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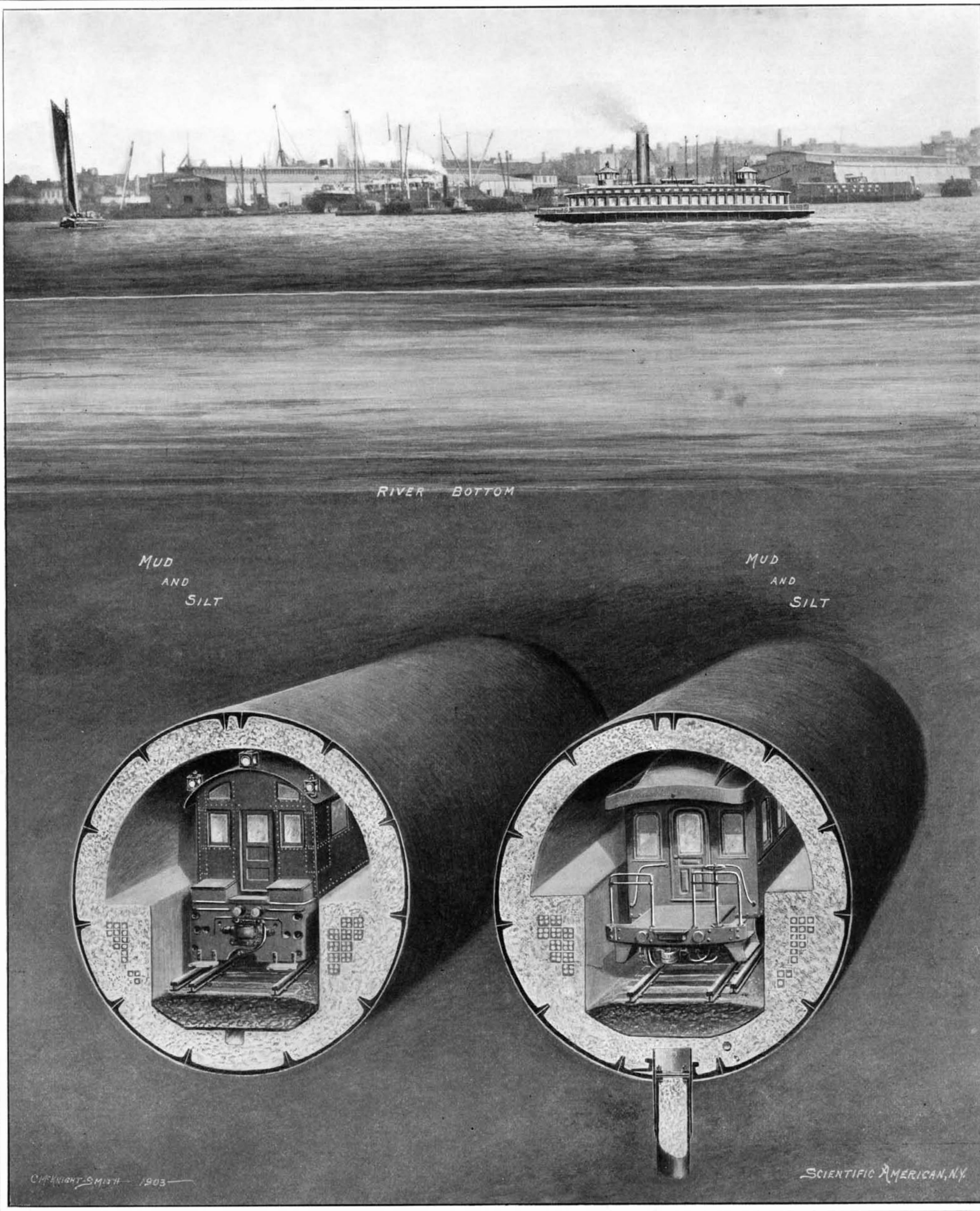

Total length of tunnel from New Jersey to Long Island, six miles. Outside diameter of shell, 23 feet.

SECTIONAL VIEW OF PENNSYLVANIA RAILROAD TUNNEL NOW UNDER CONSTRUCTION BENEATH THE HUDSON RIVER.—[See page 42.]

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NEW YORK, SATURDAY, JANUARY 16, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PROPOSED RECONSTRUCTION OF THE BROOKLYN BRIDGE.

It has been for some time a matter of common knowledge that the Brooklyn Bridge is unequal to the present heavy duty that is laid upon it. Although there is no actual danger of collapse, there are certain elements in the design and construction which are continually giving evidence of weakness. This is particularly true of the floor system, in which is included the stiffening trusses. The latter are giving continual trouble by buckling in the lower chords under heavy concentrations of traffic. In saying this we cast no reflection upon the designers and builders of the original bridge. Considering its unprecedented size, the Brooklyn Bridge must ever be regarded as the pioneer structure in the class of extremely long-span bridges. The theory of bridge construction was not so well understood than as it is now. The structure has done noble work in the twenty years of its life, and in the latter half of that period it has been carrying far greater loads than it was originally designed for. The late Commissioner of Bridges, Mr. G. Lindenthal, has left on record in his office a most valuable preliminary study for the reconstruction of the bridge with a view to eliminating its faulty features, enlarging its capacity, and dividing up the duty of the bridge, so that all parts shall take their proper share of the load, and the stress be so distributed that there shall be no uncertainty whatever as to the work that each part has to do.

The chief faults of the original design are, first, the presence of diagonal wire rope stays running from the stiffening truss back to the top of the towers, to which they are rigidly attached. The sagging of the main cables, under a combination of high temperature and congested traffic, throws the greater part of the load on these diagonal stays, with the result that the trusses are strained beyond their strength and are continually buckling out of shape. Secondly, the stiffening trusses are altogether too shallow to be of any great service, some of them having a depth of only 12 feet on a span of 1,600 feet. The main cables have always been the most satisfactory element in the whole structure, for they have a margin of strength beyond the maximum load, that is much greater than the margin in other parts of the structure. In the proposed reconstruction it is sought not only to bring the stresses in each part of the structure within known limits and keep them there, but also to increase the carrying capacity of the whole structure.

Briefly stated, the desired end is accomplished by the removal of the present shallow trusses and the substitution of a pair of great continuous stiffening trusses, 75 feet deep at the towers and 19 feet deep at their shallowest portion in the center of the main span. These will extend across the main span and half way across the two shore spans, terminating at each end at a steel holding-down pier, by which the inshore, overhanging portions will be tied down to a mass of masonry at the ground level, of sufficient weight to counterbalance the excess weight of the main span portion of the trusses. The total length of this great truss will be 2,628 feet, the length of the portion spanning the East River being 1,595 feet 6 inches and that of each of the overhanging shore arms 516 feet 6 inches.

It is designed that these stiffening trusses shall carry their own weight, neither more nor less—the live load, that is the elevated cars, trolley cars, etc., and the load of the floor system, being carried by the main cables. In view of the fact, however, that the stiffening trusses will be built as part of the floor system, and will be rigidly attached to the same, it would seem at first thought as though this division of the load would be impossible. It will be accomplished, however, by a very ingenious method, which consists of cutting out a section of the bottom chord at the towers and placing between the abutting ends a hydraulic plunger which is maintained under a pressure exactly equal to that due to the load of the truss itself. Consequently, when the cables begin to bend under an accumulation of live load, there is no additional load thrown upon the trusses, for the reason that the hydraulic plunger begins to yield, thus maintaining the predetermined stresses throughout the trusses.

The relieving of the cables of the great weight of the present six stiffening trusses and making the two substituted trusses carry their own load, renders it possible to admit a much larger live load upon the bridge, and this is done by providing two decks, on the upper of which will be four elevated railway tracks, and on the lower deck two trolley tracks, two 17-foot roadways and two passenger footways. The roadways will thus be restored to the full width of the roadways on the present bridge before the trolleys monopolized a third of the space. The trolleys, being separated from the roadways, can run at twice the average speed that obtains at present, while there will be a clear gain of two new elevated tracks.

The diagonal suspenders, which have been the cause of so much trouble in the past few years, will be entirely removed, and the load upon the towers lightened by the amount of their aggregate weight. The weight of the big stiffening trusses, moreover, will not rest upon the towers, but upon steel piers which will be built inside the hollow spaces of the towers and will rest directly upon the masonry foundation below. The floor system will be entirely reconstructed, the present narrow latticed floor beams being replaced by plate-steel floor beams and stringers of approved modern construction. The wire-cable wind bracing will be removed, the new trusses and their lateral bracing being designed effectively to sustain any possible wind pressure. In order to take care of the increased pull on the anchorages due to the larger live loads that will be carried, the anchorages will be increased in size, a considerable addition of solid masonry being made at the shore ends. Moreover, to prevent any settlement or sliding, steel sheet piling is to be driven entirely around the base of the anchorages.

It will be very gratifying to the citizens of Greater New York to learn that by the proposed scheme of reconstruction not only is the life of the great Brooklyn structure indefinitely prolonged, but its usefulness and capacity are increased over fifty per cent. Unfortunately the reconstruction cannot be taken in hand until the new Manhattan Bridge is completed. The plans for this structure, which call for eye-bar cables, were drawn particularly with a view to expeditious erection; and if the work is put in hand at once, the bridge should be ready for use in three and a half years from the present date. There will be some slight interference with traffic during the reconstruction of the present Brooklyn Bridge, but the plans have been so drawn that the bridge will be in practical service during the whole period of reconstruction.

The numerous plans accompanying the report on this work will be found in the current issue of the SUPPLEMENT.

LUNAR SUPERSTITIONS.

In his recently published book on the moon, Prof. W. H. Pickering presents an interesting account of the superstitions in which the moon plays an important part.

Probably even in prehistoric times men have noticed the face of the "man in the moon." Plutarch noticed it and even wrote a whole book on the face. But besides this, many other objects are supposed to be visible. The dark markings on the surface are likened by the Chinese to a monkey pounding rice. In India, they are said to resemble a rabbit. To the Persians, they seem like our own oceans and continents reflecting as in a mirror.

The size of the moon, as seen by different persons, varies from that of a cart wheel to a silver dollar. To many it seems about a foot in diameter, from which Prof. Young concludes that to the average man the distance of the surface of the sky is about 110 feet. It is certain that artists usually represent the moon much too large in size in their paintings. Occasionally they represent it in evening scenes with the horns turned downward instead of upward, whereas they must always point away from the sun. The true angular size of the moon is about half a degree, so that it can always be concealed behind a lead pencil held at arm's length.

From the earliest times it has been a source of speculation why it is that the sun and moon, when rising or setting, appear to most persons from two to three times the diameter that they have when near the meridian. As a matter of fact, the sun is slightly and the moon measurably smaller when near the horizon, because they are further off than when overhead. The true explanation, according to Prof. Pickering, is twofold. Human estimates of angular dimensions are dependent not merely on the various dimensions themselves, but also on extraneous circumstances. The case is analogous to our estimates of weight, which are dependent primarily on the real weight of the object, but secondly upon its bulk. Thus a pound of lead feels much heavier than a pound of feathers. One circumstance affecting our estimates of angular dimensions is the linear dimension of the object itself. Alhazen, who died 900 years ago, showed that if we hold the hand at arm's length and notice what space it apparently covers on a distant wall, and then move the hand well to one side, so that it is in front of some very near object, we shall find that it will appear to us decidedly smaller than the part of the wall which it previously covered. An analogous effect causes the full moon, when rising or setting, to appear larger than when it is well up in the sky. On the horizon, we can compare it with trees and houses and see how large it really is. Overhead we have no scale of comparison. The same optical illusion, however, is noticed at sea, so that we must cast about for some additional explanation. Clausius, about 300 years ago, showed that our estimates of size depend largely upon the altitude of the object under consideration. When we pass under an archway or under the limb of a tree, we know that we are nearer the object than we are when we see it at a lower altitude. At the same time, it appears just as large to the average person angularly as it does when we are several feet further away. We are in fact all our lives, as we walk about, used to seeing objects rapidly lifting from their angular positions, yet not appearing as we pass them any larger than they do when we are slightly more distant from them. Thus we always unconsciously make some compensation in our minds for the real changes in angular size that actually occur. If now, the limb of the tree that we pass under, instead of really growing angularly smaller at the low altitude than it was when overhead, should remain of the same angular size in all positions, we should say that it looked larger at the low altitude. This is exactly what happens in the case of the heavenly bodies. Unlike all terrestrial objects, they are practically of the same real angular dimensions when on the horizon as they are in the zenith. Involuntarily we apply to them the same compensation that we are expected to apply to terrestrial objects, and are then naturally surprised to see that they appear larger at the lower altitude.

The majority of the superstitions relating to the moon relate to the weather. Besides, we have the superstition that sleeping in the moonlight, especially if the moon be full, induces insanity. Witness our word "lunacy," in which the belief is expressed. Farmers believe that the moon exercises a certain influence over vegetation, and that beans should be planted when the moon is light and potatoes when it is dark. Many believe that a change in the weather will come at about the time that there is a change in the moon. Prof. Pickering points out that since the moon changes every seven and a half days, every change in the weather must come within four days of a change in the moon, and that changes will necessarily come within two days of a lunar change. This superstition must not be confused with the real, but ill-defined, seven-day period of the weather, which is a genuine phenomenon and holds true to a certain extent. Thus if one Sunday is stormy there is a probability that the several Sundays following may also be stormy. This phenomenon is probably due to terrestrial causes and has nothing whatever to do with the moon.

Some people believe that if the horns of the new moon will hold water, it will be a dry month; that if they are so tipped that the water will run out, it will be rainy. Nearly as many people hold the reverse view. Both views are wrong. The line joining the moon's horns is always perpendicular to the direction of the sun and, therefore, depends merely upon the place of the moon in its orbit.

It has been said that thunder storms are influenced by the moon. Nearly 12,000 observations collected by Hazen in the United States in the year 1884 show a preponderance of thirty-three per cent in the first half of the lunar month. The greatest number of thunder storms come between the new moon and the first quarter; the least number between full moon and the last quarter. This is, perhaps, the only satisfactory evidence that we have that the weather is at all influenced by the moon. Even in this case the effect is so slight that it has only a theoretical interest.

THE PROBLEM OF THE MUTUAL INFLUENCE OF CATHODE RAYS.

In a note read before the recent congress of German naturalists, F. Neesen attempts to show that the absence of a mutual influence of different cathode rays does not depend on an electrodynamical back effect. Two cathode rays from independent discharges were led one beside another in opposite directions and close together, in the same tube, when no effect was observed, though the electrodynamical influence should aid the electrostatical effect.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

After an absence of a quarter of a century, the American Association returned to St. Louis and there held its fifty-third annual meeting during the week beginning December 28.

The officers for the meeting were: President, Carroll D. Wright, Commissioner of Labor, Washington, D. C. Vice-presidents of sections: Mathematics and Astronomy, Otto H. Tittmann, superintendent of the Coast and Geodetic Survey, Washington, D. C.; Physics, E. H. Hall, Harvard University, Cambridge, Mass.; Chemistry, W. D. Bancroft, of Cornell University, Ithaca, N. Y.; Mechanical Science and Engineering, C. M. Woodward, of Washington University, St. Louis, Mo.; Geology and Geography, Prof. C. H. Hitchcock (in absence of I. C. Russell, of University of Michigan, Ann Arbor, Mich.); Zoology, Edward L. Mark, of Harvard University, Cambridge, Mass.; Botany, T. H. McBride, of University of Iowa, Iowa City, Iowa; Anthropology, Anita Newcomb McGee, Washington, D. C. (in absence of M. H. Saville, of the American Museum of Natural History, New York, N. Y.); Social and Economic Science, Simeon E. Baldwin, New Haven, Conn.; Physiology and Experimental Medicine, H. P. Bowditch, of Harvard University, Cambridge, Mass. Permanent secretary, Dr. L. O. Howard, Washington, D. C. General secretary, Charles S. Howe, of Case School of Applied Science, Cleveland, Ohio. Secretaries of the sections: Mathematics and Astronomy, L. G. Weld, of the University of Iowa, Iowa City, Iowa; Physics, Dayton C. Miller, of the Case School of Applied Science, Cleveland, Ohio; Chemistry, Richard S. Curtiss, of Union University (in absence of C. L. Parsons, New Hampshire College, Durham, N. H.); Mechanical Science and Engineering, William T. Magruder, of Ohio State University, Columbus, Ohio; Geology and Geography, G. B. Shattuck, of Johns Hopkins University, Baltimore, Md.; Zoology, C. Judson Herrick, of Denison University, Granville, Ohio; Botany, F. E. Lloyd, Teachers' College of Columbia University, New York, N. Y.; Anthropology, George H. Pepper, of American Museum of Natural History, New York, N. Y.; Social and Economic Science, J. F. Crowell, of the Bureau of Statistics, Washington, D. C.; Physiology and Experimental Medicine, Frederick S. Lee, of Columbia University, New York, N. Y.

On Monday at 10 o'clock in the morning, in the large auditorium of the Central High School, on Grand Avenue, the first general session of the meeting was called to order by Dr. Ira Remsen, of Johns Hopkins University, who introduced his successor, the Hon. Carroll D. Wright, United States Commissioner of Labor, as presiding officer for the meeting. Addresses of welcome were made by the Hon. David R. Francis, honorary president of the local committee, in behalf of that body; by Hon. C. P. Walbridge, in behalf of the city of St. Louis, and by Prof. C. M. Woodward, president of the board of education of the city of St. Louis, in behalf of the educational interests of the city. To all of these a suitable reply was made by President Wright, after which the members adjourned to their respective section rooms and organized for business. During the afternoon the retiring addresses of the vice-presidents of the previous meeting were presented before the respective sections and were as follows:

That before the section of Mathematics and Astronomy was entitled, "The Message of Non-Euclidean Geometry," and was presented by Prof. George B. Halsted, who fills the chair of mathematics at Kenyon College, Gambier, Ohio. Prof. Halsted in beginning spoke of the origin of geometry as a science, due to Thales and Pythagoras. The most diversely demonstrated and frequently applied theorem of geometry bears the name of Pythagoras, and due to him is the first solution of a problem in that most subtle and final of ways, by proving it impossible; his solution of the problem to find a common submultiple of the hypotenuse and side of an isosceles right triangle, an achievement whereby he created incommensurability.

He then passed to the king of geometers, Euclid, whose construction is considered by Alfred Russell Wallace as the most remarkable product of all the ages. Continuing, Dr. Halsted said, "Until the very present, Euclid has absolutely dominated the human mind. The break came not at any of the traditional centers of the world's thought, but on the circumference of civilization, in Russia and Hungary. The new idea is to deny one of Euclid's axioms, and to replace it by its contradictory. There results, instead of chaos, a beautiful, a marvelous, new geometry. Euclid has based his geometry on certain axioms or postulates which have been in all lands and languages systematically used in treatises on geometry, so that there was in all the world but one geometry. The most celebrated of these axioms was the so-called 'parallel postulate,' which in a form due to Ludlam, is simply this: 'Two straight lines which cut one another cannot both be parallel to the same straight line.' The Magyar, John Bolyai, and the Russian, Lobachebski, made a geometry based not on this axiom or postulate, but on its direct contradiction. Wonderful to say, this new geometry, founded on the flat contradiction of what has been ever accepted as axiomatic, turned out to be perfectly logical, true, self-consistent and of marvelous beauty. In it many of the good old theorems of Euclid and our own college days are superseded in a surprising way."

Clear and erudite was the retiring address on, "The Elements: Verified and Unverified," which Dr. Charles Baskerville, head of the department of chemistry in the University of North Carolina, presented before the Section of Chemistry. After a sympathetic tribute to the memory of Dr. H. Carrington Bolton, the bibliographer of chemistry, whose recent death all chemists mourn, and who from his splendid work in the early history of the Section of Chemistry might well have been called its father, Dr. Baskerville in a masterly way reviewed the history of the concept or definition of the idea of an element from the far-away time of the early Greek philosophers, tracing it through the dim ages of alchemy until Dalton and the able chemists of his time brought the crude ideas of former days into the more perfect light of modern times. Then he discussed the modifying influences of the newer discovered elements, and the effect that radio-activity has had upon the significance of the word "element." This address, which marked the high tide of similar addresses before the section, was accompanied by a long list of chemical elements with their life histories, showing in tabular form their origin, development, and end.

The retiring president of the Section on Geology and Geography was Prof. William M. Davis, of Harvard University, who spoke on the geography of the United States. An abstract of this paper will be found in the current SUPPLEMENT.

Prof. Charles W. Hargitt, of Syracuse University, was the presiding officer last year of the Section of Zoology. He was unfortunately unable to be present at the St. Louis election, but his retiring address on "Some Unsolved Problems of Organic Adaption," was read by Prof. Charles C. Nutting. Much of his address was on the problem of coloration among lower invertebrates, and he discussed three classes of pigments: First—Those directly serviceable in the vital processes of the organism. Under this head may be classed such pigments as hæmoglobin, chlorophyl, zoonerythrin, chalorocruorin, and perhaps others less known. It need not be emphasized that by far the most important of these are the two first named. The others, found chiefly among the lower invertebrates, are believed to serve a function similar to the first. Second—Waste products. Among these the several biliary products are too well known to call for special note. Guanin is a pigment of common occurrence in the skin of certain fishes and is associated with the coloration of the species. Similarly, certain coloring matters have been found in the pigments of many Lepidoptera, known as lepidotic acid, a substance closely allied to uric acid and undoubtedly of the nature of a waste product. Third—Reserve products. Of these there are several series, one of which, known as lipochrome pigments, is associated with metabolism involved in the formation of fats and oils. Perhaps of similar character are such pigments as carmine, or rather cochineal, melanin, etc. It may be somewhat doubtful whether these pigments do not rather belong to the previous class, where should probably be listed such products as hæmatoxylin, indigo, etc., etc., all of which have been claimed as resultants of destructive metabolism in process of being eliminated from the physiologically active tissues of the body of the organism. Of similar character is probably tannic acid, a substance well known among plant products and involved in the formation of many of the brownish and rusty colors of autumn foliage, particularly of the oaks and allied trees, as are the lipochromes in the formation of the reds and yellows which form so conspicuous a feature among autumn colors.

The Section on Social and Economic Science, as well as an interested audience, listened with pleasure to Harry P. Newcomb's address on, "Some Recent Phases of the Labor Problem."

As to why workmen organize he said: "The instinct which impels workingmen to organize rather than to deal separately with their employers is precisely the same as that which at other points of economic contact has universally led to efforts to mitigate the consequences of competition by the simple device of combination. The single workman, dealing with an employer of many workmen engaged to render similar service, is at exactly the same sort of disadvantage which confronts the small manufacturer who has to sell in a market to which a multitude of competing producers have access on equal terms. There is nothing strange in the fact that the characteristic movement of the great industrial revolution which has been in progress since the invention of the spinning jenny and the power loom has left its impress upon labor as well as upon capital. If labor had not organized it would have been a sadly belated factor in the industry of the opening years of the twentieth century. Just as capital must continue to compete with capital, so labor will compete with labor as long as capitalistic production and the wages system endure, but on either side folly could go no further than to seek the perpetuation of the crude, cut-throat competition which seeks the immediate extermination of the rival at whatever cost to the survivor. Such competition is crude in its methods; it is destructive in its consequences, and it is not to-day a means of attaining the highest degree of economic efficiency. Both capital and labor are amply justified in uniting to mitigate this kind of competition."

Concerning the treatment of employers, he said: "The principles which require the fair treatment of fair employers must be established as part of the creed of unionism before the latter can become a genuine means of industrial and social betterment. This would require the revision of some very important features of the methods now current among labor organizations; it would abolish the sympathetic strike and also the general strike, which, in recent instances that all will recall, has frequently paralyzed the industry of entire sections. It would leave labor controversies to be settled by the parties directly concerned and would pretty effectually deprive both of the equally fickle support and opposition of public sentiment based on mere personal inconvenience and annoyance."

