Nov. 16th. Quotations have been forced up some 25 per cent since yesterday, but the market again closed with an unsettled appearance.

Nov. 17th. At beginning of first 'Change, small sales were made at 105 1/4s. three months, 104 1/2s. fourteen days, 104 1/4s. sharp cash, but a sharp decline then took place.

According to the returns of the Bureau of Statistics, the import movement of tin has been as follows, during the first nine months of the year, in cwt.:

Table with columns: Imports, Re-exports, Net imports. Lists tin import statistics for September, 1881, and previous years.

Stock, November 1st. Imports — Straits and Malacca into New York. Australian into New York. Billiton and Banca. L. & F.

Consumption. Shipments to Europe. Total spot stocks. Afloat to date: Straits and Malacca—Sept., Oct., Nov. shipments by sail, steam.

During the week, there have been sales about 700 tons at figures going upward from our last quotation to 23c. at the close, when the market is in an excited condition.

Tin Plates.—Dull but very strong, owing to light stocks here and strong foreign markets, coke tins being quoted at 17s. 3d. @ 17s. 6d. in Liverpool.

Messrs. Robert Crooks & Co., of Liverpool, under date of November 16th, say of tin and terne plates: This market continued sluggish all round until the beginning of the week.

Lead.—The market has been dull and quiet, 5 1/2 @ 5 1/4c. being asked, but not being realized except for retail lots. About 300 tons of a Western brand are reported as having changed hands at 5 5/8c.

supplies they use from outside sources. In the West, lead is quiet, selling at St. Louis for 4'80c@4'90c. and at Chicago at 5c. In refined lead, there have been some sales at 5'10c., and 5'20@5'25c. is now asked.

For the first nine months ending September 30th, the imports and exports of lead were, in tons of 2000 pounds :

Table with 4 columns: Imports, Re-exports, September 1881, 9 mos. 1881, 9 mos. 1880.

The shipments of lead over the St. Louis & San Francisco Railroad to St. Louis during the week ended November 21st amounted to 136 tons.

Spelter and Zinc.—The scarcity in spelter continues, and transactions are limited in consequence, though the demand, notably from galvanizers, is good ; 5 1/2 @ 6c. is quoted for Western, and 6c. for foreign. Sheet-zinc, which is very scarce, is now held at 8c.

The imports and exports of tin, spelter, and sheet-zinc, during the past nine months of the present year, have been as follows, the figures being given in pounds :

Table with 4 columns: Imports, Exports, September 1881, Nine months 1881, Nine months 1880.

For sheet-zinc, the following are the figures :

Table with 4 columns: Imports, Re-exports, September 1881, Nine months 1881, Nine months 1880.

Antimony.—There is some activity, and Cookson's is quoted at 14 1/2c., Hallett's at 13 1/2c., and American at 13c.

Quicksilver.—The San Francisco Commercial Herald of November 24th says :

The London price has fallen to \$6 10s. per bottle, and with us to 38c.

The exports for the week, by sea, were as follows :

Table with 3 columns: To, Value, Flasks.

Totals..... 252 \$7,686

Previously since Jan. 1st, 1881..... 29,286 \$51,252

Totals..... 29,538 \$58,938

Totals same period 1880..... 32,452 \$76,597

Receipts since January 1st, 1881, 46,259 flasks.

The shipments by rail for the first nine months aggregate 9090 flasks, of which 5430 flasks were shipped from this city.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Dec. 2.

There has been a fair, but not large, business done in iron. Prices are strong on all articles, with indications of a very large business during the winter months, and still higher prices.

According to the returns recently published by the Bureau of Statistics, the imports of iron and steel during the first nine months of the present year were as follows, in tons of 2000 pounds :

Table with 4 columns: September 1881, Nine months 1881, Nine months 1880, Line.

American Pig.—There is a large demand for good brands, with an upward tendency to prices. We note sales of 5000 tons of Thomas No. 2 Foundry, at \$23 1/2. We quote No. 1 Foundry at \$25@26; No. 2 Foundry, \$23 1/2@24; and Forge, \$22@23.

Scotch Pig.—The Glasgow market is steady, and freights from there here both scarce and strong. The business doing in this market in this iron is small, and the importers prefer putting the iron into store rather than break prices. Several late arrivals have been treated thus. We quote Eglington, at \$23; Coltness, \$26@26 1/2; Glengarnock, \$24 1/2@25; and Gartsherrie, \$25@26. English iron is quoted at \$21 1/2@22. A sale of 500 tons mixed numbers was made during the week at \$20 1/2, on cars Philadelphia. In Bessemer iron, a sale of 1000 tons is reported at \$26 on spot.