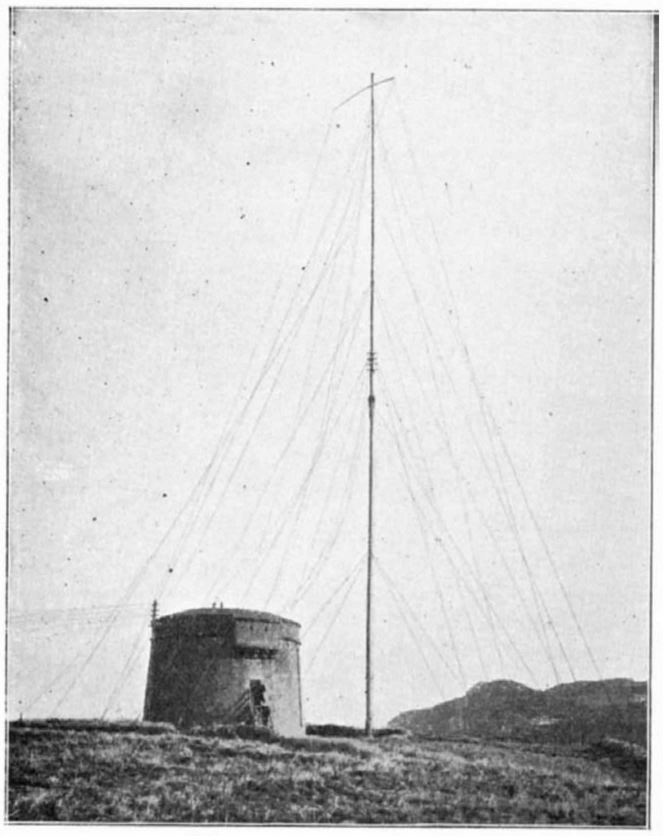
Dr. Ira Remsen, president of the Johns Hopkins University and long head of the chemical department of this university, delivered his retiring address on Monday evening. The subject which he presented to the members was, "Scientific Investigations and Progress." He said in part: "The objects of the association are, by periodical and migratory meetings, to promote intercourse between those who are cultivating science in different parts of America, to give stronger and more general impulse and more systematic direction to scientific research, and to procure for the labors of scientific men increased facilities and a wider usefulness. The first object, you will observe, is, 'to promote intercourse between those who are cultivating science in different parts of America'; the second is, 'to give a stronger and more general impulse and more systematic direction to scientific research'; and the third is, 'to procure for the labors of scientific men increased facilities and a wider usefulness.' Those who are familiar with the history of the association are well aware that it has served its purposes admirably, and I am inclined to think that those who have been in the habit of attending the meetings will agree that the object which appeals to them most strongly is the promotion of intercourse among those who are cultivating science. Given this intercourse, the other objects will be reached as a necessary consequence, for the intercourse stimulates thought, and thought leads to work, and work leads to wider usefulness. While the alchemists were at work upon their problems, another class of chemists were engaged upon problems of an entirely different nature. The fact that substances obtained from various natural sources and others made in the laboratory produce effects of various kinds when taken into the system led to the thought that these substances might be useful in the treatment of disease. Then further, it was thought that disease itself was a chemical phenomenon. These thoughts, as is evident, furnish strong motives for the investigation of chemical substances, and the science of chemistry owes much to the work of those who are guided by these motives. And so in each period, as a new thought has served as the guide, we find that men have been actuated by different motives, and often one and the same worker has been under the influence of mixed motives. Only in a few cases does it appear that the highest motives alone operate. We must take men as we find them, and we may be thankful that on the whole there are so many who are impelled by one motive or another or by a mixture of motives to take up the work of investigating the world in which we live. Great progress is being made in consequence, and almost daily we are called upon to wonder at some new and marvelous result of scientific investigation. It is quite impossible to make predictions of value in regard to what is likely to be revealed to us by continued work, but it is safe to believe that in our efforts to discover the secrets of the universe only a beginning has been made. Although science is not likely, within periods that we may venture to think of, to do away with the necessity of cultivating the soil, it is likely to teach us how to get more out of the soil than we now do and thus put us in a position to provide for the generations that are to follow us. And this carries with it the thought that, unless scientific investigation is kept up, these coming generations will be unprovided for."

In a later paper we shall hope to mention some of the more important papers that were presented before this meeting of the association.

At the Kelvingrove Museum, Glasgow, Scotland, a very interesting cast-iron crossing has just been placed in position. It was laid on the Liverpool & Manchester Railway in 1829, at Rainhill. It has just been taken up out of a siding after being 74 years in traffic.

THE DE FOREST WIRELESS TESTS ACROSS THE IRISH CHANNEL.

During the early part of last December, Dr. Lee de Forest, inventor of the De Forest system of wireless telegraphy, conducted, under the auspices of the British post office, a series of experiments with his system between Holyhead and Howth. As briefly described in the SCIENTIFIC AMERICAN at the time, these experiments were very successful. We are now enabled to give our readers a complete description of the apparatus used at these tests, together with interesting photographs of the stations. The distance in a direct line between the two stations is 64 miles. At Howth the apparatus was installed in the old Martello tower, at present used as a cable station, the government mast, 120 feet high, being utilized for the erection of the aerials. At Holyhead the apparatus was installed at the top of a cliff, 400 feet above sea level, where a mast 180 feet high was used for supporting the antenna. One would naturally suppose that at such a height ideal conditions for wireless communication would be afforded. This, however, was not the case, for the composition of the cliff was of such a nature as to afford a very poor ground. For this reason the successful results of the experiments deserve all the more credit, for communication between the stations was maintained with practically free Hertzian waves, that is, the waves were not attended with the usual earth currents.



HOWTH STATION OF THE DE FOREST SYSTEM INSTALLED IN AN OLD MARTELLO TOWER.

The accompanying diagrams illustrate the connections of the transmitting and receiving apparatus used at each station. Power was derived from a 3-horse-power petrol engine, coupled to a 1-kilowatt, 500-volt, alternating generator, operating at a frequency of fifty cycles. This current was not taken directly into the transmitting system, but supplied the latter through a one-to-one transformer *A*, the purpose of which was to steady the load and prevent injury to the generator from induced high potential caused by static discharges. From the secondary of the transformer, the current passed through a switch *B*, transmitting key *C*, regulator *D*, to the primary of the step-up transformer *E*. The regulator *D*, which is termed a "reactance regulator," provided a means for choking down the energy in the circuit in case it rose to such a point as to form an arc across the spark gap. The transformer *E* raised the potential from 500 volts in the primary to 20,000 volts in the secondary, and current at this pressure was conducted to the spark gap *G*, through a helix *F*. Connected in shunt with the circuit were a series of 12 Leyden jars. Dr. De Forest has discovered that the relative positions of the jars largely affect their efficiency. The best arrangement is to place the jars in a circle; but, for the sake of economizing space, the usual practice was followed of placing them in four rows of three jars each, and connecting them up in two parallel sets of six jars each. With this arrangement, the jars had a total capacity of 0.006 microfarad. The helix *F* was made of ¼-inch copper tube, coiled in a spiral 18 inches in diameter. This formed a cage about the spark gap. The self-induction of this helix, which could be varied by means of a movable contact, was utilized to obtain an approximate syntony of the system. Owing to the high frequency of the oscillations, a very slight movement of the contact sufficed to produce a marked effect upon the waves emitted.

The aerials were connected to the oscillating circuit in a very ingenious manner, as shown at *H*. It will be observed that the antenna comprised five wires, secured at the top in an ebonite insulator and separated midway of their length by a rope spreader held taut by guy ropes. Four of the antenna wires were connected in parallel, leaving a single wire at the right. Two spark gaps, each 1-32 inch in length, were formed between these wires and the terminal of the oscillating helix. The high potential of the transmitting system sufficed to bridge these small gaps, but they acted as insulators for the receiving circuit. The latter was attached to the single strand of the antenna. The receiving circuit may be traced in Fig. 2 as passing through switch *B*, adjustable inductance *K L*, adjustable capacity *N*, responder *O*, and back through *M*, switch, *B*, and condenser *J* to the earth. The responder *O*, which was used at these tests, differs from the type heretofore used, but owing to the fact that patents on the improvements are not yet secured, we are unable to give details of its operation. In general, however, it works on the same principle as the original responder invented by Dr. de Forest. This, our readers will remember, was an electrolytic device, which is self-restoring on reception of the Hertzian waves. The local receiving circuit included a potentiometer *R*, and the signals were produced in the telephone *P*. In tuning up the receiving system the inductance *K L* and capacity *N* were adjusted to syntony with the transmitted waves.

While Dr. de Forest does not claim absolute secrecy by means of syntony, yet his success in tuning the two stations is indicated by the fact that after the first day's experiments his instruments were not in the least affected by the Marconi station which was operating three miles away.

During the course of the experiments the number of wires in the antenna was gradually cut down until but two remained, and with these communication between the De Forest stations was successfully maintained, though the sounds produced in the telephone were rather weak.

The sensitiveness of the system is shown by the fact that at one time the engine at Holyhead slowed down, diminishing the frequency of the transmitting spark. This was at once detected by the operator at Howth, who telegraphed back: "You have my sympathy. I hear your engine slowing down."

Those who witnessed the experiments were surprised at the high speed at which messages were sent, the normal rate being about thirty words a minute.

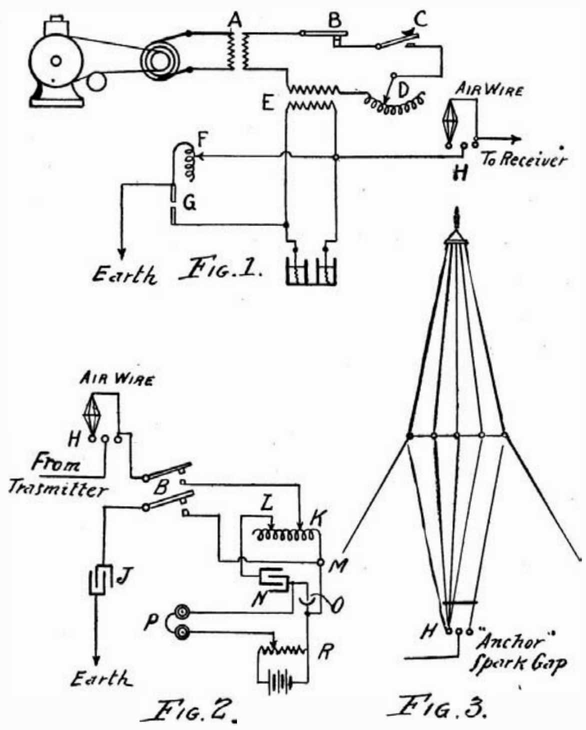


DIAGRAM SHOWING CONNECTIONS OF RECEIVING AND TRANSMITTING APPARATUS.

The Union Engineering Club.

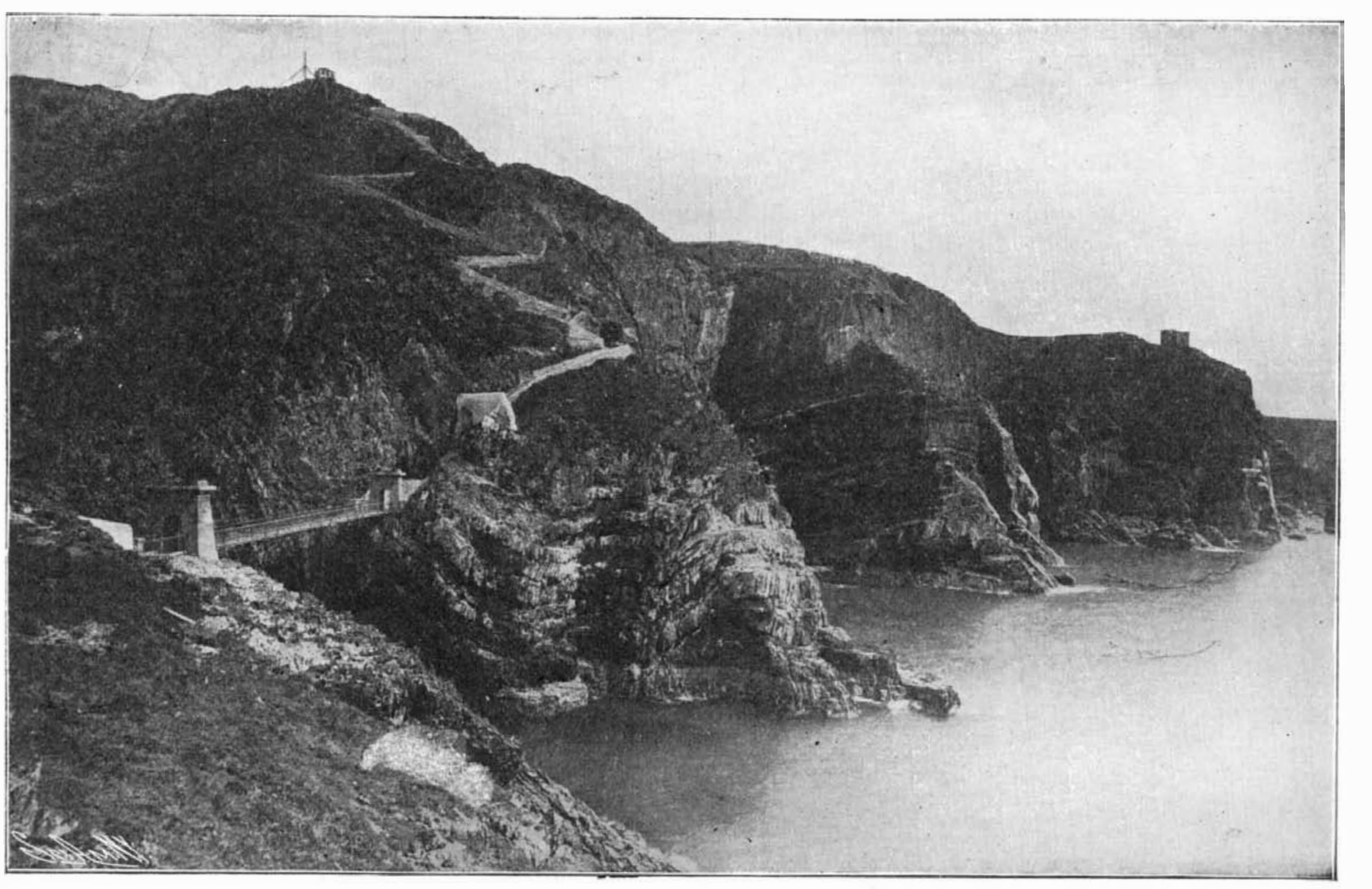
Two new club buildings will be erected in West Thirty-ninth Street, New York City, to be known as the Union Engineering Building. In these structures the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Society of Mining Engineers, and the American Society of Electrical Engineers will be housed.

These societies, with the exception of the Society of Civil Engineers, have formally agreed to unite under one roof. It is expected that the last-named society will within the next two weeks pass the favorable vote necessary to this union. The plans for this clubhouse are not yet complete, but each of these technical societies will have a floor for its exclusive use, including a small hall for special business meetings. There will also be provided a large hall for union meetings of all these societies.

Mr. Carnegie, in his letter of February 14, 1902, to the societies, declared: "It will give me great pleasure to give, say, $1,000,000, to erect a suitable union building for you all, as the same may be needed."

The total cost of these two clubhouses will be, it is said, over $2,000,000.

A new long-range torpedo has been invented by a young engineer in the torpedo factory at Fiume, Austria. The weapon measures 23 feet in length, is very slender but strongly built, and can be discharged with accuracy to a distance of 3,800 yards. Experiments have been carried out with this torpedo before the Austrian government with conspicuous success, and its capabilities are to be demonstrated at an exhibition before representatives of all the powers.



STATION AT HOLYHEAD FROM WHICH DE FOREST WIRELESS TESTS ACROSS THE IRISH CHANNEL WERE CONDUCTED.

THE SIEMENS & HALSKE NEW ELECTRIC HAND-DRILL.

Siemens & Halske's new electric hand-drill does away with the inconveniences inherent to the drill with flexible shaft and, at the same time, has the advantage over the crank drill in being of greater efficiency although of sensibly the same weight. In other electric drills the motor that actuates the drill properly so called through a flexible transmission is generally established upon a portable frame. In consequence of such an arrangement the manipulation of the apparatus is relatively complicated, and the working parts are more difficult of access than practice necessitates. Moreover, the vibrations of the shaft render any accurate work very difficult. The use of the flexible transmission greatly reduces the efficiency, so that with an equal power the motor has to be larger. Finally, the flexible shaft and the frame of the motor are relatively costly.

In the new hand-drill illustrated, the mechanical and electric parts are united in a single apparatus. The current is led to the motor by a flexible cable that in no wise interferes with the mobility of the drilling machine. The arch of the electro-magnets of the motor is wrought iron. The core of the armature, as well as the poles, is laminated. The collars, handles, and center plate are of aluminium. In the posterior collar is formed an aperture, which is closed by an aluminium cover, which, when removed, permits of easy access to the collector and brushes. The interrupter is placed in the handle. Upon pressing upon this the motor is put in circuit, and, upon freeing it, is put out of circuit. The machine is made in two sizes for actuation by a continuous current of 110 or 220 volts. The smaller type is used for delicate work. It is capable of drilling holes of 0.24 of an inch in diameter, and has a net weight of 12 pounds and a gross weight of 33. The larger type, shown in our illustration, is capable of boring holes 0.64 of an inch in diameter and has a net weight of 21 pounds and a gross weight of 44. A lengthening piece for certain special purposes may be inserted by screwing it in between the collar and center plate. The method of using the machine is shown herewith.

The convenience and simplicity of this drill, along with the economic qualities resulting therefrom, will soon make of it an instrument indispensable in all shops in which drilling has to be done and in which electricity is available.

THE ORTHODIAGRAPH. AN APPARATUS FOR DETERMINING THE TRUE SHAPE AND SIZE OF INTERNAL ORGANS.

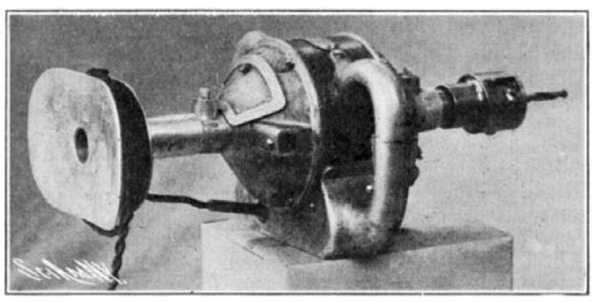
BY OUR BERLIN CORRESPONDENT.

The orthodiagraph, just brought out by the Berlin Allgemeine Elektricitäts-Gesellschaft, is a Röntgen apparatus allowing of the true image of any object being obtained in any desired position of the drawing plane.

Röntgen rays, as is known, are propagated from a point on the anticathode of the Röntgen bulb in straight lines radiating in every direction, and the image of a body projected on a phosphorescent screen or a photographic plate is a silhouette, the outline of which coincides with the places where the Röntgen rays touching the edge of the body strike the screen. This outline therefore is the periphery of the base of a cone, the point of which coincides with the luminous spot on the anticathode. As in any case the object to be projected is located between the Röntgen bulb and the screen, its image on the latter will be magnified, this magnification being the stronger the greater the ratio of the distance of the object from the image plane to the distance of the object from the Röntgen bulb. The image projected by a stationary Röntgen bulb, so far from recording the true dimensions of the object, will show the latter in a magnified shape apart from more or less considerable deformations.

There is only one possibility of obtaining the object in its true shape and size; the Röntgen rays touching the body and forming on the plate an image of its outline have to be made parallel and strike the plate at right angles. In other words, the projection from a centrum will have to be replaced by a parallel projection. Endeavors in this line have been made as far back as 1898; devices have even been invented allowing of such projections being obtained in the case of the objects to be projected lying on horizontal surfaces. The orthodiagraph, as above stated, is free from this restriction, allowing of projections in true shape and size being obtained in any desired position of the drawing plane.

HOW THE ELECTRIC DRILL IS MANIPULATED.



THE ELECTRIC DRILL.

The luminous screen, which also carries the drawing stylus, is rigidly connected with the Röntgen bulb by a U-shaped frame. This frame is made up of a number of jointed sections, which permit of any desired adjustment of the screen with the bulb. A rod extending from the screen is longitudinally adjustable in a split sleeve on the end of a tube lying parallel with the axis of the drawing stylus. The tube is provided with a telescoping member, on the projecting end of which a second split sleeve is adapted to slide. This sleeve is formed on the end of an arm which is thereby supported at right angles to the telescoping member. The clamp which holds the Röntgen bulb has ball-and-socket connection with a member which may be adjusted to any position along this arm.

When properly adjusted the propagating joint of the Röntgen rays should lie on an extension of the axis of the stylus. This may be approximately done by adjusting the bulb clamp and other members of the U-shaped frame.

In order to obtain perfect adjustment of the bulb, i.e., such an adjustment as would permit working with accurately perpendicular rays, the screen may be adjusted in one plane, by moving its supporting rod longitudinally in the split sleeve above referred to, and in a plane at right angles thereto by adjustment of the screen within its holder. By noting the shadow cast on the screen by the end of the stylus projecting therethrough, the operator can readily ascertain when accurate adjustment has been obtained.

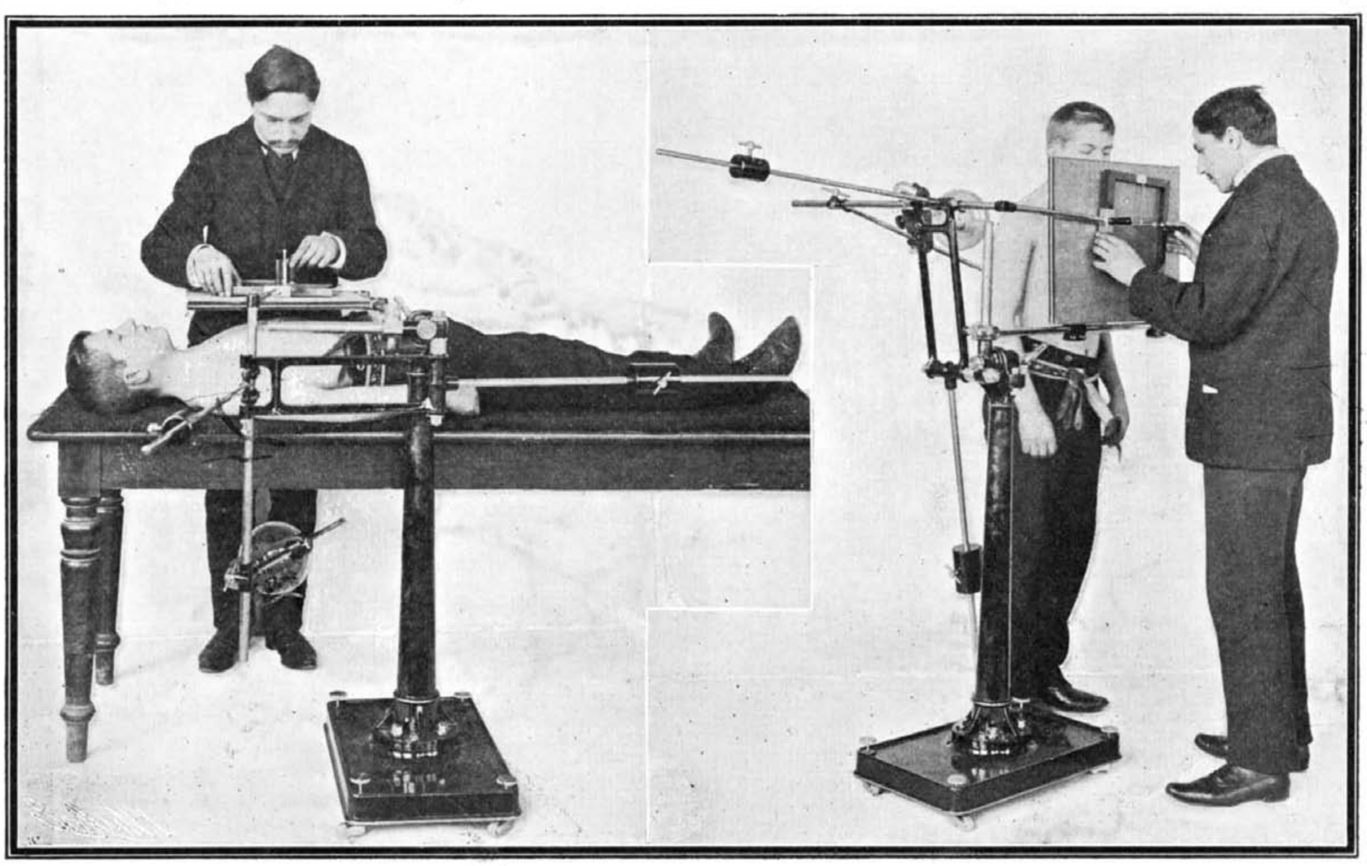
Parallel movement of the bulb with the screen is obtained by means of two levers, one pivoted to the other. A lever which supports at one end the U-shaped frame is hinged to a second lever, which in turn is pivoted to a bracket on the head of the supporting column of the apparatus. Each lever is provided with a counterweight movable along its outer arm, and these weights serve to hold the parts in equilibrium.

The bracket just mentioned also carries a rod to which by means of a universal joint the drawing frame is attached. The drawing frame is adapted to be covered with heavy bristol-board held therein by holders at the sides, and on this surface the drawing stylus is softly pressed by a spiral spring.

Now the whole system so far described is movable round the axis in the head of the main supporting column and may be clamped in any position by means of a milled nut; an additional fixing lever may be grasped to prevent this system from suddenly dropping on loosening the nut. At the same time, the accurately vertical and horizontal position of the system is indicated by a spring catch. The length of the supporting column is such that on turning the system round its axis into a horizontal position, the drawing plate will just be at a convenient distance above a person lying on an ordinary table about 30 inches in height. The heavy base plate is provided with four rollers allowing of the drawing apparatus being readily moved. By operating special screws these rollers may be removed and the apparatus placed on the points of the screws, which in addition will allow of the column of the apparatus being given an accurately vertical position even on oblique or uneven floors.

When a drawing is to be made directly on the body, the bristol-board is removed from the drawing frame, and a dermatograph stylus should be inserted into the drawing stylus instead of a pencil. The drawing frame is provided with three pencil holders or "plotters," as they are called, which are movable in the plane of the screen or that of the drawing plate and provided with scales in both co-ordinates; the position of a person with regard to the central ray may be thereby ascertained, so that on the examination being repeated, the same position of the person may be accurately secured. A fourth auxiliary plotter has been provided which slides on a scale projecting from the extended axis of the lower supporting lever.

In addition to reproducing the true shape and size of organs, the apparatus may be used advantageously to ascertain the depth of foreign objects. This can be done by meas-



THE ORTHODIAGRAPH, AN APPARATUS FOR DETERMINING THE TRUE SHAPE AND SIZE OF INTERNAL ORGANS.

uring the apparent diameter of the object when the Röntgen bulb is stationary and then ascertaining the actual shape of the body by means of parallel movement of the drawing stylus and the bulb. Now if $a\,l$ is the apparent length of the foreign body, $r\,l$ its real length, D the distance of the anticathode of the tube from the luminous screen, and d the distance of the object from the anticathode, the equation $d = \frac{r\,l \times D}{a\,l}$ will give the true distance of the foreign body from the luminous screen.

THE PENNSYLVANIA TUNNEL AT NEW YORK CITY.

Rapid progress is being made in the initial stages of the great engineering project by which the Pennsylvania Road is to secure a terminal station in Manhattan Island and through connections with the Long Island Railroad system. The work of clearing away the buildings on the four large city blocks that will be occupied by the passenger station is well under way, two of these blocks, over a third of a mile in total length, being ready for excavation. The shafts from which the work of tunneling will be carried through have been sunk; and before many weeks have passed the whole stretch of work from the portal in Jersey to the portal in Long Island will be covered with as big a force as can be crowded upon it.

The location and profile of the tunnel are shown in the accompanying diagrams. Commencing at the western approach to the tunnel, two tracks will enter the western end, known as the Hackensack portal, in the face of Bergen Hill, which runs parallel with the Hudson River. From this point to the portal which marks the exit on Long Island will be a distance of a trifle under six miles. The two tracks will pass through the hill in separate tunnels, which will extend to the Weehawken shaft, a distance of a little over one mile. On this portion of the work the tunneling will be of standard construction, but from the Weehawken shaft to the shaft on the western shore of Manhattan Island, a distance of about 6,000 feet, the two tracks will be carried in separate circular tubes of a construction hereinafter described. The line will descend from the Hackensack portal to its lowest point below the North River on a grade of 1.3 per cent, and at its lowest level the bottom of the tubes will be about 90 feet below mean high water of the North River. From this point, for a distance of 2,000 feet, the line will rise on a grade of 0.53 per cent, and then for another 3,000 feet it will ascend on a grade of a little under 2 per cent to a point between Ninth and Tenth Avenues on Manhattan Island. At the Manhattan shaft, going eastward, the tubular construction ceases, and the two tracks diverge into two triple, parallel tunnels, with three tracks in each—the main line and two sidings. The triple tunnels extend for about 1,100 feet, when they merge into a four-track, single-arched tunnel, which extends for 605 feet to the western end of the terminal station. The new terminal station will be the greatest structure of its kind in existence. It will extend from Seventh to Ninth Avenue, and from 31st to 33d Street, and will cover a great parallelogram measuring about 460 feet north and south by about 1,800 feet east and west. The details of the station and the architectural features have not as yet been made public; but the treatment will probably be a modified classic, or some style agreeable to such a monumental structure.

The portion of the tunnel thus far described is under the charge of Charles M. Jacobs as chief engineer. The portion now to be described, extending from the station to the end of the tunnel in Long Island, is under the charge of Alfred Noble as chief engineer. The latter division, which commences just east of Seventh Avenue, consists of two lines of three-track arched tunnels, one below Thirty-second Street, and the other below Thirty-third Street. This form of construction continues for 1,650 feet, when each set of three tracks merges into a double track carried in a concrete-arched tunnel for a distance of 2,400 feet. At Second Avenue the tracks swing to the left, and are carried in two concrete-lined tubes beneath the East River to East Avenue, a distance of about 6,000 feet; and from East Avenue to the end of the tunnel at Thompson Avenue, a distance of 3,700 feet, the tracks are carried beneath four separate concrete arches. The tracks descend from Seventh to Fifth Avenue on a 0.5 per cent grade, and from Fifth Avenue to the lowest point beneath the East River on a 1.5 per cent grade, from whence they rise on a 1.25 per cent grade to surface.

On the whole of the tunnel work thus outlined, that lies beneath the East River and the land, it is not anticipated that any conditions will be encountered that will call for special construction and present any obstacles to the smooth and uninterrupted prosecution of the work. The borings indicate that beneath the land the tunnels will be driven chiefly through rock, and under the East River through fine to coarse sand and gravel. In passing below the North River, however, it will be necessary, in order to avoid going to a depth which would involve heavy grades that would be expensive to operate, to carry the tunnel through a river mud and silt that are of such consistency that the question of the stability and perfect alignment of the tunnel calls for special study. Although the silt is sufficiently firm to preserve the tunnel itself in perfect alignment, it was considered by Mr. Jacobs that provision should be made for carrying the moving train loads independently of the tunnel shell. It was considered that if the heavy Pullman trains, weighing with their locomotives as much as 600 to 700 tons, were allowed to bear directly upon the shell of the tunnel, their weight and impact might produce a settlement and set up bending stresses that would result in fracture and leakage. The problem will be solved by driving a line of very massive cast-iron screw piles through the floor of the tubes, at 15-foot intervals, with their heads projecting within the tubes, and capping the piles with a system of heavy transverse girders and longitudinal stringers, upon which the track rails will be laid. The heavy load and severe impacts of the trains will thus be received by the piles, and should there be any slight settlement of the piles under load, the movement would not affect the tubes, which would serve their proper purpose as an envelope for the protection of the trains. The piles will be driven either to rock or to a bearing capable of sustaining a predetermined load without settlement. Of the 24,049 feet of cast-iron single-track tunnel, 12,174 feet will be reinforced with screw piles.

The cast-iron shell consists of bolted-up segments, each 30 inches in length and containing eleven segments and a key piece in each. The shell is 2 inches in minimum thickness, and the segments are flanged on all sides, the joints being planed and provided with five or six 1½-inch bolts, as the case may be. At stated intervals corresponding to the position of the piles, plates are cast with flanged holes, which are temporarily closed by a cast-iron block. After a certain length of the shell has been driven, it will be bulkheaded off, placed under pneumatic pressure, and the piles will be screwed down from the interior of the shell. The piles are 27 inches in outside diameter, with 1¼-inch thickness of shell, and they are made in 7-foot sections. The lower end of the pile is square, and is provided with one turn of a wide screw cast integrally with the pile, the outside diameter of the screw being 4 feet 8 inches. The pile is screwed down by means of a special hydraulic ratchet arrangement bolted to the head of the pile, and as one section is carried down, another 7-foot section will be bolted to it, the process continuing until rock or impenetrable bottom is reached. The core of mud inside the hollow pile will be excavated for a depth of 12 feet below the tunnel tube, and the space filled in with concrete. After the pile has been driven, the last section will be removed, cut to exact length, to bring it flush with the floor of the tube, and replaced and bolted. The upper end of the pile after it has been filled with concrete will be closed by a bolted disk. Above the cap of each pile will be bolted heavy transverse girders, and upon these girders, bridging the intermediate space of 15 feet, will be a pair of longitudinal girders, upon which the railroad tracks will be laid. By this method the weight and impact of the heavy trains will be borne directly by the piles, and the iron and concrete tube will have no other duty to perform than that of forming, as we have said, a protective envelope for the trains.

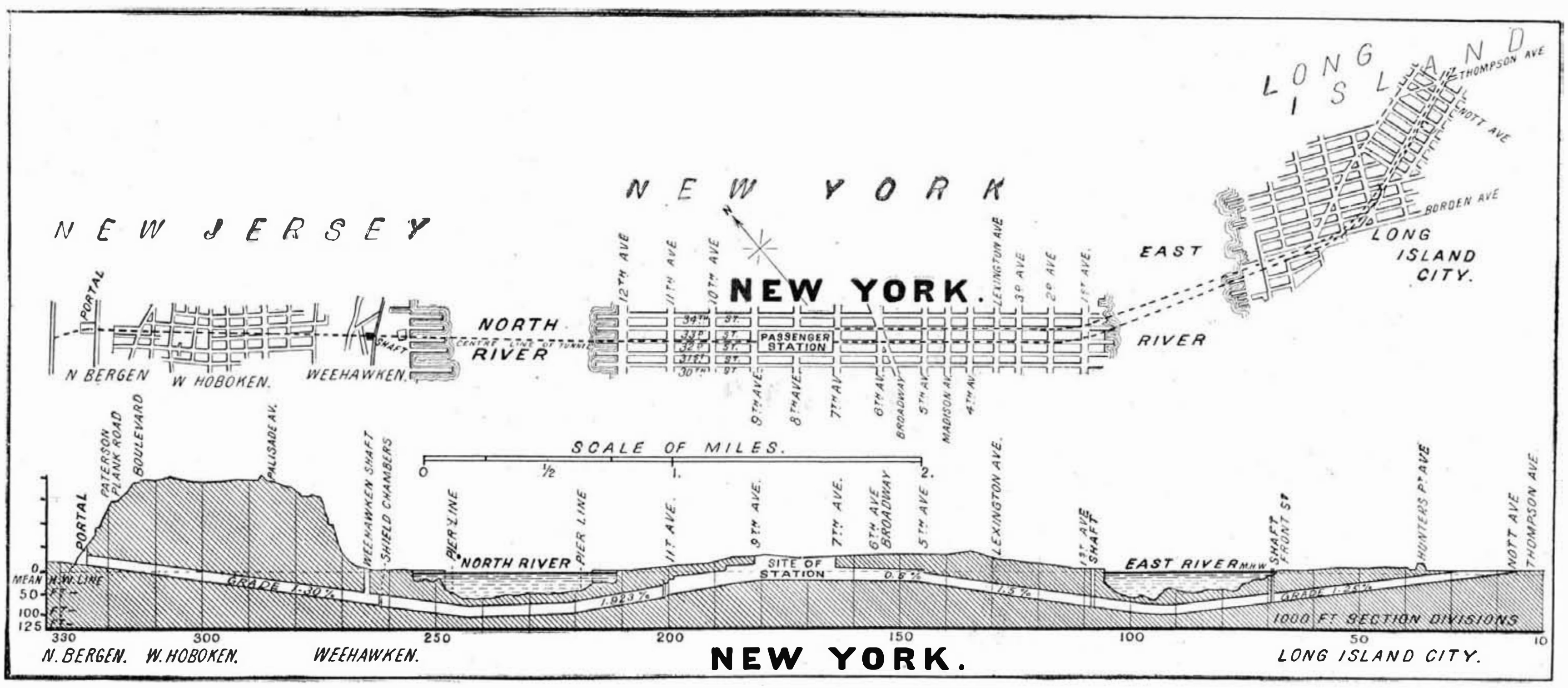


DIAGRAM SHOWING THE LINE OF THE PENNSYLVANIA TUNNELS UNDER THE HUDSON AND EAST RIVERS.

The tunnel, particularly that portion of it beneath the rivers, has been planned with a view to the prevention of accidents to trains, or mitigating the dangers, should an accident occur. In the first place, the sides of the tunnel are filled with a mass of concrete up to the level of the car windows. This will reduce the damage due to derailment or collision to a minimum, and will provide a means of egress from the tunnel in case of accident. Should a train be held in the tunnel for any reason, it would be possible for the passengers to climb out upon these footways, and escape by them to either end of the tunnel. Moreover, should a car jump the track, it would be impossible for it to slew out of line, and it is probable that the whole train could be brought to a stop before any more serious injury than the breaking of windows had been done. The electric cables will be carried in conduits and embedded, as shown in our engraving, in the concrete mass of these side benches. At stated intervals there will be refuge niches formed in the concrete for the use of employes, and, lastly, the whole tunnel will be thoroughly lighted from end to end.

Parisian Airship Fund.

The Municipal Council of Paris has appropriated an annual allowance for the encouragement of physiological research in connection with balloon ascents. The studies will especially be directed to the exaggeration of vital activity in high altitudes.

Correspondence.

Writing on Blue Prints.

To the Editor of the SCIENTIFIC AMERICAN:

In connection with the use of alkaline agents for writing in white on blue prints, one frequently sees this or that solution mentioned, but always with the disappointing statement that the solution will blur by spreading through the fibers of the paper.

I have thought it might be of interest to such of your readers as are using blue prints to know of a method which I have used for some time with entire success, consisting of mixing the bleach with a more or less thin gum arabic or mucilage water.

Oxalate of potash (10 per cent solution) is about the only alkali that will produce a pure white and satisfactory mark. W. F. MOODY.

Denver, Col.

The Elimination of Titanic Acid.

To the Editor of the SCIENTIFIC AMERICAN:

I take the liberty of offering a suggestion which may perhaps arouse the interest of some inventor.

In spite of the millions of tons of iron ore containing metallic iron up to 60 to 70 per cent to be found in this country, there is no possible method of using this ore, because it contains an amount of titanic acid which renders smelting unprofitable. If the titanic acid could be removed cheaply, so that smelting would pay, a great industry would be opened in many countries.

Chemical experiments for the purpose of removing titanic acid have been made, and have succeeded; but they are expensive for commercial application.

Christiania, Norway. A. JOHANNESEN.

New British Standard of Weights.

The British government has taken the first step toward the adoption of the decimal system of weights. It has just been announced by the Board of Trade that, under a special order in council, it will sanction the use of a weight of 50 pounds, instead of the present standards of 112 pounds (called a hundredweight) and 56 pounds (called a half hundredweight). The 50 pounds is by this action made a legal standard of weight. This reform has been adopted after forty years of agitation by Liverpool merchants and later on by petitions to the government by the chambers of commerce throughout the country, and particularly by the chamber of commerce of that city. Liverpool has felt the necessity for the change more than any other city, as this is the leading *entrepôt* for American and colonial produce of bulk, the weighing of which is a considerable item in the handling and, indeed, in the ultimate cost of the shipments. More cotton, corn, provisions, and tobacco are imported into Liverpool than into any other city in the world, and by far the largest proportion of these imports comes from the United States; so the United States is peculiarly interested in the reform just instituted. The Liverpool Journal of Commerce comments approvingly as follows:

"All these great quantities are calculated by the American sellers in pounds avoirdupois, but by the British buyers they have had to be counted in hundredweights, quarters, and pounds, in accordance with our antiquated and absurd and anomalous system of weights. What is the consequence? To give a concrete example: The buyer wishes to ascertain, say, the weight of 100 pounds of tobacco; to do so the nearest weight he can employ is a quarter, or 56 pounds, to which must be added smaller weights until the exact quantity is ascertained. But two 50-pound weights will give him the exact amount at once; three will give him the weight of 150 pounds, four 200 pounds, and so on, smaller weights being used for fractions of 50 pounds. The consequence is an enormous simplification of calculation. It should be remembered that the men who weigh these materials at the docks are not, as a rule, mathematicians who can tell the time of day by algebra. They are largely day laborers, who have not had a superior education, and to weigh quantities with a set of weights necessitating the calculation of fractions of pounds, and thereby the use of dozens of small weights, necessitates a mental effort of which all are not capable, and the use of a multiplicity of weights which confuses them leads to errors and loss of time—and time is money. But by the adoption of a 50-pound weight a unit of calculation has been obtained which will sweep away a whole set of weights, prevent errors, and save confusion, time, and money. It should be remembered that the present complicated and wasteful method of calculating weights has to be gone through four times—first, when the goods are warehoused; second, by the customs, for the purpose of duty; third, in the counting-house; and fourth, in the factory—and in all these cases the same cumbrous system of calculation by hundredweights, quarters, and pounds has to be gone through, and the loss of time, convenience, and money quadrupled. But by the adoption of a 50-pound weight, though four separate calculations will still be necessary, they can be done simply and quickly. The saving in bookkeeping will alone be great. The present system necessitates a maze of figures of different denominations; but by their reduction to the one common denominator of pounds weight whole columns of figures will be saved and the risk of mistakes minimized."

Section of Geology at the St. Louis Winter Meeting of the American Association.

The section met for two days with the Association, then joined in the annual meeting of the Geological Society.

Among the papers read that by Prof. L. C. Glenn, of Vanderbilt University, Nashville, Tenn., described some peculiar "dikes" of sandstone which occur in the western part of Kentucky and Tennessee. These dikes are vertical, or nearly vertical, walls of various widths and form a network in the Eocene clays of the region. The sandstone forming the dikes is somewhat laminated parallel to the walls. Sometimes there has been slight vertical faulting. The material of the dikes is micaceous and contains Eocene fossils in the form of casts. The fissures do not seem to have been connected in any way with the action of mountain-making forces. The region is one that has experienced severe earthquakes within recent historic time and it has suffered likewise in the geologic past. It is probable that the fissures described in this paper were formed as a result of earthquakes in Eocene time and that the dikes consist of the underlying sands which rose therein.

The deposits found in caves are always of interest through the light which it is hoped that they will throw on the question of the antiquity of man. Deposits containing fossils are rather rare in caves in this country, but important ones have recently been exploited in California and Arkansas. The results of the former, done by the University of California, were presented in a paper by Mr. W. J. Sinclair, which was read by Prof. J. C. Merriam. This cave, which is on Potter Creek, has furnished fossil remains representing a Quaternary fauna which has hitherto been imperfectly known. The Potter Creek cave in 1878 furnished the late Prof. Cope specimens of the cave bear, but the recent explorations in this and neighboring caves have brought to light more than fifty species of mammals and birds. Many of the forms are new to science. More than 7,000 specimens have been collected here thus far, and a complete record has been kept of the relation in which each was found. The deposits in the cave were found to be distinctly stratified. Some fragments of bone suggesting human workmanship have been found among the fossils.

The officers of the section for the meeting were: Prof. C. H. Hitchcock, of Hanover, N. H., chairman, in the absence of Prof. Israel C. Russell, of Ann Arbor, Mich., who was elected to the office last year; and Dr. G. B. Shattuck, of Baltimore, secretary. The officers elected for the ensuing year are: Chairman, Prof. E. A. Smith, of University, Ala.; secretary, Dr. E. O. Hovey, of New York city.

The Death of Sergeant Frederick.

Sergeant Julius Frederick, a member of the Greely Arctic expedition, died at Indianapolis, on January 6. The expedition under Lieut. Adolphus W. Greely was sent out in 1881 to establish one of a chain of thirteen circumpolar stations for scientific purposes. The party of twenty-five persons was left at Discovery Harbor on August 12, 1881, with equipment and provisions for twenty-seven months. Additional stores were to be sent in the summers of 1882 and 1883, but Greely was ordered, if these failed to reach him, to retreat southward not later than September, 1883. The members of the party made many excursions and observations; and as relief failed to reach them, they started south on August 9, 1883. All had kept well up to that time. They had to abandon their steam launch in the ice in October, and went into winter quarters at Cape Sabine, where they suffered greatly for want of provisions, and sixteen of the party died from starvation, one was drowned, and one was shot for persistently stealing food. The seven survivors were rescued by the third relief expedition, under Capt. Winfield S. Schley, on June 22, 1884, in so exhausted a condition that it was thought that had forty-eight hours more elapsed, they would all have died.

Death of Prof. Von Zittel.

Prof. Karl Alfred von Zittel, the well-known paleontologist and president of the Academy of Sciences, died at Munich January 6.

Prof. von Zittel was born in the Grand Duchy of Baden in 1839, and was a son of Karl von Zittel, a well-known statesman. He studied at Heidelberg and Paris, and later at the Imperial Institute of Geology at Vienna. After serving as an assistant at the Hof-mineralien Kabinet there he was appointed professor of mineralogy at the Polytechnic at Carlsruhe, and in 1866 he became professor of geology and paleontology at the University of Munich and director of the paleontological museum there.

In 1873 and 1874 Prof. von Zittel took part in the Rohlf scientific expedition to Egypt and Libya, and the valuable results of that expedition were due in great part to his work. He wrote a book on the expedition under the title "Contributions to the Geology and Paleontography of the Desert of Libya," and among his other well-known works may be mentioned his "Primitive Times: A Picture of the History of Creation," and his "Treatise on Paleontology."

Prof. von Zittel visited this country in 1883, and was present at the opening of the Northern Pacific Railroad.

Electrical Notes.

The electrical current offers a remedy for the consumptive, according to the Lancet, London. Experiments have been conducted to this end by Dr. J. Cunningham Bowie with a high degree of success, the doctor securing the best results with an alternating current of high frequency and low potential. A special apparatus was made for the work, one permitting of a great range of adjustment. In practice the current density ranged from 300 to 800 milliamperes and from 50 to 70 volts, and the application from 10 to 20 minutes. Almond oil containing iodine, thymol, and other antiseptics was used for intralaryngeal injections. The arrest of the lesion was brought about much more quickly than by the simple use of the antiseptic oils alone, and the doctor says he is entirely satisfied that the use of the alternating current promotes healing.

Peter Cooper Hewitt, the inventor of the vapor lamp which has been mentioned heretofore, has recently been granted a patent on a new form of his lamp. Up to the present time, the lamps have been constructed for installation in a vertical position, but the inventor has discovered that by placing the lamps in a horizontal position, a number of practical as well as æsthetic advantages are secured. The lighting of the room is said to be accomplished in a much more satisfactory manner, and the quality of the light is improved. Mr. Hewitt has also been granted a patent on an improvement in the construction of the lamps, by which the starting of the lamp is facilitated at a much lower potential. This is done by the addition of red sulphide of mercury to the interior of the lamp during the course of construction.

The report of the African Concessions Syndicate, just published, constitutes one of the most interesting items of recent news. The company in question has been formed to exploit the possibilities of the Victoria Falls on the Zambesi. These falls are over 400 feet high, and while the total amount of energy running to waste at Niagara is 7,000,000 horse power, the corresponding figure for the Victoria Falls in the wet season is 35,000,000. The railway has now been completed to within 70 miles of the falls, and will reach them before the end of next March. It is believed that it will be practicable to carry the electric energy generated at the falls economically even as far as the Rand, and it is hoped to work by means of it a large proportion of the South African Railway mileage, as well as to supply the power needed to the gold mines. American estimates are that, with conditions similar to those in Rhodesia, it will be possible to convey the current 330 miles and deliver it there at a cost of $22 per kilowatt per annum, the load being on for the whole twenty-four hours of the day. Within a radius of 300 miles of the falls are included the Wankie coal-fields, Bulawayo, the Gwelo, Sebakwe, Selukwe, Lomagunda, and Hartley gold fields, the northern copper fields, and about 900 miles of railway line; while a transmission of 600 miles would take in the whole of the South African gold fields. The site of the falls is said to be healthy throughout the year, and the whole region is thought to be more richly endowed with mineral wealth, including copper, gold, iron, and coal, than any similar area on the surface of the globe. At present only preliminary survey work is in progress, but it is expected to complete this very shortly, and work will then be begun with the building of a hydro-electric generating station, much on the lines of that at Niagara.

Zinc White from Mine Slag.

News received from abroad would seem to indicate that Prof. Ellershausen, a well-known German chemist, has invented a process of extracting zinc white from slag. He and Prof. Sir William Ramsay successfully experimented at the Hafaa mine in North Wales, showing that a ton of zinc white can be extracted from fifteen tons of slag by a far simpler and cheaper process than is now used in a roundabout production from spelter.