Messrs. John E. Swan & Brothers, of Glasgow, under date of November 11th, report 105 furnaces in blast, as against 119 at the same time last year. The quantity of iron in Connal & Co.'s stores was 612,452 tons, an increase of 2707 tons for the week. The shipments show a decrease since Christmas of 94,182 tons, as compared with the shipments to the same date in 1880. The imports of Middlesbrough pig-iron for the same period show an increase of 39,773 tons. The following were the quotations of the leading brands of No. 1 pig-iron: Gartsherrie, 59s.; Coltness, 59s.; Langloan, 60s.; Summerlee, 58s. 6d.; Carnbroe, 53s.; Glengarnock, 52s.; Eglington, 51s. 6d. Middlesbrough pig-iron was quoted as follows, f. o. b.: No. 1 Foundry, 46s.; No. 2, 44s.; No. 3, 42s.; No. 4, 41s. 6d.; No. 4 Forge, 41s.

Rails.—A sale of 10,000 tons of steel at about \$60 for next year's delivery is reported. In iron rails we learn of no business.

Old Rails.—In Ts., we only learn of a sale of 1500 tons at \$29. In D.Hs., there has been a sale of 7000 tons on private terms, and 500 tons Philadelphia at \$31 1/2. We quote D.Hs. at \$31 1/2@32.

Wrought Scrap.—We only note a sale of 500 tons for shipment this month at \$31 Philadelphia. This article is firm and scarce. We quote in store at \$31 and yard \$32@32 1/2.

We publish the following letters from our regular correspondents :

Louisville.

Nov. 29.

[Specially reported by GEORGE H. HULL & Co.] The iron market is firm, but without any change in price. Sales have not been large, in consequence of difference of views between buyers and sellers. We quote for cash as below :

FOUNDRY IRONS.

Table with 3 columns: No. 1, No. 2, Price.

MILL IRONS.

Table with 3 columns: Description, Price.

CAR-WHEEL AND MALLEABLE IRONS.

Table with 3 columns: Description, Price.

Milwaukee.

Nov. 29.

[Specially reported by R. P. ELMORE & Co.] A steady business is done in this line, and supply and demand are equal; no evidence of speculative mania, consumers being the only purchasers. Present prices are strong. We quote as follows :

Richmond.

Nov. 28.

[Specially reported by ASA SNYDER.] The iron trade is active, strong, and free from speculation. Quotations as follows :

Table with 3 columns: Description, Price.

St. Louis.

Nov. 26.

[Specially reported by HOFFER, PLUMB & Co.] There is no change to note in this market. Offerings are light, and generally accepted as soon as made.

Philadelphia.

Dec. 2.

Opinions and quotations are divergent at the present writing. Iron is firm but not active, as the large companies are not making any effort to sell. The furnaces which make the best brands have no stocks to sell. Lehigh and Upper Schuylkill grades sold in good-sized lots at \$20 on cars, while other companies refuse to sell at \$20. Several small lots sold at \$21 at furnace. No. 2 iron is scarce, and \$23.50 was paid to-day for 200 tons, while \$24 is asked by some sellers. No. 1 Foundry sells between \$25@27. There seems to be an influence at work to harden prices. The English market is firm. Foreign stocks are exhausted virtually. Domestic supplies are barely equal to the demand, and when buyers want iron they find sellers firm in their views. A lot of

FREIGHTS. Coastwise Freights. Per ton of 2240 lbs. Representing the latest actual charters to Dec. 2d, 1881.

Table with 4 columns: Ports, From Philadelphia, From Baltimore, From Elizabethport, Port Johnston, South Amboy, Hoboken, and Weehawken.

* And discharging. † And discharging and towing. ‡ 3c. per bridge extra. § Alongside. ¶ And towing up and down. ** Below bridge.

10,000 tons Bessemer pig was bought by parties here at \$26. Several other orders are in hand, but large consumers can afford to let the present continental demand for English Bessemer run itself out. Ocean freights are keeping back several shipments of English and Scotch looke 1 for, and hence quotations are nominal. Those furnaces which have a portion of their product after January 1st at their disposal are not seeking buyers, because of the greater probability that English iron can not interfere. A few lots of fine No. 1 commanded \$27, while less known iron sold at \$25.50. Fifteen hundred tons muck bar were sold in lots from 50 to 200 tons at prices varying from \$44.50 to \$45.50 at mill. There are several inquiries for charcoal blooms in the market, but forges are sold too far ahead to accept orders. Merchant orders were taken yesterday and to-day at 2 1/2c. The demand is regular, and a disposition to accommodate customers is shown. The stores report a steady demand at 2'0c. Structural iron orders have been dropping off, but with three to four months' work on hand, and inquiries flying about, manufacturers feel assured of a busy spring. Quotations are firm. Plate iron orders have fallen off. Mills are pushing orders through as rapidly as capacity will allow. A further advance is regarded as