Great Britain imports about 200,000 tons of zinc white annually from the United States, Germany, and Belgium.

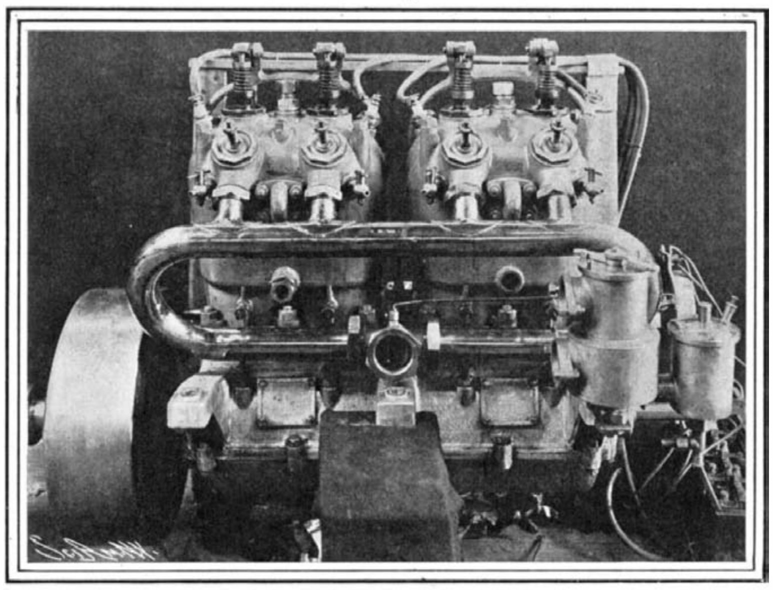
THE BARTON 150-HORSEPOWER AIRSHIP'S FORTHCOMING TRIAL TRIP.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

In the Scientific American for May 3, 1902, there was reproduced a photograph of a model of Dr. F. A. Barton's aeroplane airship. Since then the design has undergone many and radical modifications. It now consists of a cylindrical balloon large enough to support the car and its contents, with movable aeroplanes fixed on a frame between the balloon and the car. The inventor claims that this combination is quite original, and that by it he has overcome the fatal defect of all existing balloons, viz., the inability to rise or fall without discharging gas or ballast.

The balloon was made in the banqueting hall of the Alexandra Palace. It embodies several novel features, and is the largest in existence. It is 176 feet long, 43 feet in diameter, and has a capacity of 235,000 cubic feet, which gives it a lifting power, when filled with hydrogen, of 16,450 pounds. It is cylindrical in form, with an ogive nose and a nearly hemispherical stern. It is constructed of varnished silk, coated with linseed oil and baked after each coat. There is also an outer cover of pure unvarnished silk, strengthened with numerous webbing bands, from which are suspended the lines supporting the ship. By means of this outer covering and the bamboo arrangement (a series of bamboo strips bound round with fine cord and carried up to the nose of the balloon) greater strength and rigidity are imparted to the balloon, and no cord or metal can come in contact with the envelope. Dr. Barton claims that should a leakage of gas occur in the balloon, escape would be impeded, owing to this outer envelope, and that even if both balloon and outer covering were penetrated by shot, the two envelopes would, as the balloon grew smaller, slide over one another, and so cover the hole. The balloon is divided by partitions into three gas-tight compartments, one division being between the main body and the tail, and the other between the nose and the main body. Ordinarily the fore and aft compartments will be closed, but there is a special arrangement by which the gas can be allowed to escape on the pressure becoming too great after the full expansion of the diaphragms, which will be allowed to bulge into the main body when the gas in the nose and tail expands.

Inside the center partition will be a small subsidiary spherical balloon—or ballonette—filled with air, with a capacity of 17,000 cubic feet, the function of which may be thus explained: When the airship rises or when the sun shines and the gas expands, the air in the small balloon inside is forced out, the rear end of the aeroplanes being raised so as to prevent the balloon rising as it passes through the air, which it otherwise would do, owing to the diminished weight of the air. If the reverse occurs, and the gas contracts, air is automatically pumped into the internal balloon, so as to preserve the shape of the external balloon. The total weight is thus increased, whereupon the aeroplanes are again employed to prevent the balloon from sinking.



One of the Three 50-Horsepower Engines.

It is of course well known that balloons are usually unable to remain for very long periods in the air (though the Comte de la Vaulx has made a record trip of 1,100 miles from Paris to Russia in under forty hours), owing to variations in temperature, causing the gas to expand or contract and necessitating the loss of gas or ballast.

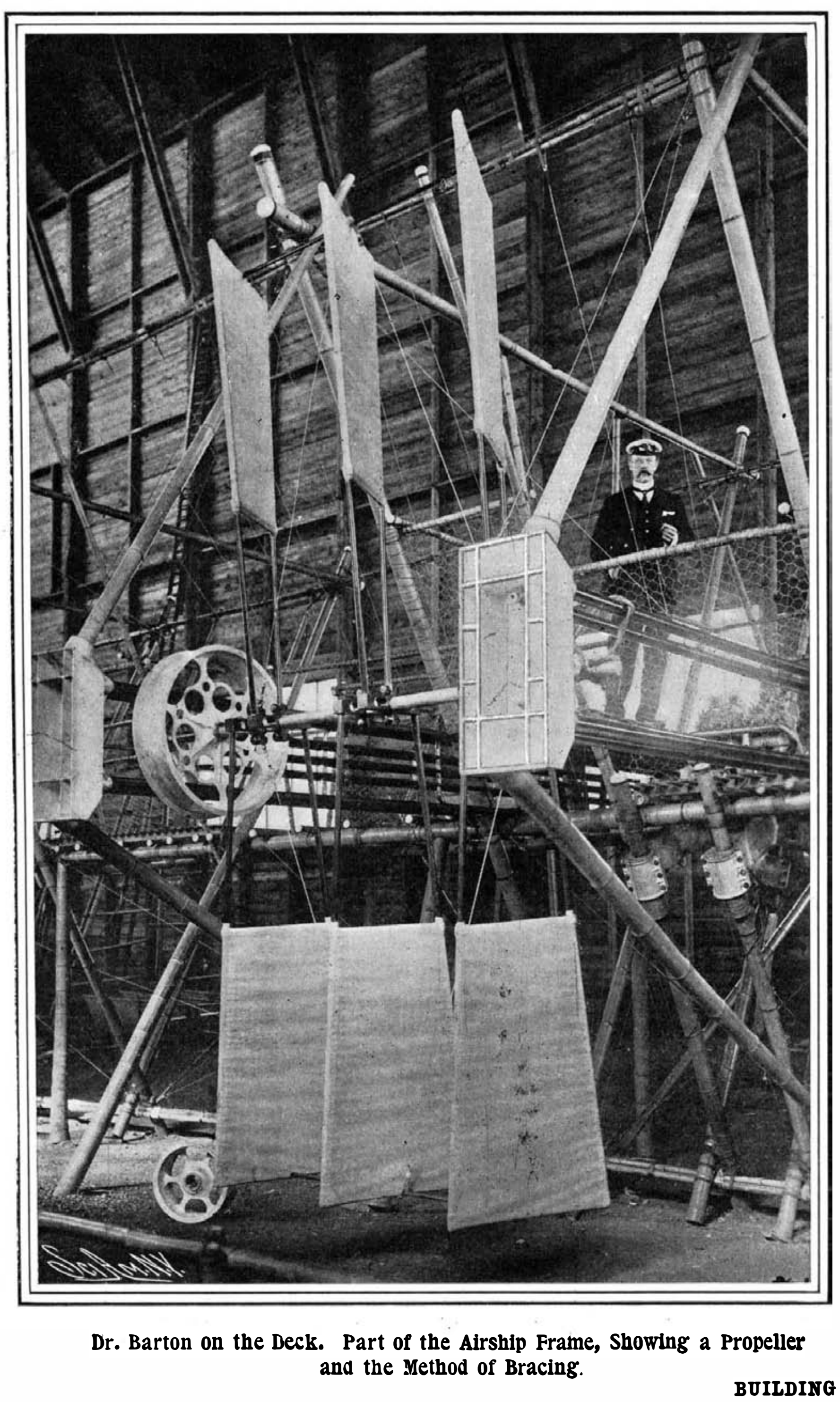
Dr. Barton's ingenious arrangement was designed to overcome this difficulty.

With regard to the balloon portion of his airship, he has said that he looks upon it solely as a lifebuoy to afford him the facilities he needs for experimenting with aeroplanes, as the balloon above will support the total weight. Gradually he hopes to diminish the size of the balloon and increase the size of the aeroplanes, and finally to dispense with the balloon altogether, evolving a vessel which will resemble those of Sir Hiram Maxim and Prof. S. P. Langley in that it will be heavier than the air it displaces, and be kept in the air and raised and depressed solely by the aeroplane surfaces.

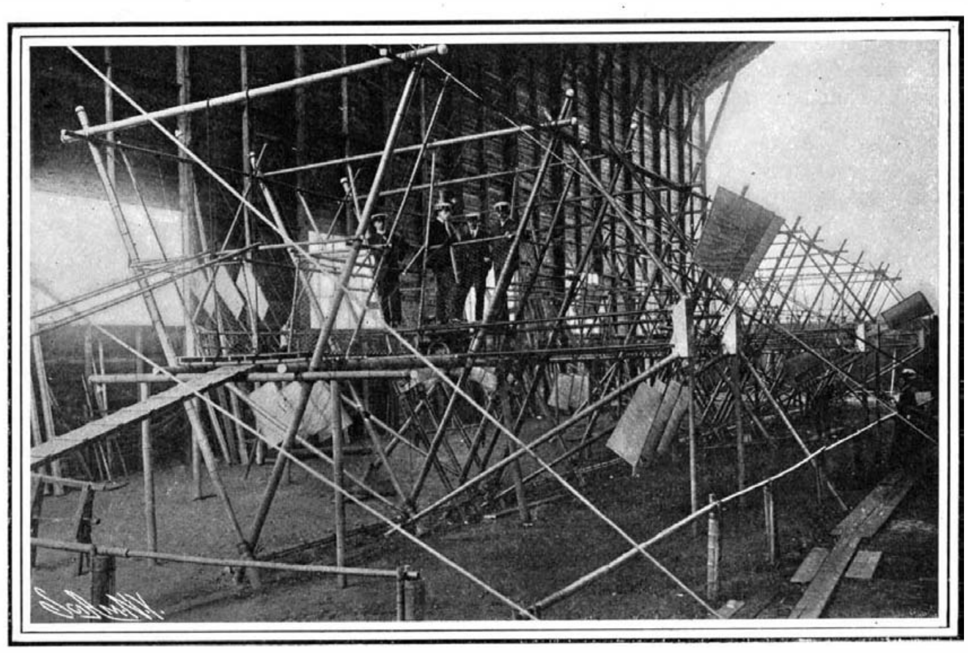
The framework of the car is constructed of bamboo varying in size from 1½ inches to 5½ inches in diameter. There are two large longitudinal members, which run from end to end and support the decks. Outside these, projecting both above and below, and placed diagonally to form a V, are at intervals other large-sized members, which are secured at their lower ends to the keel. The keel is constructed of three bamboos lashed side by side. The upper ends of the sloping members are connected together by longitudinal and transverse bamboos. The frame is left square at the back, but tapers off in front up to the sloping bamboo to form the bows. The frame thus formed somewhat resembles the skeleton of a ship, except that the sides are straight.

The two large longitudinal members carry smaller cross bamboos at close intervals, and along the center of these is laid a narrow deck, which is widened out at certain points to form the captain's and motor decks. The deck is made of latticed wood, and a light bamboo framework filled in with wire netting incloses it on all sides.

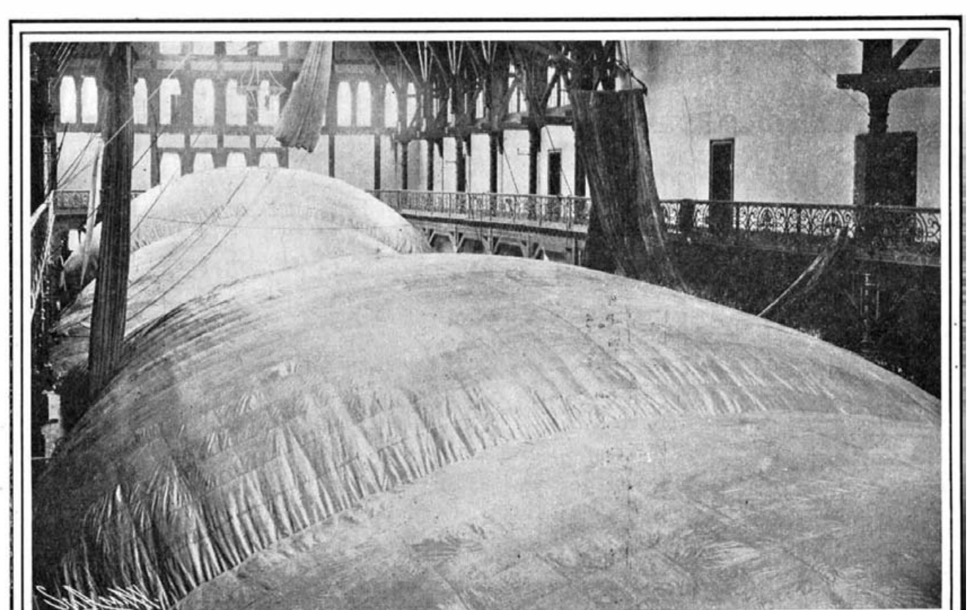
The bamboo members forming the frame are lashed



Dr. Barton on the Deck. Part of the Airship Frame, Showing a Propeller and the Method of Bracing.



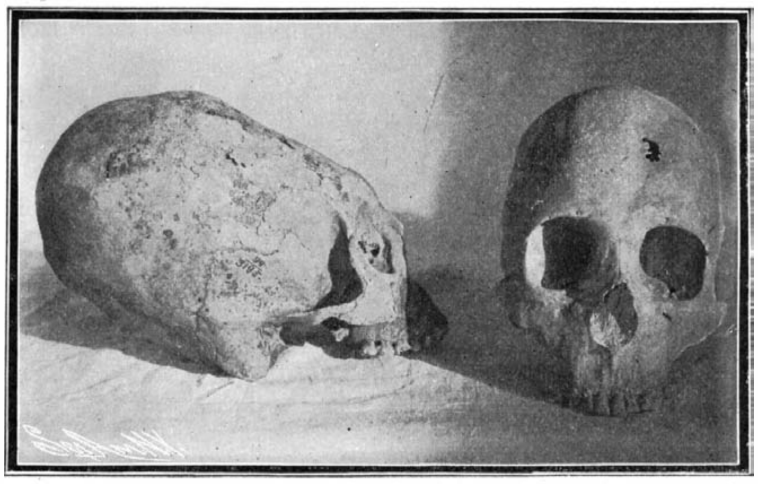
The Bamboo Frame and the Propellers.



Part of the Gas Bag Temporarily Inflated, Filling Nearly the Whole of Banqueting Hall in Alexandra Palace.

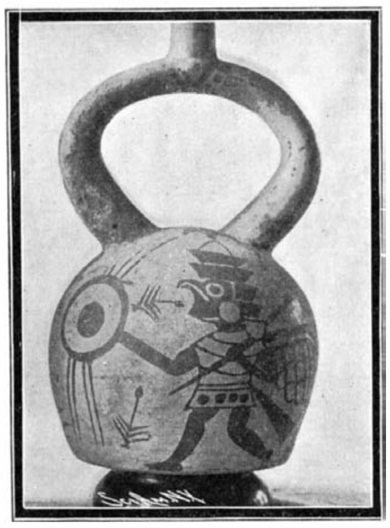
BUILDING THE BARTON AIRSHIP.

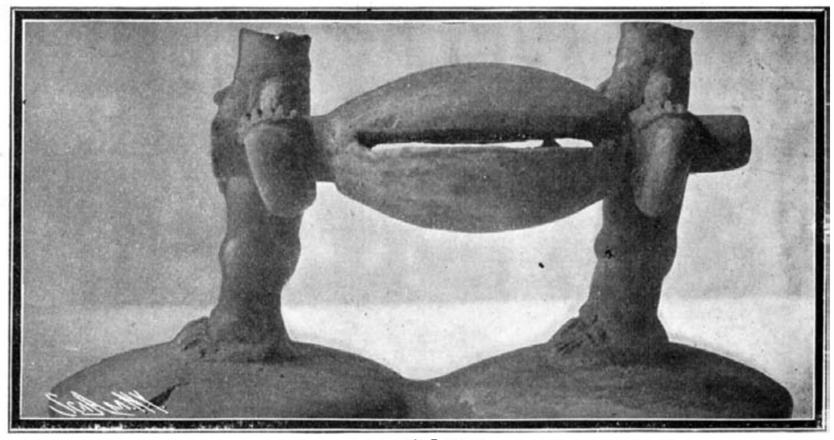

Cup of Solid Gold 8 Inches High.


Deformed and Trephined Skulls.


Water Jar.


King Condor and His Prey Water Jar.

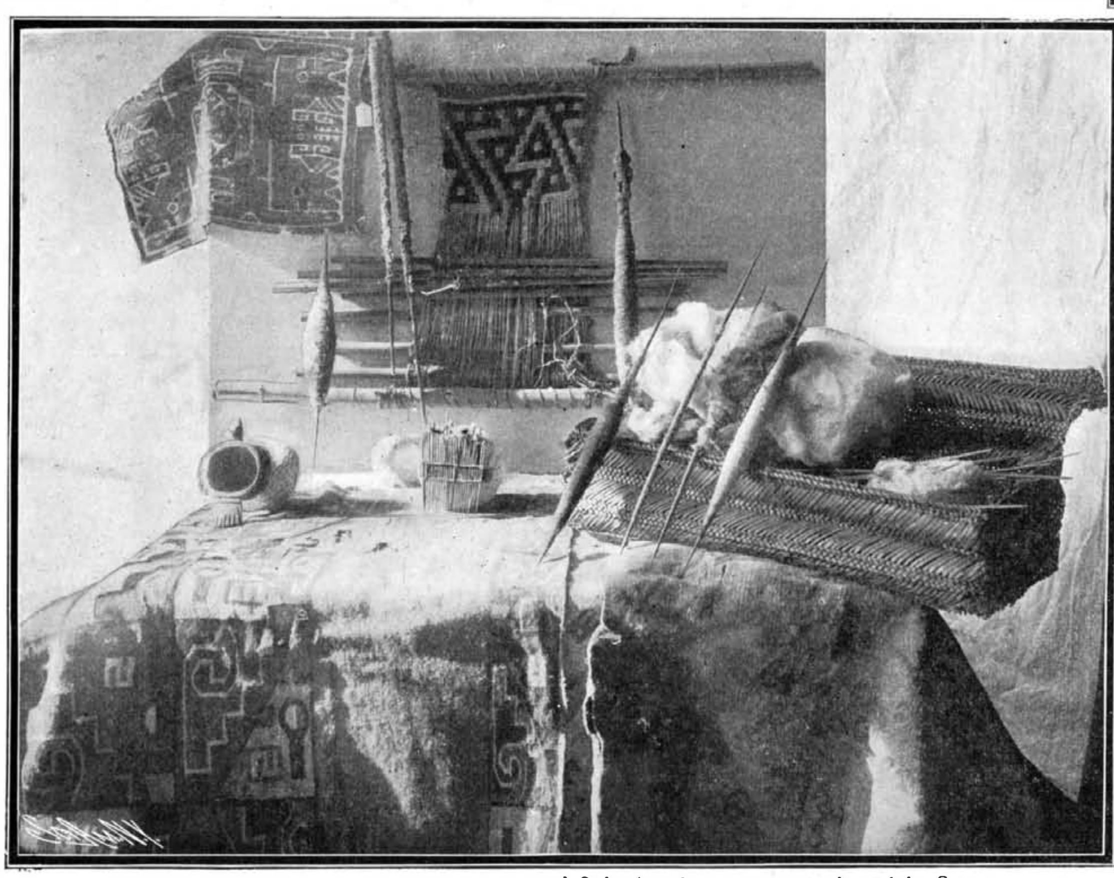

Inca Warrior Water Vessel.


Funeral Litter.


Water Vessel—Sleeping Child on Llama.


Silver Cup 12 Inches High.


Coast Mummy, With False Head and Funeral Offerings


Woman's Work Basket, Weaving Loom, and Spinning Implements as Found in Grave.


Llama of Solid Silver and Image—A Sacrificial Offering.

Photos by the Author.

INCA RELICS UNEARTHED IN PERU BY THE BANDELIER EXPEDITION.

[See next page.]

together with stout, specially-made, hand-laid cable cord of Dutch flax at the joints, and there is not a nail, screw, or bolt used in the whole framework, which is lashed together by steel wire cable to tension.

The keel is 120 feet long, the deck 123 feet long, and the upper frame 127 feet long.

There are three "motor decks," in each of which will be two of the crew, one to look after the motor, the other to control a set of aeroplanes. The full complement is seven, and the captain on the center deck can communicate with the crew by means of ship telegraphs, speaking tubes, etc. The telegraphs will ring in front of each motor, and on the captain's table will be arranged the lines connected with the valves, pressure gages, etc.

The vessel will be driven through the air by three 50-horsepower Buchet gasoline motors, each of which drives two six-bladed propellers, arranged three on one side of the deck and three on the other. The motors are bolted down to strong aluminium castings, which are clipped to the large bamboo members, and they are placed longitudinally of the airship. The power is transmitted from countershafts by belts to the propeller shafts.

Large Clarkson radiators for cooling the circulating water are attached to the steel tubes forming the framework supporting the propellers. The normal speed of the engines is about 1,600 revolutions per minute, and there is a speed reduction of 8 to 1 employed between the motor and the propeller.

In conjunction with Mr. Walker, Dr. Barton has recently designed a new gasoline motor which develops 20 horse power and weighs only 90 pounds. This works out at only 4½ pounds per horse power. The present Buchet engines weigh 6 pounds to the horse power, exclusive of the flywheel, which will add another hundredweight.

Each of the six propellers is made up of three two-bladed propellers, the blades of each, which are rigid, lying behind one another. The propeller shafts are of solid steel 2 inches in diameter and 7 feet, 8 inches long. They are fitted with aluminium pulleys.

Dr. Barton points out that Count Zeppelin's balloon could be slightly inclined by the aeronaut, so that the propellers drive it upward or downward. Instead of having, like the Count, four propellers 4 feet in diameter driven by 32 horse power, Dr. Barton has a balloon less than half the size, with six propellers 12 feet in diameter, driven by 150 horse power, which by means of the aeroplanes should suffice to sustain the airship even without the help of a balloon.

The inventor calculates that 150 horse power will keep in the air a weight of 18,300 pounds to 34,650 pounds, whereas the total weight of the balloon fully loaded with crew and all accessories is under 16,000 pounds. There is no doubt that an airship using aeroplanes alone could obtain a very high rate of speed, as the resisting medium of the air is so much less than that of water or the friction of rails. It is calculated that the six propellers of the Barton airship, when revolving at their full speed, displace 1,200,000 cubic feet of air per minute, and a speed of 17 to 20 miles an hour is anticipated.

There will be no less than thirty aeroplanes for the steering of the ship in the vertical plane. They are mounted between the deck line and the top of the frame in three banks of ten, one in front of each motor, five of the aeroplanes in each bank being placed on each side of the flying deck.

Three aeroplanes in each set of five are mounted one above the other nearer to the motor than the other two, which are also above one another, but placed somewhat further forward and in such a way that they lie between those behind them. Each aeroplane is 15 feet long by 3 feet across, giving a surface of 45 square feet. The total surface is 1,350 square feet. The aeroplanes are pivoted to the frame at their forward end and the surfaces can be raised or depressed by the man in charge of them. By means of a large rudder at the stern the vessel is steered in the horizontal plane.

The ingenious system of shifting water ballast employed by Dr. Barton to keep his vessel on an even keel, when she shows a tendency to shove her nose or tail into the air, owing to the moving about of the crew or other cause, has been used by some inventors of submarine boats, notably by the late M. Claude Goubet, but has never, so far as we are aware, been adopted in aerial machines. At each end of the vessel is a 50-gallon water tank; the two are connected by a pipe, and will contain only 25 gallons each. When the longitudinal stability shows signs of being disturbed, water is automatically pumped from the forward to the aft tank, or *vice versa*. The motor-driven pump is situated on a separate deck in the fore portion of the airship.

Five hundred thousand incandescent electric lamps will be employed in the illumination of the World's Fair grounds and buildings.

REMARKABLE DISCOVERIES BY BANDELIER OF INCA CIVILIZATION IN PERU.

BY WALTER L. BEASLEY.

In recent years, one of the most interesting regions of the New World, interesting both to the historian and excavator, has been the western coast of Peru and the lofty Bolivian plateau. On the latter was situated the far-famed Inca tribe, who had developed in pre-Columbian times an advanced culture which for centuries has been the object of vain study. Mr. A. F. Bandelier and his gifted wife have carried out researches under the auspices of the American Museum of Natural History, the first two years' exploration, however, being supported by the late Henry Villard. The discovery by the Bandeliers of many relics of the ancient Indian empire of the Incas has been considered a brilliant achievement, and has won additional fame for this eminent investigator, whose discoveries now add so greatly to history and the early culture of South American civilization.

Chief among the curious features of the Inca people was their manner of interring the dead, and the unusually large number of objects placed in the grave as funeral accompaniments for the body on its long journey to the future world. The scattered population of the coast of Peru, for some five or six hundred miles, cultivated every available foot of good land and used the desert and barren stretch near the water as a cemetery. The people of the high plateau of the Andes used the sides of steep cliffs or stone towers, called Chulpas, as burial places. The graves of the coast were arranged in groups, being sometimes round or square-shaped pits, varying in depth from 2 to 12 feet. A matting and framework of reeds was used as a top cover to protect the contents from the pressure of the sand above. Some graves contained only one body, others three or more on the same level. The standing of a person was usually determined by the character and number of objects deposited, as well as the embellishment of the outer covering or dress of the mummy pack. The latter usually consisted of a finely woven woolen fabric, having a rich border. A typical mummy is here shown just as it was unearthed by Mrs. Bandelier. An interesting statuette found shows the Inca method of carrying the dead to the grave. An oval-shaped litter, having projecting ends resting on the shoulders of two men, was used. The right hand of each is placed over his heart as a method of expressing sorrow. Weaving was one of the industries in which the Peruvian Indians excelled. Articles associated with this occupation were the most frequent of those found in the graves. A number of reed rods, having their ends wound round with bright thread, so as to form a pattern, are placed within the folds of the outer pack. Other peculiar adornments of the outer mummy dress are small hanging pouches or bags, embroidered in rich design. These are filled with coca and various foodstuffs. As the Indian dress in life consisted of a short poncho and a loosely-worn wrap, a dangling pouch or pocket for the keeping of provisions and other necessaries which were indispensable on a journey while he was living, the same were thought necessary for comfort in death, and were therefore attached to his body. The peculiar crouched position which was given to the dead body seems to have been a long-established mortuary custom of the people. In this they simply imitated the every-day life of the inhabitants; for as the wearied Indian at the close of his daily labor seeks rest in a squatting position, he is correspondingly consigned to his eternal rest in the same attitude. The method of packing the body was to tie it in skins and matting. The whole was then bound tightly together with cords. The square form of the mummy is produced by a stuffing of the white cotton sack with seaweed and leaves. The poorest style of burial was of plain white cloth. Children in a great many instances were found wrapped and fastened full length on a bed of rushes or reed cradle surrounded with toys, domestic pets, and their favorite playthings in life. Some of the ever-recurring and characteristic objects met with in the graves of the coast were work-baskets made of plaited reed-grass used for containing the wool-spinning and sewing implements, dove-shaped wooden receptacles, combs of thongs, and other articles of daily life employed by the women. Often a complete loom having a partly completed pattern would be found. Among the most noted of the contents of such a work-basket are the beautifully finished and decorated spindles. These are looked upon as some of the most elegant and tastefully ornamented articles of Peruvian handiwork. They are of hard smooth wood, painted in showy colors. The elaborate embellishment of these spindles is somewhat surprising, as when in use the ornamented parts are hidden from view by the thread wound around them. The designs are either painted on, burnt in, or incised. Some of the textile work obtained in grave deposits is to-day fresh and magnificent in color and appearance, equaling some of the choicest Gobelin tapestries of modern times. Some contain 62 threads to the square inch. These beautiful fabrics are decorated in bird, animal, and geometrical patterns. They were woven from the wool of the alpaca and vicuna. One of the striking forms of burial was the addition of a false head. This was stitched on top of a square pack, which contained the wrapped body inside, and was stuffed with seaweeds and leaves. The eyes, mouth, and lips were generally indicated by a white thread, the nose by wood and occasionally padded white material. Frequently, though, these organs are represented by thin, cut-out pieces of copper and gold. Often the whole mask is made out of thin silver and attached to the head. The complexion of the face is often indicated with red and blue ocher painting, and the hair by a long fiber, dyed black. The false head is usually wrapped by bandages of bright cloth. The idea of this extra death-mask or head was seemingly to give a human appearance, which they wished their dead to retain even in their buried abode.

Of all the industries which occupied the attention of the greater part of the population, undoubtedly that of pottery was one of the most prominent. Specimens of this art are the most abundant and diversified of all the objects found in the graves. It was in the production of water vessels, jars, and vases that the inventive faculty of the Indian artisan was displayed to its fullest extent. Leaving no written language, nearly all of our knowledge of the people is due to the handicraftsman in clay, who made it a practice to represent faces, architecture, costumes, and characteristic scenes of every-day life on his creations in pottery. Thousands of these fanciful shapes were taken from coast burials and those of the upland plateaus. The material is of red, black, light colored or gray, and varies much as to ingredients and execution. The most elegant types are of fine gray and brown clay, with glazed surfaces, and show little or no granular mixture. These are considered the most beautiful form of Peruvian ceramics. In general, the bulging form prevails, although the shape varies according to the skill of the artist and the use intended. Some have a flat, others have a cone or egg-shaped bottom. The latter were set on a clay base with funnel-shaped opening. This kind of pottery, with little or no plastic decoration, but handsomely painted and of chaste form, is the true Inca pottery, made near Cuzco. The more showy results of the potter's art were displayed to the best advantage in the employment of animal and human figures.

The most satisfactory and artistic productions in clay are thought to have been when the whole vessel was treated as a human head, with the attached mouthpiece serving as a head-dress or covering. These portrait jars are especially noteworthy and highly prized, as they afford in most cases a lifelike representation of the face and features of the Peruvian coast Indians, as well as illustrating the technique. One of the types is unusually interesting, for it portrays a personage clothed in warrior's garb. Possibly here is depicted one of the chiefs, armed and equipped for battle. The striking feature of the costume is the high head-dress or conventionalized human face, with immense ear plugs. The left hand grasps a shield made of llama skin, to which are fastened short throwing-darts. The right holds a battle-ax. The other weapons used in warfare by the Incas and coast people were slings, for hurling stones, clubs four to five feet long, having five or six sharp points of metal or stone, and throwing-lances fifteen feet in length. Forest animals and maritime creatures of the period, notably the great condor with his helpless victim, were on the various forms of pottery met with. Probably one of the most extraordinary and remarkable pieces of pottery from an imaginative standpoint, at least, is one depicting a resting llama, with a sleeping child snugly clinging to its warm and fleecy back.

The great abundance of gold and silver in the time of the Incas, and their skill in soldering and fashioning these metals into striking shapes, are exhibited by the hundreds of personal ornaments, statuettes, and ceremonial objects wrested from burial places. Mosaic work on shells, supplemented by wide bands of gold, the ends terminating in a parrot's head, were evidently common household adornments, a number of such being recovered. Necklaces of golden balls, nearly the size of a twenty-five cent piece, were evidently commonly worn. Huge drinking or ceremonial cups a foot high, of silver, and more than half that length, in gold, wrought into portraits, attest the lavishness of display which flourished among the people. Long wrist-bands of solid gold and silver were worn. Instead of sacrificing the living llama, on some occasions, figures of this animal ten inches high, of solid silver, were buried as an offering. Gold was secured by washing in the mountain torrents and streams. Silver was obtained from easily fusible ores by reduction on the site where the ore cropped out, and also by fusion in small and rude ovens, placed in the open air. Copper was treated in the same manner. Silver and gold were mostly hammered.

The foregoing sketch has been intended more as a general pictorial display from the recent finds, showing the handicraft and everyday objects used by the Incas, rather than an historic survey.

The author acknowledges indebtedness to Mr. A. F. Bandelier and to the American Museum of Natural History for the courtesy of reproducing the accompanying illustrations.

Carbon Wool.

Messrs. Constant and Henri Pelabon have recently brought out the fact that carbon is produced in the form of fine thread-like filaments in some forms of coke furnaces. These filaments when agglomerated in a mass, form a material which may be termed *carbon wool.* The carbonization of bituminous coal in the formation of coke for industrial purposes gives rise to a deposit of a thread-like character which is formed in the mass of the coke itself. The collection of such filaments gives rise to the product which the authors call carbon wool, and they have determined to some extent the structure and composition of the product. These deposits, which are never observed in recuper ation furnaces where the coal is distilled in a closed chamber, are found especially in coke which comes from open furnaces, particularly of the older types. Here the air comes into the furnace through openings and the gas is allowed to burn in the apparatus. All the flames unite and are concentrated toward an opening placed in the upper wall. Near the opening is a region which is much hotter than the other parts of the furnace, and it is here that the deposits of filiform carbon are found.

These deposits occur inside of geode-like cavities in the coke. Some parts of the carbon wool formed by the intermeshed filaments are gray and other parts quite black. By observing the separate filaments of gray wool under the microscope, they are found to have a cylindrical form in general. The surface is seen to be covered by a glaze such as is observed on the neighboring coke masses. Sometimes filaments are seen which have an alternate contracted and expanded section, as if formed of a great number of cones placed one after another. No trace of crystallization was observed, however. In the carbon wool small black masses are sometimes noticed, about the size of a pinhead. These consist of a mass or roll of very fine and closely packed filaments which are formed on some parts of a coarser filament. The black filaments have a dead color and the surface is covered with asperities which are sometimes disposed quite regularly. These filaments are seen to be formed of a series of rings. One of them had 6 rings per 1-250th inch. The thicker filaments are generally from 0.0012 to 0.0035 inch in diameter. The very fine threads which form the black masses above mentioned and seem to be attached to the thick filaments, are much finer and measure about 0.0008 inch. The length is generally about 2 inches, but may reach as high as 3 inches.

A number of experiments were carried out in order to determine the nature and composition of the threads. By burning them in oxygen, carbon dioxide is formed. Placed in a Moissan oxidizing mixture, with the addition of nitric acid and chlorate of potash, the filaments seem to be either dissolved or changed to a yellow substance. This latter is supposed to be a graphitic oxide. It deflagrates and produces quantities of sparks when heated to 300 deg. C. The carbon wool which is produced in the coke furnace is somewhat similar to that which Schutzenberger formed by passing cyanogen gas over a mixture of retort carbon and cryolite heated to redness in a porcelain tube.

Some Troubles of the Explorer.

Prof. Flinders Petrie says in the London Times:

"Unhappily, the growing lawlessness of Egypt, which Lord Cromer noticed in each of his recent reports, has affected our work, and 'a large number of offenses, not very serious in themselves, but which cumulatively become serious, have been committed, and but too often have been committed with impunity.' (Report, 1902, p. 40.) A statue was stolen from my house; and though the footprint of the thief exactly agreed with the very peculiar foot of one of the men who were notoriously accused in the village, and all the links were named by witnesses, yet no conviction could be obtained; £35 are said to have changed hands as bribes over this. Next, my workmen from Quft were subject to a general conspired assault in the market, and each robbed of his money at once. But no redress whatever could be obtained. The police officer added to the injury by taking away one man who had been beaten to see the doctor, who did nothing but detain him till he paid 10s. bribe to be let go. Last year the relations of a man who died of fever were mulcted of £6 by another doctor; and, on my complaining, the official inquiry resulted in giving an account which was absurdly false, to my personal knowledge.

"It is impossible that the present machinery can work to elicit the truth. Witnesses are examined by petty officers, who dictate the final statement of evidence at their own will; and the witnesses are summoned, through their sheikh, who is the first man to be 'squared' by the offenders, and, 'who, they think, will assuredly sooner or later endeavor to wreak his vengeance on them.' (Report, p. 36.) Such a system, dating long before the British occupation, is the most perfect for facilitating bribery and the suppression of truth. This is not the place to discuss the remedies. Happily Lord Cromer considers that 'the points which most require attention are the police, the department of justice and sanitation.' I do not touch on more personal threats to our party and being fired at, as I only wish here to refer to the failure of justice. But matters have gone so far that we must look for safety to our own resources rather than to the law, which has in each case proved to us useless."

A HARMLESS REPTILE.

BY A. R. M. SPAID.

If there is anything we need to teach more than another, it is that numerous insects and reptiles, which are held by many persons to be poisonous, are perfectly harmless. This is especially so of the pine-tree lizard, or, as it is often called, the fence lizard. It is true that the lizard has teeth, but they are almost too small to be seen, the finely serrated jaws feeling just like the rough lips of a bass. Moreover, these little saurians seldom attempt to bite, and make interesting pets.

I have a box two feet long, one foot high, and six inches wide, the sides being of glass and the bottom covered with white sand to a depth of two inches. With this on my study table I have a good opportunity for watching the five interesting inmates as they eat and sleep. Two are males and three are females, easily distinguished by their color. Their color seems to be influenced by the conditions of the atmosphere. After a rain or when they first come out of their hiding places in the morning, many of them are very dark. By holding them in the hand a short time, the color changes very perceptibly.

TAME LIZARDS AS ORNAMENTS.

When my pets are ready to go to bed, they dive into the sand, where they remain covered up until morning. Then here and there a head bobs up, and gradually the saurians either stretch out on the sand or prop themselves up on their forelegs in a most comical manner. They soon become alert, and show how keen their appetites are if flies, crickets, grasshoppers, or katydids are thrown to them. Frequently, when one has seized a particularly fat grasshopper, another will attempt to take it away. They are also fond of roaches, but care nothing for hard-shelled beetles. They will not seize an insect unless it is moving, and one often knows when the attack is to be made, as the lizard opens its mouth just a little way before springing upon its prey. It uses its tongue with the same agility as does the frog or toad, and gorges a large insect pretty much the same way as a snake swallows a toad.

In burrowing in the sand they make several strokes with the right or left forefoot, changing from one to the other; but when this dirt is to be worked out of the way, they use their hind feet with alternate strokes with great rapidity. The female in this way evidently digs into the ground, where she deposits a dozen or more white eggs, which she leaves for the warm earth to hatch.

I know of nothing else so easily tamed. When caught in the hand they seldom attempt to escape. Placed on one's clothing, they often sit in the same position for a long time. Knowing this peculiarity, I decorated my little son with nineteen lizards, just to prove to some skeptical people that I was willing to back up my assertions with a demonstration. Yet one observer who witnessed it declared that it was risky, and that he knew a man who had lost a finger from the venomous bite of a fence lizard. A teamster who was not afraid to handle a snake could not be persuaded to touch a lizard, although they both saw a finger thrust into a little saurian's mouth. Ignorance is hard to banish, but it easily drives away the truth.

They are not only harmless, but beneficial. Lying on the fences which surround the field of growing crops, they devour many insects as these attempt to enter the fields, thus benefiting the farmers, who have no appreciation of their value.

A Strange Use for Skimmed Milk.

BY GUY E. MITCHELL.

A use to which skim milk, sour milk, buttermilk, or even whole sweet milk is not often put is paint-making, yet this product of the diary makes possibly one of the most enduring, preservative, respectable, and inexpensive paints for barns and outbuildings. It costs little more than whitewash, provided no great value is attached to the milk, and it is a question whether for all kinds of rough work it does not serve all the purposes and more of the ready-mixed paint, or even prime lead and paint mixed in the best linseed oil. It is made as follows, and no more should be mixed than is to be used that day: Stir into a gallon of milk about three pounds of Portland cement and add sufficient Venetian red paint powder (costing three cents per pound) to impart a good color. Any other colored paint powder may be as well used. The milk will hold the paint in suspension, but the cement, being very heavy, will sink to the bottom, so that it becomes necessary to keep the mixture well stirred with a paddle. This feature of the stirring is the only drawback to the paint, and as its efficiency depends upon administering a good coating of cement, it is not safe to leave its application to untrustworthy or careless help. Six hours after painting this paint will be as immovable and unaffected by water as month-old oil paint. I have heard of buildings twenty years old painted in this manner in which the wood was well preserved. My own experience dates back nine years, when I painted a small barn with this mixture, and the wood to-day—second growth Virginia yellow pine—shows no sign whatever of decay or dry-rot. The effect of such a coating seems to be to petrify the surface of the wood. Whole milk is better than buttermilk or skim milk, as it contains more oil, and this is the constituent which sets the cement. If mixed with water instead of milk, the wash rubs and soaks off readily. This mixture, with a little extra of the cement from the bottom of the bucket daubed on, makes the best possible paint for trees where large limbs have been pruned or sawed off.

The Current Supplement.

The current SUPPLEMENT, No. 1463, opens with an illustrated account of the Stewart-Eaton steam-operated cinder pot. Mr. Stephen de Zombory presents an excellent discussion of aerial tramways as economical means of transportation. His paper is illustrated with engravings of historical interest, among them one showing a Roman wire cable dug up in Pompeii, another a historical German rope tramway reproduced from an old print. Commissioner Lindenthal's proposed improvement of the Brooklyn Bridge, whereby the carrying capacity of the structure will be materially increased, is described. Mr. Albert P. Sy's account of the nitrocellulose stability tests is concluded. Prof. W. M. Davis' paper on the geography of the United States, read before the American Association for the Advancement of Science, is also printed.

The Scientific American at the South Pole.

A subscriber, who is at the head of one of the large transatlantic steamship companies, informs us that through his instrumentality the SCIENTIFIC AMERICAN is about to take a southerly journey which will certainly carry it further toward the South Pole than it has ever traveled before, and probably as far, if not farther, south than any printed matter has yet made its way. He tells us that in packing a box with articles, which he was sending out to a friend by the relief ship which will shortly sail from Tasmania in search of the "Discovery," he included a year's file of the SCIENTIFIC AMERICAN. With the papers was sent a strict injunction that one copy at least was to be nailed to the South Pole! While we must confess that we are scarcely as confident in the near discovery of the pole as our subscriber, we must confess that among the remote corners of the earth to which the SCIENTIFIC AMERICAN has penetrated, this last is decidedly the most unlooked-for and interesting.

Legal Notes.

A SEWING MACHINE PATENT CONSTRUED.—The Johnston patent, 324,261, for a ruffling or gathering attachment for sewing machines, was declared void for lack of invention by the Circuit Court of Appeals in the case of Greist Manufacturing Company vs. Parsons (125 Fed. Rep. 160).

The patent relates to alleged improvements in sewing-machine attachments for making ruffles, plaits, or gathers. In the operation of these attachments, as a genus, a steel blade moves back and forth near the needle in the direction of the feed; levers are so connected that the up-and-down motion of the needle bar is converted into the to-and-fro movement of the ruffling-blade; the two pieces of cloth to be sewn together are placed under the needle, with the ruffling-blade in contact with the upper piece; and as the needle rises out of the cloth the ruffling-blade pushes the upper piece into a fold which is secured by a stitch when the needle descends. To regulate the size of the fold, one species had means for controlling the amount of "lost motion" between the needle-bar and ruffling-blade. The less the lost motion, the greater the stroke of the ruffling-blade, and *vice versa*. Within this species, one class adjusted only the limit of the backward stroke of the ruffling-blade, while another adjusted also, to a less extent, the limit of the forward stroke, so that the blade moved farther forward in making full than in making scant gathers, in order to bring the stitches nearer the center of the folds. This was all old. To the creation of genus or species or class the disclosure in the present letters contributed nothing. The alleged improvement was held to be a mere variation within the last-named class.

"The mechanism, so far as the claims in suit are concerned, may be described as consisting of two levers, pivoted at a common point, one connecting with the needle-bar and the other with the ruffling-blade, which levers are made to co-operate with each other by means of two stops mounted on one of the levers and a cam-shaped contact device pivoted to the other lever and interposed between the stops. By turning the cam on its pivot, its opposite edges may be caused to recede from or approach both stops simultaneously, whereby the amount of lost motion between the levers is varied, and the limit of both the forward and backward stroke of the ruffling-blade is adjusted."

After a careful examination of the thirty-five reference patents, the Court failed to find a ruffler that could not be distinguished from the exact terms of each of the claims sued upon. The prior art is full of various combinations of levers, stops, and cams which are operated to produce all the work that can be done with appellee's ruffler. The Court thought that each element of the claims in the suit was old in this very art, and had been used to perform the same function assigned to it in Johnston's present device. "This ruffler introduces no new mode of operation, produces ruffles no better and no faster, and does not afford to the user (though it may to the manufacturer) any advantage over others. The novelty consisted in selecting and rearranging old elements to produce a machine new in form, but old in function, and therefore an old machine. And though Johnston made a better selection and arrangement than did Horace's painter, who 'joined a human head to neck of horse, culled here and there a limb, and daubed on feathers various as his whim, so that a woman, lovely to a wish, went tailing off into a loathsome fish,' the genius of the artist was not more wanting in the one case than that of the inventor in the other; for 'it is not invention to combine old devices into a new article without producing any new mode of operation.'"

The decree of the Circuit Court dismissing the appeal was affirmed.

A CURIOUS ASSIGNMENT.—The recent case of Canda vs. The Michigan Malleable Iron Company, decided by the Circuit Court of Appeals for the Sixth Circuit (124 Fed. Rep. 486) brings out the law of assignments in a manner that every inventor can easily understand. F. E. Canda had obtained a patent on improvements in the construction of drawbar attachments for railroad cars. He assigned this patent in an instrument which reads as follows:

"I, the undersigned, Ferdinand E. Canda, of the borough of Manhattan, in the city of New York, for and in consideration of one dollar and other good and valuable considerations, the receipt whereof is hereby acknowledged, have sold, assigned, and transferred, and by these presents do sell, assign, and transfer, unto Canda Brothers, a firm composed of Charles J. Canda and myself, all my rights, title, and interest in and to six certain letters patent issued to me by the United States of America, and numbered and dated as follows, viz.: No. 460,426, dated September 29, 1891 [and five others enumerated], being an entire interest therein for the sole use of said firm of Canda Brothers, and legal representative, successors, and assigns."

It was contended that "my" interest meant "the" entire, not simply "an" entire interest. The assignor was the sole patentee, and also one of the assignees. No criticism was made upon that fact. The Court thought the objection was hypercritical, and that the intent and effect of the assignment was to transfer a one-half interest to the other partner, nothing being to show that the partners stood upon unequal terms.

The patent in suit was one granted to Ferdinand E. Canda for improvements in the construction of drawbar attachments for railroad cars. The defendant set up the usual answer of anticipation by previous patents. The Circuit Court held all the claims invalid upon the ground that the alleged invention was not new. From the decision of the Circuit Court an appeal was taken.

In drawbar attachments provision is usually made for easing the shock in starting and stopping the cars, this end being attained by allowing a sliding motion of the drawbar between the draft timbers running lengthwise at or near the inner end of the drawbar, and so associated with it as to register the inward thrust of the drawbar as well as the lengthwise pull in forward draft. One end of the spring is secured or in contact with the drawbar or some of its attachments—as, for instance, a follower fixed thereon—and the other to the draft timbers or something thereto attached. A casing is necessary to contain and hold in place such springs and the tail of the drawbar sliding between them and the followers and sometimes other parts. It is particularly this casing which is the subject of the Canda patent. The inventor made his casing with rigid sides and top, adapted to be let into the inner sides of the draft timbers. To provide easy access to the parts, and also to receive a bottom plate, he leaves the bottom of the casing open, the expectation being that the bottom will be supplied by the builder.

The counsel for appellee made the point that because a casing without a bottom would serve no purpose and could be put to no use, the claim in which it appeared must fail. But the Court thought it erroneous to suppose that because the element or the combination of elements in a claim would not of themselves constitute an operative invention, the claim is, therefore, void. A man may invent a single element or an improvement in some element in a machine, or he may invent an entire machine or product.

An examination of the state of the art convinced the Court that none of the prior patents cited showed the peculiar adaptation of the Canda patent to the bottom of the casing for connection with a bottom plate having recesses to receive the lower edges of the sides of the casing, thereby contributing to its strength. The decree was reversed.

A QUEER CASE FOR DAMAGES.—The Topeka Journal states that a farmer who drove into Iola, Kan., some time ago found all of the hitching racks in town full, and so tied his horse to an empty box car standing on a side track in an alley. A few minutes later a switch engine coupled on to the car and started up the alley. The hitchstrap in this instance was a rope, and it was tied around the animal's neck. The horse did fairly well until he encountered a telephone pole. The buggy was demolished there. The engine kept on going, so did the horse, until another telephone pole was reached. Then the horse tried to go on one side and the engine and car on the other. The animal's neck was broken. Now the farmer wants damages from the railroad company.

INVENTION IN THE MANUFACTURE OF TUBING.—A bill was filed against Spang, Chalfant & Co. by the National Tube Company (125 Fed. Rep. 22) for alleged infringement of Letters Patent 581,251 to Patterson, covering a process of making butt-weld pipe by charging the plates into the furnace from the rear, and withdrawing them from the front by means of tongs or other suitable device, which also draws them through the welding bell.

The Court admitted the value of the back-charging practice and its advantages over former methods. "It is a natural, continuous, and straightaway method, and, like all such improved methods of continuous handling, it avoids congestion of workmen; allows steady, as compared with intermittent, work; it utilizes the same heat and labor to produce a larger product. We are also satisfied that by a quiescent charging better heat results are obtained and less scrap made. We are also satisfied that further use of the practice has developed advantages additional to the two which alone the patentee had in mind and referred to in the application, viz., even longitudinal heating and separation of the working force. But, conceding such difference and progress, the fact still remains that the step here made was one of gradual, and to be expected, progress which marks every great, and therefore progressive, industry. In that advance the tongs and movable draw bench afforded scope for inventive genius, and presumably have secured protection to those who devised them. The principle of back-charging was not Patterson's invention. Now, why should the general principle and practice of back-charging which tongs have made available for butt-weld heating be monopolized to prevent their use for that purpose? Nor was the principle of quiescent charging his. He simply utilized these principles by employing them in the only way they could be used by means of improved tongs and shifting draw bench, and in a way the draw bench naturally suggested. That this use disclosed new and unexpected advantages may be conceded, but it is not everything that is novel and useful that is patentable. Many processes and methods have proved exceedingly valuable in manufacturing that have not been patentable. To use, with some changes, the language of another, we may say that the development of this as of every great industry develops a constant demand for new methods, which the ordinary skill of those versed in such branch has generally been adequate to devise, and which devising is the natural outgrowth of such development. Each forward step prepares the way for another, and to burden a great industry with a monopoly to each improver for every step thus made, except where marked by an advance greater than mere progressive skill, is unjust in principle and hostile to progress. In reaching the conclusion of the invalidity of this patent we are not unmindful of the prima facies to which its issue entitles it. But the prima facies is necessarily affected by the fact that the record discloses neither in the specification of the patent nor in the action of the examiner any reference to the so-called Crane practice. Indeed, the proofs show it was not known to Patterson. His specification contains no reference to it."

While the testimony of the experts in the case showed thermal and operative advantages of back charging, a conclusion with which the court agreed, and while the process is simple, effective, and economical, the Court was nevertheless satisfied that it involved no invention. The patent was declared invalid, and the bill dismissed.

A NUMBERING MACHINE PATENT CONSTRUED AND DECLARED INVALID.—William A. Force & Co. sought to restrain the Independent Manufacturing Company (124 Fed. Rep., 72), from continuing an alleged infringement of letters patent for a numbering machine granted to Willard W. Sawyer in 1891. The patent in question was adjudicated in a recent case of W. A. Force vs. Sawyer-Boss Manufacturing Company et al. (111 Fed. Rep., 902, affirmed in 113 Fed Rep., 1018). After the decree in this previous suit, the Sawyer-Boss Manufacturing Company sold out to the defendants in the present suit, the Independent Manufacturing Co.

The court thought that the defendants enjoined by the former decree were making an infringing machine, particularly so since Robert A. Stewart, the defendant in this and the former suit, is the president of the Independent Manufacturing Company, and that the individual defendants of the former suit were members of the Independent Manufacturing Company. Nevertheless, the chief contention involved the question of infringement; for the machine manufactured by the Independent Manufacturing Company was claimed to be different from the former infringing machine, the complainant charging infringement of the first claim of the patent, which was as follows:

"1. In a stamp, the combination of a main frame, a series of similarly spaced numbering wheels, corresponding ratchet wheels, detents for these numbering wheels and ratchet wheels operating radially within a support, pawls for imparting motion to said ratchet wheels, a movable yoke sustaining the numbering and ratchet wheels, and a frame-like lever carrying the pawls and pivotally connected to said yoke and also to the main frame, and an inking lever fulcrumed to the main frame and pivotally connected between its ends with the said lever which moves the pawls substantially as specified."

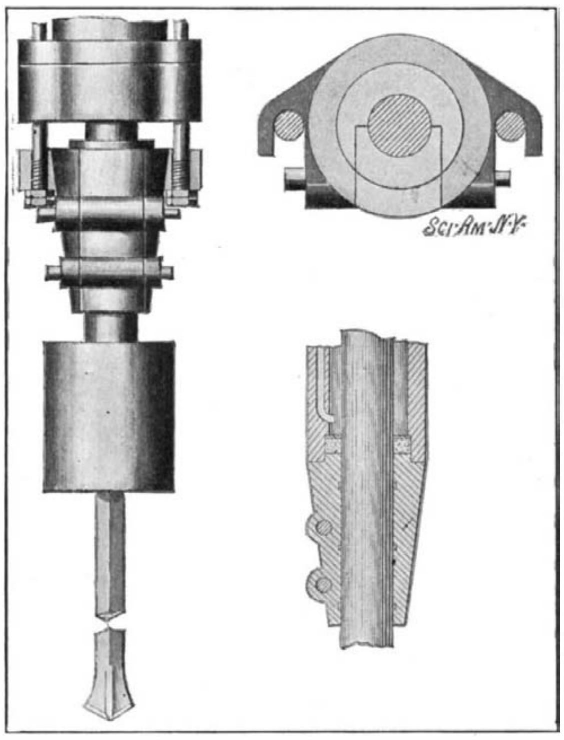
"All the parts of this combination are old," said the court, "except the frame-like lever pivotally connected with the yoke and main frame, and an inking lever fulcrumed to the main frame and pivotally connected between its ends with the lever which moves the pawls. In other words, the inventor devised the frame-like lever, which moves the pawls and also the inking pad by the same downward motion of the rod or plunger. When the rod descends, the lever throws the inking pad out, and moves the pawls which actuate the ratchet wheels, and this becomes possible because the frame-like lever is pivotally connected to the yoke and also to the main frame, and the inking lever fulcrumed to the main frame is pivotally connected between its ends with the lever which moves the pawls. This practically conjoint movement of the pawls and inking lever results from such pivotal connections. The vital point of the invention is the pivotal connection; the vital result is this movement of the pawls and inking lever."

This was old, and the bill was consequently dismissed.

Patent Department

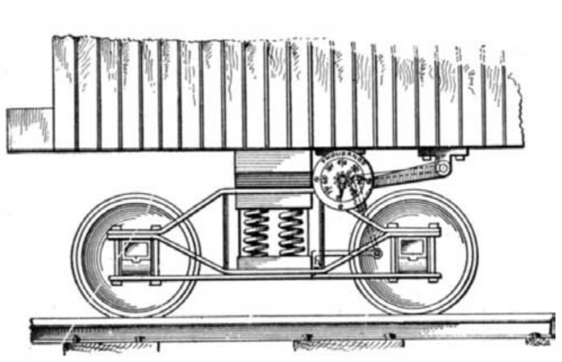
FRONT CYLINDER HEAD FOR ROCK DRILLS

The constant jarring of rock drills of the percus sion type when in operation, causes the cylinder pack ings to frequently become disordered and require re pairs. In order to render the parts readily accessible Mr. John S. Spencer, of Cripple Creek, Col. (Box 72) has invented an improved front cylinder head which can be very quickly and easily removed without disturbing the other parts of the mechanism. In our il lustration the general view shows the cylinder head partly removed. The cylinder head is formed with a body member cut out at one side to receive a closing member. Lugs are formed on the two members, and the latter are firmly united by taper pins driven through the lugs. The cylinder head is formed with a longitudinal bore to receive the piston. It is preferably tapered, and is provided with an annular offset at the top, which fits into a recess in the front end of the cylinder, as shown in section in our illustration. The cylinder head is held against the cylinder by side bolts from the latter, which engage open ears formed on the body member of the former. When it is desired to move the cylinder head, the nuts on these bolts are loosened, permitting the cylinder head to drop to the position illustrated. The taper pins are then driven out, permitting the body and closing member to be drawn apart and removed from the piston. The process is, of course, reversed in applying the cylinder head to the cylinder. The simplicity of the construction and its advantages are such that it should appeal to all who are interested in drills of this type.


REMOVABLE FRONT CYLINDER HEAD FOR ROCK DRILLS.

A Railway Chronograph.

Among the new industrial companies recently formed is one at Milwaukee, Wis., which will engage in the manufacture of a novel railroad device. The latter is called the railway chronograph, and is the invention of H. G. Sedgwick, formerly of Beloit, Wis., and now a resident of New York. By the use of the device referred to, an accurate record of the trip is kept, so that it is possible after the completion of the run to ascertain the location and the rate of travel of the train at any time during the trip. The apparatus is contained in an iron box one foot square and three inches thick, which is fastened to the front of the cab. This holds a self-winding clock, by means of which a tape is kept in constant motion, and by means of connections maintained with the various parts of the engine, a record is made of everything which transpires thereon. Every stroke of the bell as well as every blast of the whistle is indicated in its proper column on the tape, and there are other columns in which are shown the time and place of each application of the brakes, and also the escape of steam by the safety valve. As the tape runs along, every tenth of a mile made by the engine is ticked off, and as the time is constantly in evidence on the slip, it is readily possible to arrive at the most minute details of the trip. There is a column on the tape known as the engineer's column, on which he may make a record of anything which he thinks may be of interest. For instance, on the occasion of a trial of the instrument, the engineer noted the loss of a jam nut, and by quickly making a note of the incident, the exact location was arrived at, and the nut recovered with little trouble.

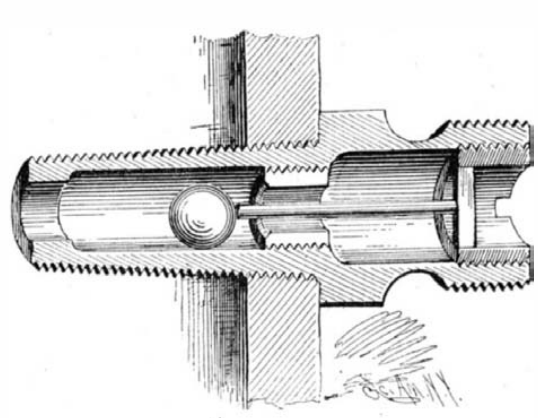

LOAD INDICATOR FOR CARS.


CONCEALED TROUSERS GUARD.

ODDITIES IN INVENTIONS.

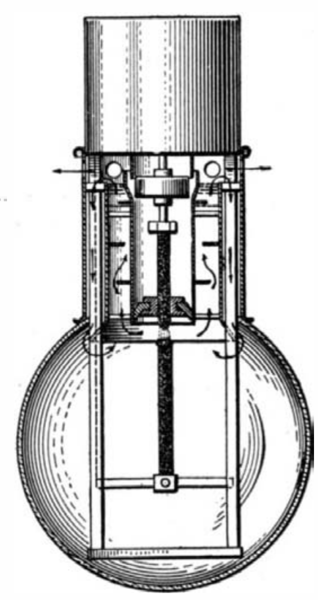
TROUSERS GUARD.—A device which bicycle riders will find very useful is a trousers guard which, in addition to holding the trouser leg rigid to prevent its coming in contact with the mechanism of the wheel, will also preserve the shape of the trousers, and when applied will be entirely concealed from sight. It consists of a band of spring metal, bent to a heart-shaped outline, with an inner circular portion connected by parallel portions forming a throat. The device is applied to the foot by forcing the ankle through the throat to the circular band within. The latter snugly fits the ankle, holding the guard in place. The trouser leg is then drawn over the heart-shaped outer rim. The guard holds the trouser leg at a slight distance from the foot, but not far enough to come in contact with the moving parts of the bicycle. The outer rim is made adjustable to different sizes of trouser legs. The guard may be readily applied or removed, and as it does not detract from the appearance of the trouser leg, it can be worn either on or off the wheel.

SAFETY NIPPLE FOR STEAM GENERATORS.—The accompanying illustration shows an improved safety device adapted to prevent escape of steam from a boiler in case of accident to the steam gages or test devices. The device consists of a plug threaded into the boiler The outer end of the plug is threaded to provide for coupling the steam gage or other attachment. A channel is formed in the plug between this threaded portion and the shell, thus weakening the plug, and providing for its rupture at that point. Threaded into the outer end of the plug is a bushing, from which a rod extends through a second bushing within the plug, intermediate of the ends. The latter bushing is formed with a valve seat on its inner end adapted to receive a valve on the end of the rod. Normally, however, the outer bushing serves as a stop to the valve stem, holding the valve unseated, as illustrated, but should the pressure in the boiler rise to a dangerous point, the plug would break along the weakened channel, and the valve would be instantly seated, thereby effectually shutting off the escape of steam.

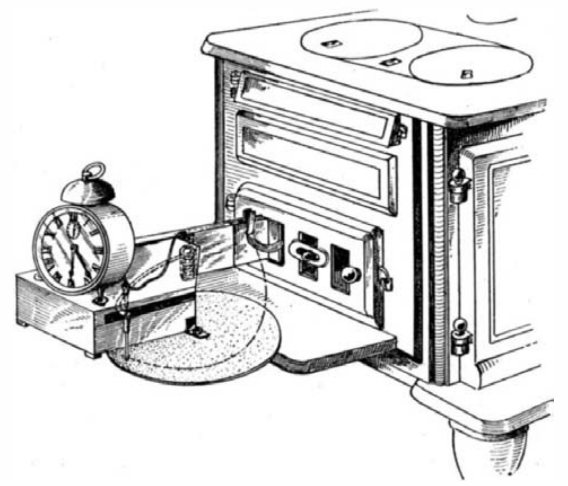

SAFETY NIPPLE FOR STEAM GENERATORS.

LOAD INDICATOR FOR CARS.—By means of the simple attachment for freight cars illustrated herewith, one is enabled to determine at a glance the weight of the load on a car, thus obviating the danger of overloading the car and dispensing with track scales. The indicator is arranged to measure the depression of the car springs, thus registering the weight they support. The indicator dial is secured to the underside of the car. The pointer on this dial is mounted on a shaft which carries a pinion. The latter meshes with a toothed-sector secured to a crank shaft mounted in the bracket on the underside of the car. The crank arm of the shaft is connected by a link with a bracket carried on the spring plank of the car truck. Now, as the car is being loaded, the weight of the load forces the car body downward, carrying with it the indicator dial. The outer end of the sector, however, is held at a constant level by the link which supports the crank shaft, and the pinion of the indicator, since it meshes with the teeth of this stationary segment, is thereby caused to turn through an angle depending upon the weight of the load. The pointer indicates this angle on the dial.

IMPROVED ELECTRIC ARC LAMP.—It has long been known that the luminosity of the arc lamp carbons could be greatly increased by the addition of salts of lime, magnesia, and other materials. However, in practice it is found that the advantages are outweighed by a number of disadvantages. The light is unsteady, owing to diffusion of smoke and vapors and the production of scoria. A recent invention is designed to overcome these defects. The lower pencil, contrary to ordinary practice, is made the positive electrode, and is formed of pure carbon with a core of carbon mixed with light-producing salt. The main body of the upper carbon is protected by a tube closed at the bottom by a shield, through which the carbon projects. Surrounding this tube is a cylinder, provided with baffle plates and screens adapted to intercept and consume the smoke and vapors which are drawn up therein. In operation any scoria formed on the positive carbon runs off without interfering with the arc. The mineral vapors produced have a tendency to rise, and are acted upon by the current throughout their upward course. On striking the shield a portion of the vapor condenses, forming a layer of reflecting material thereon, which increases the efficiency of the lamp.


IMPROVED ARC LAMP.

AUTOMATIC FIRE LIGHTER.—Surely laziness and not necessity is the mother of many present-day inventions. A Pennsylvania inventor has devised a scheme for making his alarm clock light the kitchen fire, thus allowing him time for an extra nap in the morning. The fire lighter comprises a friction plate on which a block is mounted. The block is secured to a bracket, which is fastened to the stove. A slot is cut in the side of the block to receive a spring arm extending from a coiled spring secured in the block. This arm, at its outer end, is provided with a holder for a match. The alarm clock is mounted on the block with the legs secured in socket pieces. A cord from the alarm key of the clock stretches to a pin, which acts as a stop for the spring arm. When at the set time the alarm is sounded, the alarm key, as usual, rotates, winding up the cord and withdrawing the pin from engagement with the spring arm. The latter then, under action of the spring, lights the match by sweeping it over the friction plate. At the end of its course, the match comes into contact with and ignites a fuse leading to the kindlings, thus lighting the fire.


AUTOMATIC FIRE LIGHTER.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

COMBINED HOISTING AND DUMPING APPARATUS.—W. F. WEBER, New York, N. Y. The improvements in this invention are intended more especially for use in hoisting quantities of coal or other loose material to a suitable height and automatically dumping or delivering the same to a receiver therefor—as an elevator, for instance—by which the material may be conveyed to any desired place.

APPARATUS FOR HEATING LIQUOR.—J. P. ROCHE, Louisville, Ky. Means are provided in this instance for the introduction of a looped steam-pipe within a bung-hole in an air-tight manner. Also means of attaching such pipe to stationary steam supply and exhaust pipes at fixed points without requiring the barrel to occupy an exact position in relation to fixed points of connection whereby steam circulation is effected through the looped pipe in a safe manner for uniformly raising the temperature of liquor confined in the sealed receptacle.

GAS-RETORT.—W. E. HARTMAN, Norfolk, Va. The object in this improvement is to provide a retort involving peculiar details of construction, whereby overheating of its upper-wall portion is obviated. The invention comprehends novel means forming a part of the retort-furnace whereby drafts of air through an air-passage within the retort's wall may be regulated. Formation of lamp-black is prevented or materially reduced.

METHOD OF TREATING AND CLEAVING SLATE.—W. A. MCLAUGHLIN, Delta, Pa. Through defective cleavage only a certain portion of blocks can be split into serviceable plates. The inventor in this case has practically applied a method of treatment and cleavage of such "bad blocks" whereby the loss is frequently but 15 per cent. Thus he works at a profit the unprofitable quarries and greatly increases the output of those of the best class.

COAL-LOADING APPARATUS.—C. ALLISON, Pocatello, Idaho. Mr. Allison's invention is an improvement in apparatus for use in the handling of coal, and has for an object, among others, to provide a construction whereby coal may be dumped from the cars directly into buckets and the latter being elevated to dump into the tender of a locomotive or other receptacle.

MOLASSES-BURNER. — J. ANDERSON, Kealia, Hawaii. In this patent the invention refers to improvements in devices for burning waste molasses in bagasse or other furnaces, the object being to provide a device for utilizing waste molasses as a furnace fuel in lieu of coal, wood, oil, or the like. For complete combustion the molasses must be sprayed into the furnace.

Electrical Apparatus.

ELECTRIC GENERATOR FOR INTERMITTENT CURRENTS.—M. P. RYDER. White-plains, N. Y. In this instance the invention relates to an electric generator capable of general use, but especially adapted for service upon locomobiles, gas-engines, etc., in which it is desirable to supply a powerful spark for the purpose of igniting an explosive charge. The apparatus may be made in various forms and is susceptible to divers applications.

INCANDESCENT-LAMP SOCKET. — C. WAGNER, Brooklyn, N. Y. This invention pertains to improvements in lamp-sockets, particularly small lamps used in candelabras, the object being the provision of a socket of simple construction and with which no exterior binding-posts are used, the several contacts or binding devices being arranged within the socket-body.

Engineering Improvements.

SPARK-ARRESTER. — J. WHITEHOUSE, Waihi, Upper Thames, Auckland, New Zealand. The principal object of this invention is the provision of means for arresting or preventing the escape of sparks or live cinders from locomotive and other stacks or chimneys and also to provide a contrivance thoroughly effective under varying conditions of use and which performs its intended functions without interfering with the draft or exhaust operations of the locomotive or other engine in connection with which the same may be employed.

PUMP.—D. MCSTRAVICK, New Orleans, La. In this case the object is not only to produce a pump operating with less friction in the shaft-bearings, to reduce the resistance met by the water in its passage upward through the pump box, but also to provide means whereby the pump will operate and lift water until the source of supply is exhausted and a means whereby the water once brought into the box will be prevented from falling backward upon the stoppage of the pump machinery and whereby the pump will be ready for operation upon application of motive power and without preliminary "priming."

PRODUCT FOR PREVENTION OF FURRING IN BOILERS.—P. BEZ, Léran, Ariége Dept., France. The present improvement refers to a product intended not only to prevent furring in boilers containing natural or purified waters, but also to allow of heating under pressure in ordinary boilers a dense solution of various salts or their equivalents, thereby keeping the boiler clean and making a better use of heat generated, without the formation of adhesive deposits and without disassociating of the chlorids.

Harness Accessories.

SNAP-HOOK.—H. R. MEILICKE, Dundurn, Canada. The purpose of this improvement is to provide novel details of construction for a snap-hook which afford a neat, simple, convenient, and perfectly safe device that may be employed for connection of bridles, reins, or halters to the driving-bit or for any purpose where it may be availably used as a detachable connecting-hook.

HAME-FASTENER.—G. B. HOCH, Freeland, Pa. The aim in this case is to provide a mechanism wherein all parts of the locking device are exteriorly located upon the hames and secured so that the hames and the device or mechanism will not be unduly weakened, as but a single groove is made in one of the hames to which the device is applied and but a single slot is made in the body of the device independent of the openings required to admit of said body being attached to a hame.

BUCKLE.—J. A. GAVITT, Pendleton, Ore. Mr. Gavitt's invention pertains to an improved form of buckle for connecting the traces with the hame-tugs in harness. In a former patent granted this inventor a buckle of this class had disadvantages, which the present article overcomes. In the new construction, owing to the peculiar form of the main and tug frames and the disposition of the spur, the pin is always kept in engagement with the trace, and yet upon relaxation of strain on the parts they may be readily disengaged.

Heating and Lighting Apparatus.

HEATING-STOVE.—H. BEACH, Carthage, and J. B. COE, Clayton, Ill. In this instance the object is to so construct a stove that the evolved gases are driven through the live coals in the fire-pot into the space below the same, where the gases are burned to give out heat instead of consuming the gases in the pot. By this arrangement the inventors find that such perfect combustion is attained that there are practically no cinders, and smoke and soot are practically eliminated, and fuel economized.

FEED-WATER HEATER.—W. THURMOND, Denver, Col. The objects of this invention are to provide a novel, simple apparatus which will afford effective means for the utilizing of exhaust-steam, to heat the water-supply for a steam-boiler, separate oily matter therefrom, and also purify the feed-water by elimination of acids or alkalies that may pervade the water when it enters the improved heater and purifier.

AIR-FEEDING APPARATUS FOR STOVES.—L. BRANDT, JR., and A. F. BRANDT, Spokane, Wash. The invention involves peculiar means whereby a draft of air is fed into a stove at the combustion-exit therefrom through the uptake. With the special draft devices the products of combustion are retarded and forced back into the fire-chamber and more thoroughly consumed than is now effected in any stove or furnace or hot-water heater known to these inventors.

INCANDESCENT VAPOR-BURNER.—G. A. BONELLI, Kingman, Ariz. In this patent the invention relates to a combined hydrocarbon-gas generator and gallery and mantle support, and further relates to an improved form of hydrocarbon-valve for use more particularly with the generator and to certain details of construction. The invention is used in connection with burners for heating, illuminating, etc.

FIREPLACE.—A. W. HALL, Hayneville, Ala. The primary object the inventor has in view is to provide means adapted to be used for cooking purposes or for heating a bed-room without interference with or change of fireplace or grate or heat from the same, these being secured by the easy adjustment or connection above the grate-basket of a cook-stove, which is arranged to serve as an apron to the grate when the fireplace is employed for heating the bed or other room alone, the novel and economic features of the stove being in part, primarily, the arranging the apron of the fireplace so as to form a stove when placed above the grate and connected to the same.

Household Utilities.

COFFEE-POT.—J. HEINRICHS, New York, N. Y. This pot belongs to that class of device in which the water is passed through a filter containing coffee or tea continuously by the action of the steam generated by means of heat beneath the lower water-compartment. The object is the provision of a device which will be quick in action, embody economy in cost of manufacture, and properly filter the water in the course of operation.

MUFFLER COOKING ATTACHMENT.—J. H. FOX, New York, N. Y. The purpose of the invention is to provide an attachment designed for use in connection with the exhaust of hot-air engines, gasoline-engines, or engines of like type and to so construct the device that it will be economic and effective, and readily applied to any hot-air or steam-exhaust pipe.

WRENCH.—C. F. BLISS, Carbondale, Col. This wrench, preferably of one piece of material, comprises a handle and clamping section fitted with teeth or roughened surface for gripping engagement with the cap to be screwed upon or unscrewed from any receptacle, so that the clamping section will embrace the article with a firm grip and uniform pressure and so that when the clamping section is adjusted and pressure applied to the handle-section the cover may be turned with little effort and without mutilation of the article.

Machines and Mechanical Devices.

HORSE-POWER.—J. VAVRA and C. VAVRA, Park River, N. D. In this instance the invention has reference to improvements in horse-power devices, and has particular application to one especially adapted for use in loading hay and elevating material from the ground to a desired point at a height above the same. It will be found very convenient for builders and contractors for raising mortar and bricks to the upper stories of buildings.

FEEDING MECHANISM FOR SEWING-MACHINES.—W. A. SMITH, New York, N. Y. A salient feature of this invention is a reversible feed mechanism under the direct control of the operator and is effective to feed the work in either a forward or backward direction at his will, such reversibility of the feed mechanism being obtainable instantly and without stopping the machine and slackening its speed, thus obviating stopping the machine, lifting the pressure foot, and turning or shifting the work.

PASTING-MACHINE.—A. SIMONSON, New York, N. Y. The machine is provided with opposing pasting members and an operating mechanism for the members, whereby one member will be receiving adhesive material while the other is depositing it, and whereby at each operation of the machine the means provided cause the opposing members to be alternately shifted, the depositing member at the upward movement of a support being placed in position to receive a fresh supply of material, while the member just applied will be placed in position to deposit the material upon an object placed to receive it.

MACHINE FOR PERFORATING CHECKS AND PRINTING THEREON.—G. F. ROBERTSON, Paris, Texas. The purpose of this improvement is to provide a machine for repeating on the face or on the back of a check, or upon both surfaces, the figure in numerals or in letters representing the amount of dollars called for by the written portion of the check, so as to render it impossible to change the amount first expressed without commercially destroying the check.

Of Interest to Farmers.

ANIMAL-SHEARS.—W. M. CAHILL, Winona, Minn. This improvement is in that class of shears known as "clippers." The object is to provide an instrument wherein the friction of the working parts is minimized. A further object is to simplify the construction of the shears by the elimination of certain friction parts present in some prior kinds of shears, and to thereby promote the efficiency of the instrument and decrease cost of manufacture.

Pertaining to Vehicles.

AUTOMOBILE SLEIGH.—E. S. WEAVER, Jersey City, N. J. The inventor has in view the provision of a sleigh which will be self-propelling, the mechanism being so arranged and of such character that the sleigh may be driven easily over snow or ice. He provides a sleigh with driving-wheels or propelling devices which will enable it to travel over rough or uneven ground covered with snow or ice, the devices also assisting in the steering operation. Means are supplied to obviate jars or shocks.

FIFTH-WHEEL.—W. B. FLETCHER, Cameron, W. Va. Mr. Fletcher's invention relates to an improvement in fifth-wheels for vehicles, wherein the friction between the various parts is reduced to a minimum, the dust excluded from the working parts, and the strain equalized and practically removed from the king-bolt, thus materially lessening the liability of breakage from any cause. The device is susceptible of adaptation to various forms of vehicles and running-gear.

BRAKE.—G. E. BABCOCK, Coronado, Cal. One object in this case is to provide a construction of detent mechanism by which to hold the brake set. In operation the driver can press the ball of his foot against a foot-plate without affecting the position of the lever, so the brake can be set to any extent without being locked in position. If desirable to set the brake and lock the same in such position, he can, while pressing with his foot against the plate, press his heel against the treadle portion of the lever and set the rack-teeth into engagement with the pawl-point.

Railways and Their Accessories.

RAIL-JOINT.—J. F. SUMMIT, Lafollette, Tenn. Mr. Summit's invention is an improvement in rail-joints, having for an object, among others, to provide means for preventing any swinging of the ends of the rails out of alinement, which is a fertile cause of derailment and wrecks. The invention securely braces and reinforces the joint and prevents the nuts from becoming loose. The construction is simple, cheap, and can be easily embodied in the rail-joints.

RAILWAY-TIE.—G. F. JENCKS, Limerock, R. I. Means for supporting the customary form of rail used in a railway are furnished in this invention. One of the objects is to provide a railway-tie or a rail-chair or a combined tie and chair with a resilient support for a rail. Another object is to provide a form of combined railway tie and chair comprising a plurality of parts economically constructed and quickly and easily assembled.

Miscellaneous.

DRAWER.—W. H. COYE, Stevens Point, Wis. In this improved drawer the inventor employs sole-strips made separate from the sides and bottom and serving as a means for solidly and rigidly joining the bottom and side walls together. These shoes afford antifriction bearing-surfaces at the lower side edges of the drawer, the surfaces being disposed at the side edges and sole edge of the shoe, whereby the frictional engagement of the drawer at the side and bottom portion with the framework is minimized and the drawer made to run freely in the article of furniture.

PROCESS OF TREATING LIME.—J. J. FEELY, Whiteplains, N. Y. The difficulties and objections met in the storage, transportation, and use of common quicklime are caused by its tendency to heat, slake, swell, and shrink. These changes occur after the lime has been made up into mortar and mixed with plaster upon walls and ceilings, in many cases causing walls and ceilings to pit, crack, and chip off. The purpose in this case is the production and manufacture of lime which overcome these objections.

MAIL-CRANE.—J. M. HOUGH, Woodbine, Iowa. This invention refers to improvements in cranes for holding mail-bags in position to be taken up by catches carried by passing trains, an object being to provide a crane of simple construction that will be light, yet strong, having no parts liable to get out of order, and that may be constructed at a small cost.

EDUCATIONAL APPLIANCE.—L. M. HOLLINGSWORTH, Fresno, Cal. In carrying out the present improvement the inventor has particularly in contemplation as an object the use of a number of members which are constructed and shaped to form geometrical figures and are capable of being so arranged and assembled that various propositions or theorems of solid geometry may be easily explained and demonstrated without the necessity of long and complicated mathematical computation.

DECOY-DUCK.—A. KREMER, Sacramento, Cal. One of Mr. Kremer's principal objects in view is to construct a decoy easily folded to occupy little space when not in use, but may be distended or inflated, so as to have the appearance of life-size fowl when brought into use. The duck when resting on the water has a perfectly natural appearance.

SHOULDER-PAD.—H. LAVINE, New York, N. Y. Mr. Lavine's invention relates to improvements in shoulder-pads for coats or like garments, an object being to provide a pad so constructed as to maintain a gradually-increasing thickness from one edge to the other, thus preventing any abrupt depressions in the shoulder portion of a coat or the like in which the pad may be placed.

SUSPENDERS.—M. MURRY, Morristown, N. J. In this case the invention refers to certain improvements in the construction of suspender-buckles and in the arrangement of these buckles with respect to the straps and suspender-ends. The suspender-straps are constructed of cloth or other fabric, as is usual, and the ends are made of metal in U-shaped form. These ends are provided with spring-clasps, which engage them with the trowers without the use of buttons.

PORTABLE DISPLAY-STAND. — J. A. MARSH, New York, N. Y. The object of this invention is to provide a new and improved portable display-stand more especially designed for displaying newspapers, periodicals, and like articles in a very attractive manner and to allow of conveniently storing the articles in the stand and locking the latter up when not in use.

SELF-PLAYING MUSICAL INSTRUMENT.—J. SUTER and W. LENK, Jersey City, N. J. In this instance the invention relates to instruments of the zithern type, and the object is to provide an instrument arranged to pick the strings, actuate bells, or other sounding devices, and to insure a proper gradation of the tones according to the requirements of the music produced and indicated on the note-sheet.

BOAT-PROPELLER.—H. W. STURGES, Wilton, Conn. One of the principal features of the invention lies in the arrangement of the motor so that the cylinder is cooled by the water in which the boat floats. This avoids the necessity of a water-jacket and circulating-pump. A tiller turns the propeller at different positions, so as to steer the boat, and is employed to actuate the reversing-gear of the propeller or to actuate devices for "turning over" the engine preparatory to starting the same.

PLAITING-MACHINE.—MARY F. HAVENS, New York, N. Y. By this machine the inventor lays the fabric in plaits or folds, steams and dries the plaits, and subjects the prepared fabric to pressure during its progress through the machine, so that it emerges in a set and finished condition, these steps in the treatment of the fabric being carried out in a manner which does not expose the fabric to injury from overheated rollers or other devices which have a tendency to burn or scorch the goods.

EXPANSION-JOINT.—R. E. Vail, Mount Vernon, Ohio. Mr. Vail's invention refers to pipe-lines; and his object is the provision of an improved expansion-joint arranged to allow free expansion and contraction of the pipe-line without danger of leakage and to allow of readily coupling the adjacent ends of a broken line together.

GARDEN IMPLEMENT.—R. Twohig, Salina, Kan. In this patent the invention has particular application to means for securing pitchforks, hoes, rakes, and similar tools to their handles. The particular object is to provide means for securing the tools to the handle in such manner that there will be no possibility of the parts separating accidentally, thereby obviating the loss of time and liability to injury.

POCKET-BALL-BEARING DOOR AND HANGER THEREFOR.—J. K. Thoma, Cooperstown, N. Y. The purpose here is particularly to provide a top and bottom ball-bearing for sliding cased doors and a ball-bearing for the upper portion of hanging doors, such as barn or car doors, and to so confine the balls that their travel on the door will be limited, while their traveling engagement with either the overhead or the lower track will be unobstructed.

ORGAN-PEDAL.—E. M. Hughes, Ashland, Ky. Definitely stated, this invention relates to pedal-keys for pipe-organs. The object is to provide a pedal or key which will work permanently and absolutely without noise. The pedal-keys for organs and other instruments work free from friction and obviate noise and lost motion common with similar pedals.

WHISK-BROOM.—H. L. Harris, New York, N. Y. The invention is an improvement in brooms, being in the nature of a rubbing attachment for use in removing spots and the like from garments. On the handle of the broom a pad of absorbent material is secured. The pad includes a core and wrapper, both made of felt, cloth, canvas, or like suitable fabric. In use the pad may be saturated with benzine or other cleaning materials. By combining the pad with the broom a convenient form of handle for the broom is provided.

UMBRELLA.—O. L. Fogle, Columbus, Ohio. The object in this case is to furnish details of construction for the frame and stick, convenient to manipulate for folding or expansion of the umbrella, adapt the frame and stick for cheap manufacture, and enable the close folding of parts of the frame, so as to reduce the same, forming a short, compact package, which will be readily packed in a trunk, valise, or other receptacle.

AWNING-HOOK.—D. W. Carr, New York, N. Y. The invention relates to hooks especially designed for attachment to awnings, whereby to hang the awning and permit it to be taken down in a more convenient and expeditious manner than ordinarily and at the same time when attached to a support to insure its remaining so under ordinary conditions of weather until purposely released, the hooks, however, being also adapted for hanging curtains and garments on fixed hooks, eyes, rods, or bars.

PARCEL-FASTENER.—B. Cohn, New York, N. Y. In this instance the object is to provide a new and improved parcel-fastener arranged to securely tie the wrapper of a box or like receptacle in position without the use of strings and the like and to give the parcel a fine and neat appearance. The device can be easily applied and cheaply manufactured.

HOLDER FOR MINERS' LAMP.—J. A. Brown, Pocahontas, Va. In this patent the invention has for its object the provision of novel, simple, and reliable means for detachably securing a miner's lamp upon the cap worn by the miner, so that the lamp will remain in place until designedly removed, in spite of any accidental displacement therefrom.

COMBINED BODY-BRACE AND TRUSS.—S. R. Shepard, Louisville, Ky. One of the principal objects of the invention is to provide means adapted to be readily applied to the body for strengthening and supporting the back and spine and the chest and shoulders, as well as to provide means whereby the abdominal region may be held in position with comfort and ease. The device is simple, and not likely to get out of order. It will not interfere with the free action of joints, muscles, or any other part of the body, and overcomes all tendencies toward abnormal stooping or bending.

PROCESS OF HARVESTING AND CURING TOBACCO.—J. B. Underwood, Fayetteville, N. C. This invention has for its object a quick method of curing and preparing tobacco for manufacturing and of improving the color and stem of the leaf. It is put in operation by the use of a V-shaped knife attached to a pistol-grip handle. The blade severs the leaf portion from the stem, leaving it attached to the stalk while the leaf is cured or dried out and freed from the stem at a much lower temperature and in shorter time, with more perfect color and without danger of sap coloring after curing. Expensive stemming is done away with and the taste and value of the product improved.

FOLDABLE PAPER BOX.—M. Hirsch, Newark, N. J. The present invention relates to improvements in paper boxes; and the object of the inventor is to provide an improved box, the blank of which is cut from a single piece of paper stock and is adapted for assemblage into a complete article without the use of mucilaginous material.

COMBINED BUTTON AND TIE-HOLDER.—E. Stempel, Buffalo, N. Y. The object of this invention, relating to garment fasteners, is to provide an improved combination button and tie-holder arranged to securely hold a scarf, necktie, or other similar neckwear in place to prevent sidewise movement or creeping of the neckwear and to give a dressy appearance to the wearer.

Designs.

DESIGN FOR A GLOVE.—F. Schmidt, New York, N. Y. The ornamental design in this glove consists of two bands of herring-bone of triple stitching on the back of the glove not quite parallel and coming together to a V-shaped point at the bottom. Between the two outer bands, equidistant a middle band is stitched. It makes no connection with the other bands. The design is open at the top.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 4970.—For manufacturers of bordered cloth and materials for making handkerchiefs, also machinery for making elastic web for garters.

Inquiry No. 4971.—For makers of cold storage for family and individual use.

Inquiry No. 4972.—For a self-winding machine.

Inquiry No. 4973.—For a complete apparatus for manufacturing concentrated acid.

Inquiry No. 4974.—For makers of paint, such as used on steamboats, smokestacks, etc.

Inquiry No. 4975.—For makers of springs, such as used on small weighing scales.

Inquiry No. 4976.—For manufacturers of machines for punching teeth in hacksaws.

Inquiry No. 4977.—For a machine for extracting fiber from sisal or hennequen plants.

Inquiry No. 4978.—For makers of castings for a 4-cycle engine.

Inquiry No. 4979.—For the makers of the "Swartz" burner, or one to give a high candle power in a small space.

Inquiry No. 4980.—For machinery for extracting fiber from maguey plants.

Inquiry No. 4981.—For machinery for making oil of peppermint.

Inquiry No. 4982.—For a successful stump puller.

Inquiry No. 4983.—For the makers of the "Star" paper weight.

Inquiry No. 4984.—For hard rubber, glass or porcelain jars for battery use; to be rectangular in shape of special dimensions.

Inquiry No. 4985.—For makers of pyrometers indicating by colors.

Inquiry No. 4986.—For makers of machines for making pressed, blown and plate glass.

Inquiry No. 4987.—For a machine for grinding pea flour and a soap mold or presser.

Inquiry No. 4988.—For makers of paper board 4 feet wide and from 8 to 14 feet long.

Inquiry No. 4989.—For firms handling the button and shell mountings.

Inquiry No. 4990.—For machinery for making celluloid or horn combs.

Inquiry No. 4991.—For a pneumatic saw lately invented in the Northwest, wanted, address of patentee or manufacturer.

Inquiry No. 4992.—For makers of entire machinery used in making sulphur matches, including splitting and preparing of stock.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9271) W. C. R. asks: Will you please tell me in your query column whether the following problem can be solved by plane geometry, and if so, how? Through the middle point (O, Fig. 2) of a chord draw two chords A D and B C. Connect A C and B D. Prove O R = O S. A. The problem may be solved as follows:

In Fig. 1, A D and B C any two chords cutting in O. M N any secant cutting A C in R, B C in P, A D in Q, and B D in S. <C = <D. △ C R G similar △ S H D, △ R G P similar △ O P L, △ Q H S similar △ O L Q.

$$\frac{CR}{Z} = \frac{SD}{X} \qquad \frac{RP}{Z} = \frac{OP}{Y} \qquad \frac{QS}{X} = \frac{QO}{Y}$$

Eliminate X, Y, Z from these equations:

$$CR.QS.OP = SD.QO.RP.$$

Similarly, $RQ.SB.OP = AR.PS.OQ.$

Divide

$$\frac{CR.AR}{SD.SB} = \frac{RQ.RP}{PS.SQ}$$

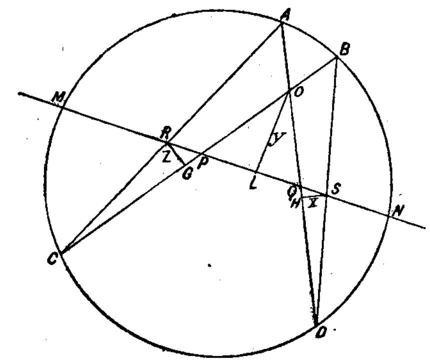


Fig. 1.

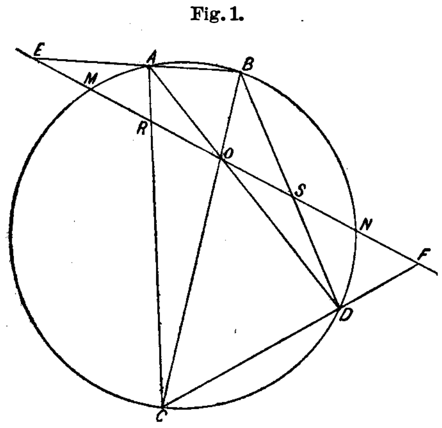


Fig. 2.

$$\left.\begin{array}{l} CR.AR = MR.RN \\ SD.SB = MS.SN \end{array}\right\}$$ products of segments of chords of a circle.

Substitute:

a) $$\frac{MR.RN}{MS.SN} = \frac{RP.RQ}{PS.SQ}$$

Fig. 2 is a special case of Fig. 1.

M N is bisected by O. P and Q vanish in O.

$RP = RQ = RO$, $SP = SQ = SO$, $MO = NO$, to prove $RO = OS$.

Equation a) becomes

$$\frac{MR.RN}{MS.SN} = \frac{RO^2}{SO^2} = \frac{(MO - RO)\ (NO + RO)}{(MO + SO)\ (NO - SO)} = \frac{(MO - RO)\ (MO + RO)}{(MO + SO)\ (MO - SO)}$$

$$\frac{MO^2 - RO^2}{RO^2} = \frac{MO^2 - SO^2}{SO^2}$$

By composition

$$\frac{MO^2}{RO^2} = \frac{MO^2}{SO^2}$$

$$RO^2 = SO^2$$

$$RO = SO$$

Q. E. D.

Similarly E M = F N.

Solution by L. Leland Locke, Instructor in Mathematics, Adelphi College, Brooklyn, N. Y.

Since the above solution was completed, we notice a number of other solutions, different from the one given above, in Amer. Math. Monthly, January, 1901.

(9272) E. E. B. asks: I wish to purchase the cheapest and most efficient opaque attachment for the lantern. Refer to some dealer. Is it possible to use the film of the kodak for projection in the lantern without transferring it to glass? In other words to use the negative film in the lantern. Is there any preparation with which wood-cuts, half-tones, etc., may be treated and projected on the screen? That is, make a paper sufficiently transparent for projection purposes. Where can I purchase an attachment to throw soap-bubble films, etc., on the screen? I wish to project the vibrations of the human voice. A traveling lecturer partly told me of an experiment to show what he called the formation of the clouds and cyclones, etc. As near as he could remember they used sulphuric acid and potasium bichromate, iron filings, and two other things that he could not remember. From this indefinite statement can you suggest the nature of this experiment or refer me to some work where I can find it described? As near as I could gather from his description it was to be projected with a stereopticon. A. The best and cheapest way to get a microscopic and vertical attachment for a stereopticon is to have the people who made the stereopticon furnish you with it. Makers usually have a complete outfit for their instruments. To get one made at a distance would result in a misfit, to a certainty. Failing in getting one from the makers you can have the attachments made by a machinist in your neighborhood, and fitted to the instrument. You can obtain good cuts of these instruments from the books on projection: Wright's "Light," price $2.00; Wright's "Optical Projection," price $2.25; Dolbear's "Art of Projection," price $2.00; Mayer's "Light," price $1.50. All these are excellent and you can profitably get them all. They contain nearly all that one requires to learn to do good work with the lantern and descriptions of all the best experiments. These, with G. M. Hopkins's work, will equip you for service. Many optical illusions are described in "Experimental Science," which you have. "Magic," by A. A. Hopkins, contains many tricks which are of the nature of optical illusions; price $2.50. No opaque attachment for the lantern is on the market so far as we know. Any mechanic can make one from the description in Dolbear's "Art of Projection," or from Hopkins's "Experimental Science," Vol. II, page 249; it presents no difficulty. Kodak films are not adapted for optical projection. A positive on glass should be made. For this, full directions are given in Hopkins's "Experimental Science," Vol. I., page 319. Special lantern slide plates can be bought for making them. Pictures from books cannot be made transparent enough to project in a lantern. They should be copied by photography, first making a negative and then a positive on glass as with any other subject. The method of projecting soap films is shown by a cut in Wright's "Optical Projection," page 326. The only apparatus required is a ring of wire 2 to 4 inches in diameter and a soap-bubble mixture which is described in all the books we have mentioned. The method of projecting clouds on the screen by chemical action is given in Dolbear's "Art of Projection." It is done by unequal chemical action forming absorbent layers in the cell.

(9273) J. P. R. says: In order to settle an argument would you please answer the following question in your "Notes and Queries" column: Is it safe to burn coke under a boiler, particularly an upright? A. Where the grates are properly arranged, coke makes the most admirable boiler fuel.

(9274) E. S. P. says: Please reply in "Notes and Queries": 1. Is the Texas boll weevil a flying beetle at any stage of its development? A. The cotton-boll weevil exists in four stages, namely, egg, larva, pupa, and adult. In the adult stage the insect has wings and is capable of flying to some extent. 2. If not, why cannot it be reduced by substituting upon infected fields other crops than cotton, thus depriving it of food and breeding place, or by letting the ground lie fallow? A. In view of the fact noted above that the weevil can fly, it is impossible to eradicate it by allowing land to lie fallow. Nevertheless, the powers of flight of the insect are so limited that many Texas cotton planters find it of great advantage to rotate their cotton with other crops. 3. If it is winged, why has it not been spread by winds, etc., more rapidly? Does it go from field to field? A. As a matter of fact, the weevil is spread to a considerable extent by the wind. The new territory invaded each year, under normal conditions, is about sixty miles. There is no doubt, however, that exceptional conditions, like the storms preceding the Galveston cyclone of September 8, 1900, have caused a great deal more than this normal spread. 4. If it simply crawls, does it gain access to the boll from the ground by climbing the stalk, and can it pass from one plant to another on their branches? A. The insect reaches the fruit of the plant, either boll or square, almost altogether by flying from one plant to another. 5. Will it attack in preference plants at some certain stage of growth, thus avoiding adjacent plants, either older or younger in growth? A. As during the growing season the cotton plant has all stages of the fruit upon it, it cannot be said that the weevil has any preference as far as the stages of the growth of the plant are concerned. 6. At what stage of growth is the plant most attractive? A. This question is partially answered under No. 5. There is no preference of the weevil for any particular stage of the plant, but there is a preference for the stage of development of the fruit. They prefer the forms or squares (immature bolls), and will always work upon them to the exclusion of the bolls as long as the supply is sufficient.—F. H. Chittenden, Acting Entomologist, U. S. Department of Agriculture, Washington, D. C.

(9275) G. B. writes: In an encyclopedia I find the statement that red, green, and blue are primary colors, and that they cannot be resolved into other colors nor produced by combining other colors. In discussing the subject a little further on, you state green is produced by combining yellow and blue, which is a contradiction of your first statement. I therefore take it that green can be resolved into yellow and blue; hence why do you say the primary colors cannot be resolved into others? A. We are not able to see the contradiction in the two statements that "red, green, and blue are primary colors" and that "green is produced by combining yellow and blue." Both are facts. Red, green, and blue are taken as primary color sensations by most modern writers, in accordance with the theory of the late Prof. Helmholtz, who was first in authority upon physiological optics. These colors satisfy most tests of a good working theory in this subject. There seems to be no better theory before the scientific world for acceptance. Until a better appears, it is not probable that this will be set aside. It is now found in almost every textbook of optics. An easy experiment may be performed with lights which illustrates the theory. Take three colored glasses or gelatines, a vermilion blue, an emerald green, and an ultramarine blue. Project these side by side on a screen, each by a separate lens, so arranged as to be movable; a circular form is perhaps more convenient for the experiment, and the projection may be so that the three circles are tangent to each other. Now move the lenses nearer together, so that the disks of colored light overlap. Do not have the disks themselves overlap, but the projections of the disks are to overlap. The red and the green light combine to form some shade of yellow, the green and blue form some shade intermediate between these shades, and the red and blue form some shade of purple. Where the three overlap you will have white, if the original colors were what are required by the proper spectrum tints. There are many other tints in sets of threes which will form white, but this set has been taken as on the whole the most satisfactory, and will for the present at least probably not be displaced. Now as to the statement that "green is produced by combining yellow and blue." Make one solution of potassium chromate, and another of copper sulphate, to which add ammonia till a rich deep blue color is obtained. Put these in vertical tanks or flat-sided bottles, and project as before. When the disks overlap, it is found that the combined disks give *white*. But if the light is allowed to pass through both solutions to the screens, the color on the screen is *green*. There is evidently something here to be studied. Test the two lights with a spectroscope or projecting prism. The yellow of the potassium chromate is found to transmit red, yellow, and green of the spectrum; the blue of the ammonio-sulphate of copper transmits green, blue and violet of the spectrum. Each absorbs what the other transmits with the exception of *green*, which is transmitted by both liquids. Green is the only portion of white light which can get through both liquids, and therefore a mixture of these colors always looks green. It is only in this sense that a combination of yellow and blue produces green, that is, by absorbing all other colors, green alone remains. If the yellow and blue lights are combined by mixture, not by absorption, *white* is produced. Both statements are facts. Each requires its proper interpretation.

(9276) S. H. asks: What is the relative increase of power as you near the focal end of a lever? To illustrate. Suppose the lever is 10 feet long and fulcrum is placed 24 inches from focal end, then to 18 inches and to 12 inches, what is the relative increase of power of the several positions as you approach the focal point? A. The mechanical efficiency of a lever is the ratio of the two arms, or distances from the fulcrum to the power and to the weight to be moved. If the lever is 10 feet long and the fulcrum is 2 feet from one end, the weight arm is 2 feet and the power arm is 8 feet. The weight is four times the power. If the weight arm is reduced to 1 foot, the power arm becomes 9 feet, and the weight will be nine times the power. In the same way the value of the lever in any case is determined. The ratio of the power to the weight is the same as that of the power arm to the weight arm.

(9277) S. S. W. asks: Will you inform me whether it is possible to raise the temperature of water any number of degrees by agitating it in a cylinder revolving at a rapid rate, if there are any impediments within the cylinder to break the water? If so, how high a temperature could be reached, and is it better to revolve the cylinder or a rod through the center to which the breaks are attached? A. It is not only possible to raise the temperature of water by agitating it, but this always occurs. The water at the foot of a fall is warmer than at the top, as has been proved at Niagara Falls. When the agitation takes place in a cylinder properly prepared for measurements, the amount of heat required to raise 1 pound one degree can be determined, and it is by this method that the work was done by Joule, upon which all steam engines are constructed. The heat unit is the quantity of heat required to raise one unit weight of water one degree, a unit in constant use in engineering. One pound of coal will produce on the average 14,000 to 15,000 heat units.

(9278) L. F. H. says: What is the method of piping now employed in the two-cycle engines in order to exhaust them under water? A. The action is somewhat similar to that which takes place in the steam engine. Exhausting a steam engine under water is a very bad plan to follow, not counterbalanced by any advantages. In striking water the steam is condensed and a vacuum is formed, the water immediately fills the exhaust pipe, and if the pipe is short, the cylinder also, unless there is a check valve in the exhaust pipe to prevent the water from flowing back. Moreover, there is a back pressure on the piston equal to the atmospheric pressure on the area of the exhaust pipe, which may or may not be 10 per cent of the power of the engine, according to the boiler pressure used. The method of piping depends upon the conditions present.

(9279) E. A. A. asks: 1. Is the energy in form of light in an inclosed furnace or under a steam boiler wasted? If not, how does it utilize itself? A. The light given out by burning coal is the same thing as its heat energy. Light and heat are the same thing, so far as energy is concerned. Both are classed as radiant energy in all the latest books of physics. The light is but an incident of an eye. If there were no eye the light would not appear. 2. How are the oil holes in the Morse twist drill made? A. We have no knowledge of the special process used in making the oil tubes in the twist drill you mention. You can address the inquiry to the company making the drill and they will doubtless give you the information. 3. How is the best magnet steel prepared and what hardness should it have to take and maintain the strongest magnetizing? A. Magnets are made of any high-grade steel. Jessup's and Stubbs' are very good. The ends of the magnet are glass-hardened, the rest remains soft. 4. Why does the resistance in an incandescent lamp filament increase with the age of it and why does the efficiency fall at the same time? A. The resistance of an incandescent lamp filament increases with use because the filament becomes smaller. The carbon is gradually driven off and flies against the bulb, making it black. As the resistance increases the current decreases, and if the lamp gets less current it cannot give as much light, since it is not heated so hot as at first.

(9280) G. W. B. says: 1. At what temperature will frost collect on glass if no moisture is in the air? A. Frost cannot collect on the windows when there is no moisture in the air at any temperature. Frost is the moisture of the air changed to ice. 2. At what temperature will it collect when there is a quantity of moisture in the air, such as is ordinarily? A. Water freezes at 32 deg. Fahr. and frost forms at the same temperature. 3. If temperature of a room is above freezing will frost collect on the windows? If so, at what temperature must the surrounding air be in order to keep glass warm enough to keep off frost and melt snow lighting on window? The idea is to keep the window transparent enough to clearly see through it. A. Frost may collect on windows when the air of the room is above freezing, since the glass is in contact with the outer air and is colder than the air in the room. The glass must be permanently above freezing to keep frost off and melt snow striking the windows. 4. What is the voltage and amperage of the ordinary circuit of lamps in a trolley car? A. If a voltage of 500 is used on a trolley car the lamps are usually of 100 volts each, and are placed in a series of five. 5. Is the current reduced by a transformer for this light circuit or taken directly from the main circuit? A. In the case above each lamp gets its requisite voltage and all are lighted directly from the trolley current without transformation. 6. Would the heat generated from an ordinary electric lamp as used in a trolley car be sufficient to melt a wax candle, if it were placed against the lamp? A. The heat from an ordinary incandescent lamp bulb is sufficient to melt wax candles and to set fire to paper or cloth left in contact with it for a long time. 7. Have you addresses of companies manufacturing condensers, as used with spark coils from ¼ inch up? A. You can obtain condensers from any dealer in electrical goods. Nearly every week we have advertisements of such in our columns. 8. Have you a SUPPEMENT giving information on making condensers? A. SUPPLEMENT No. 1124, price 10 cents, gives the instructions necessary for making a condenser and a complete coil giving a spark of six inches. 9. Where can I buy or at what kind of place can I obtain tin-foil? A. Tin-foil can be bought from any electrical store.

(9281) A. N. says: What size wire must I use to magnetize a wire core for an induction coil, core being 7 inches by ⅞, No. 20? Annealed iron wire using 2 amperes, 20 volts? Also at 1½ amperes, 27 volts? Also at 1 ampere, 40 volts, or what would be the best current to use? I have a 40-watt dynamo which I am going to wind for it. What current would be best to wind it for, for use on coil? What is the carrying capacity of copper wire in armatures, that is, sizes from No. 16 B. & S. to No. 30 B. & S.? Also carrying capacity of wire in fields from No. 16 B. & S. to No. 30 B. & S.? Have you any SUPPLEMENT giving the above carrying capacities? If so, what number? Is hard granular carbon, such as used in telephone transmitters, good for coherers in wireless telegraphy? Should it be a rather fine powder or coarse? What is the best coherer to make and use for experimental purposes? Is there any that don't need decoherers? If so, what? How big a spark should 1½-pound s. c. c. B. & S. No. 35 copper wire give? How far will 1½-inch coil work a coherer? What size spark is used to signal across the Atlantic? What current is used in primary? Can more than one induction be connected in series? If two 1½-inch coils are connected in series, would it give 3 inches, or how should they be connected? A. Induction coils are made for certain length of spark, not for certain voltage and amperes of current. Wind the coil for spark, and then put on the current. The primary is always wound in two layers of coarse wire from end to end of the spool, which is mounted on the core, leaving the wires of the core projecting somewhat from the heads of the spool. You should get a book of directions for coil making, and follow its instructions. You will then be able to secure the sort of coil you desire. We recommend Norrie's Induction Coils, price $1. One and a half pounds of No. 35 cotton-covered magnet wire may give as a secondary of a coil a spark of ¾ to 1 inch long. As to your questions regarding wireless telegraphy, very little is known about the apparatus used for sending signals across the Atlantic Ocean. Coherers are made with silver or nickel filings in fine powder. You will find in our paper several forms of coherers. We can send you six papers on wireless telegraphy, or a dozen for that matter, which will give much assistance in the making of an apparatus. Two coils of a half-inch spark cannot be connected so as to give a spark of double the length.

(9282) H. F. asks: We have an electric light plant in our little city, direct current, 220 volts, quoting us a price of 10 cents per thousand watts. How much will this quotation cost us to run a 4-horsepower motor per 24 hours, as the city has installed this plant, and their engineer cannot give us the figures in horse power? A. An electrical horse power is 746 watts. Four horse power would be 2,984 watts per hour, and for 24 hours would be 71,616 watts. This at 10 cents per 1,000 watts would cost $7.16.

(9283) E. S. B. asks the following questions: If in any of the past issues the following questions are explained, I would only be too glad to get those SCIENTIFIC AMERICANS; but if the Editor cannot refer me to a back number, I will look for the answers in the columns of Notes and Queries. Explanation of alternating current, two-phase and three-phase current, and two-phase three-wire system. What is meant by inertia, the moment of inertia, and the inertia of a flywheel? How is the flywheel for an ordinary steam engine calculated? How is the flywheel of an air compressor belt-driven calculated? How is a flywheel calculated for an air compressor, the air compressor being connected tandem fashion to a steam cylinder, the air compressor in one case being single-acting, and in another case double-acting? How is the flywheel of an ammonia compressor calculated, having twin horizontal steam cylinders and twin vertical ammonia cylinders, the cranks being set at 90 deg. to each other, and the cylinders being double-acting and in another case single-acting? How is the balancing weight in the main driving wheel of a locomotive calculated? A. Your college library must surely contain books giving the information you desire. Any work on electricity will define an alternating current; any book on physics will define inertia. Any teacher of physics in the college can help you, and a technical college surely is provided with apparatus for illustrating all these points. An alternating current is one which changes the direction of flow at regular intervals. A current of 60 alternations would change 60 times per second, and would have 30 cycles or complete changes from positive to negative and back again. "Phase" expresses the relation of the e. m. f. to the current. In a single-phase current the pressure rises from zero to a maximum, falls to zero and to a negative value equal to the maximum positive value, and rises to zero again in each cycle. This current serves a two-wire circuit with a single pressure. A direct current dynamo would give this current if the commutator were replaced by rings. A two-phase machine has connection made with the armature coils, so that two single-phase currents are taken from it at the same time for two different currents, but the time of greatest pressure in one is the time of zero pressure in the other. The phases are 180 deg. apart. A three-phase circuit has theoretically three circuits of two wires each, and the pressure on any one is 120 deg. from those on either side of it. You will find the whole matter fully explained in Sheldon's "Alternating Current Machines," which we can send you for $2.50 by mail. In a two-phase system four wires are required for the use of both phases separately. Inertia is the tendency of a body at rest to remain at rest, and of a body in motion to remain in uniform motion in a straight line, unless compelled to change by some external force. The moment of inertia is the force necessary to give a body a unit angular velocity in one second. It is calculated for bodies of regular forms by formulas which you may find in books of higher mechanics. A good simple presentation of the subject may be found in Stewart and Lee's "Practical Physics," Vol. I., which we can send you for $2.25. The moment of inertia of a flywheel is that of a ring, very nearly, since the arms are usually very light as compared with the rim. The formula for this is $I \dfrac{R^2\ r^2}{2} \times M$, in which M is the weight, R the radius of the outside of the rim, and r the radius of the inside of the rim. See SCIENTIFIC AMERICAN SUPPLEMENT No. 891 on centrifugal force as applied to revolving machinery, flywheels, etc., price 10 cents mailed. Thurston gives for automatic engines the formula $250{,}000 \dfrac{A\ S\ p}{R^2\ D^2} =$ the weight of flywheel, in which A is the area of the piston in square inches, S = stroke in feet, p = mean steam pressure in pounds per square inch, R = revolutions per minute, D = outside diameter of wheel in feet. This formula is also applicable to belt-driven air compressors, and to the differential conditions of the steam and air cards of a steam-driven air compressor. In any form of compressors for air or ammonia, the compensating conditions of crank angle and opposite pressures must be considered and balanced in the complicated problem of flywheel weight and size. The balancing of the driving wheels of locomotives is somewhat complex, depending upon their reciprocating weights in the longitudinal and vertical direction. The subject of flywheel weights and sizes and counterbalancing locomotives is fully discussed in Kent's "Mechanical Engineer's Pocket Book," $5 by mail.

(9284) L. F. B. asks: Is there any reason why the —— and also the —— dry batteries, which are good, strong cells for automobile work, cannot be made more durable? The cell as it is now made is soldered. The joint of course starts small independent action, and that starts leaking and vaporization of the contents by the joint giving way. I have found this so almost invariably. It seems to me that a *zinc cell* could be made of seamless tubing, thus avoiding a soldered *joint* or *lap*. Better still, the whole cell could very easily be stamped or pressed out in one piece, as the common cartridge cell is pressed out. Is there any reason why this change in making would not be vastly superior, and also make the life of the battery considerably longer. The manufacturers would also save in cost of manufacture. A. The strong competition between the makers of cells has reduced the prices, but also unfortunately reduced the quality also. A good and durable dry cell is very much to be desired. Your suggestions seem to be of value.

(9285) W. S. says: How can I chemically treat Canton flannel and cotton draperies to make them non-inflammable? A. A composition, to be used for theatrical scenery (or the mounted but unpainted canvas to be used for this purpose), and also for woodwork, furniture, door and window frames, etc., is to be applied hot with a brush like ordinary paint. It is composed of boracic acid, 5 pounds; hydrochlorate of ammonia or sal-ammoniac, 15 pounds; potash feldspar, 5 pounds; gelatine, 1.5 pounds; size, 50 pounds; water, 100 pounds; to which is added a sufficient quantity of a suitable calcareous substance to give the composition sufficient body or consistency.

NEW BOOKS, ETC.

THE TENEMENT HOUSE PROBLEM. Edited by Robert W. DeForest and Lawrence Veiller. New York: The Macmillan Company. 1903. Two volumes. 8vo. Pp. 470, 516. Price $6.

This book is published as a contribution to the cause of municipal reform. It embodies the result of the investigations made in connection with the work of the New York State Tenement House Commission, appointed by President Roosevelt when he was Governor of the State of New York in 1900. It also includes the Tenement House Law as amended, and an introduction bringing down the history of tenement reform in New York to 1903. The work is filled with illustrations showing typical conditions in American cities, and it must be said that the volumes are put down with a sense of sadness that such awful conditions can obtain in a civilized city. There is, however, the brighter side to the subject, as the second volume in particular shows what is being done to ameliorate the very terrible conditions which exist in New York city.

RADIANT ENERGY AND ITS ANALYSIS. Its Relation to Modern Astrophysics. By Edgar L. Larkin, Director of the Lowe Observatory, California. Los Angeles: Baumgardt Publishing Company. 1903. 12mo. Pp. 334.

The information presented in this book originally appeared in the form of a series of articles on radiant energy and its analysis in the San Francisco Examiner. Starting with an introductory chapter on radiant energy and on wave motion, Prof. Larkin passes to spectrum analysis and the spectroscope, showing just how important to the modern scientist the spectroscope has become. A chapter on Fraunhofer's work explains the discovery of Fraunhofer lines and their importance in the solar spectrum. Indeed, the most important chapters of this book are devoted to spectrum analysis, for very good reasons, too, in a popular book of this kind. Solar spots are discussed in a short chapter. Solar protuberances have also their place. The moot question of the terrestrial influences of sunspots is briefly reviewed, and likewise the relation between auroras and solar disturbances. The chapters on the sun discuss the amount of energy which the center of the solar system constantly emanates, as well as its influence upon terrestrial life. In the articles on the stellar universe in general, Prof. Larkin shows what modern astronomers have succeeded in doing with high-power instruments.

HOW TO MEASURE UP WOODWORK FOR BUILDINGS. By Owen B. Maginnis. New York: Industrial Publication Company. 1903. 18mo. Pp. 79. Price 50 cents.

This little work describes the simplest and most accurate methods to be followed when figuring all the woodwork required for either brick or frame houses. The author is a thoroughly practical man, being an inspector of buildings in the city of New York, and is a well-known writer on building construction. The little volume is an excellent one, and one which we can commend to all architects, contractors, and carpenters.

LOCOMOTIVE BREAKDOWNS, EMERGENCIES AND THEIR REMEDIES. By George L. Fowler, M. E. New York: Norman W. Henly Publishing Company. 1903. 12mo. Pp. 244. Price, $1.50.

The author is well known from his work on air brakes. The subject is dealt with in a peculiarly lucid manner, and nearly all the ills that locomotives are heir to are dwelt upon in a thoroughly common-sense manner. The popular question and answer system is used, this system serving to keep the writer to his point. Engineers and firemen, and those who aspire to be, will find the book full of good material.

UP-TO-DATE AIR-BRAKE CATECHISM. By Robert H. Blackall. New York: Norman W. Henley & Co. 1903. 12mo. Pp. 305. Two large folding charts. Price, $2.

The eighteenth revised edition is before us, and we must admit that it is a thoroughly adequate treatise on one of the most important subjects in the railway world. Practice is so constantly changing, that a book on the subject a few years old is obsolete. The popular question and answer system is retained. The diagrams and folding diagrams are excellent, while the colored charts are the most elaborate we have seen, and show both passenger and freight equipment. We commend the book most cordially to all interested.

WIRELESS TELEGRAPHY, ITS ORIGINS, DEVELOPMENT, INVENTIONS AND APPARATUS. By Charles Henry Sewell. New York: D. Van Nostrand Company. 1903. 12mo. Pp. 229. Price $2 net.

The aim of this book is to present a comprehensive view of wireless telegraphy, its history, principles, systems, and possibilities in theory and practice. It will prove of use both to the student and the general public. The art is in an imperfect state, and any literature which will tend to dissipate the general ignorance and misconception will be welcomed.

ONE HERTZIANE E TELEGRAFO SENZA FILI. By Dott Oreste Murani. Milan: U. Hoepli. 1903. 18mo. Pp. 341. Price, 75 cents.

The excellent little compends called "Manuali Hoepli" are eight hundred in number, and are an extraordinary monument to the ability of the publisher. All works on wireless telegraphy are popular at the present time, and it is to be hoped that this excellent book will soon be translated.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES. Thirty-sixth Annual Number. New York: Poor's Railroad Manual Company. 1903. 8vo. Pp. 1720. Price $10.

This work is probably among the most useful ever published for investors, and to the railroad official it is indispensable. It deals with the history, mileage lines of road operated, track mileage, water lines, proprietary railroads, capitalization of systems, interests in other railroad systems, rolling stock, profit and loss account, and various other statistics. Poor's Manual has long been a recognized authority upon the subjects which it treats. The length of railroads completed on December 31, 1902, was 203,131 miles; the net increase of all railroads in the United States in the calendar year 1902 was 3,447 miles. The total mileage of track is 274,835 miles. There are 41,626 locomotives, 27,364 passenger cars, 9,726 baggage and mail cars, and 1,503,949 freight cars.

EXPERIMENTAL RESEARCHES ON REINFORCED CONCRETE. By Armand Considère. Translated and arranged by Leon S. Moisseiff, C.E. New York. 1903. 8vo. Pp. 188. Price $2.00.

We have already had the privilege of reviewing the French edition of the author's work. The highly useful nature of concrete to the engineer is being felt more and more. The older books on concrete did not deal with reinforcing, which was largely brought into use by French and German engineers. The importance of the new material has become such that no civil engineer can well afford to be without a thorough knowledge of its properties, and this knowledge can be gained from this book.

ROOF FRAMING MADE EASY. By Owen B. Maginnis. New York: The Industrial Publication Company. 1903. 12mo. Pp. 164. Price $1.00.

The carpenter or builder who will study the methods described in this book will realize the constructive value of every piece of timber which enters into a framed roof and will understand how to lay out every piece of timber used without wasting valuable time and material on cutting and trying.

The language used is that of the practical workman; scientific phrases and confusing terms have been avoided where possible; and everything has been made so plain that any one who will faithfully study the book will understand it from beginning to end. In fact, every problem in the book was "tried" on a boy who had no experience in building work, and he understood every problem with a little study. This will show that the book is valuable to the beginner as well as the advanced workman.

HANDY LUMBER TABLES. Containing Board Measure, Plank Measure, Scantlings, Reduced to Board Measure, With Other Useful Data and Memoranda. New York: The Industrial Publication Company. 1903. 18mo. Pp. 24. Price 10 cents.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 5, 1904.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Adding machine, F. Buresh ... 748,924
Adding machine automatic attachment, H. Marshall ... 748,766
Agricultural implement, J. Downing ... 748,706
Air and gas mixing and delivering apparatus, Brown & Truckses ... 748,840
Air brake, emergency, W. H. Honsberger ... 748,733
Air brake pump lubricator, T. M. Henderson ... 748,731
Air compressor, hydraulic, W. O. Webber ... 748,898
Air into its constituents oxygen and nitrogen, mechanism for separating liquid, H. Dumars ... 749,040
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Bag closure, G. Winkler ... 748,902
Bale, H. Stockman ... 748,999
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Belt, L. Wertheim ... 748,900
Bicycle frame, P. Haag ... 748,602
Blocks. See Building block.
Block signal system, J. Weatherby, Jr ... 748,824
Blower, steam, I. A. Fraser ... 749,050
Boat, life, R. A. Brown ... 748,919
Boiler furnace, locomotive or other, A. F. Kingsley ... 748,748
Boiler, superheater, steam, E. T. Hannam ... 748,945
Bolster attachment, G. J. Friend ... 748,600
Book, account, J. H. Rand ... 748,789
Book, manifolding sales, W. M. Kubon ... 748,755
Boom swinging machine, J. Bird ... 748,691
Bottle, J. Auld ... 748,570
Bottle, J. Wagner ... 749,117
Bottle, W. H. Wright ... 749,124
Bottle filling apparatus, J. J. Clifford ... 748,585
Bottle, non-refillable, M. Reinfeld ... 748,885
Bottle stopper, T. Hentgen ... 749,060
Bottle stopper, E. G. Howe ... 749,063
Bottle stopper holder, water, A. C. Eggers ... 748,937
Bottle washing machine, J. J. Clifford ... 748,584
Bottles, jars, etc., detector of the contents of, A. J. Mottlau ... 749,080
Brake apparatus, load, H. R. Mason ... 749,075
Brake beam fulcrum, L. A. Shepard ... 749,107
Brake shoe, F. W. Sargent ... 749,103
Breech closing device, eccentric screw, De Nordenfelt & Ternstrom ... 748,978
Brewer's apparatus, Neubert & Wiedenbeck 749,087
Briquets, making, W. Huffelmann ... 748,739
Brush, W. Braun ... 748,917
Brush, fountain blacking, S. W. Marshall ... 748,767
Bucket, well, C. A. Crane ... 748,704
Buckle, cotton bale tie, J. F. Matthews ... 749,076
Buckle, harness, A. W. & T. H. Nance ... 748,776
Buffing machine, Winkley & Phillips ... 748,677
Buggy boot, C. Nelson ... 748,779
Buggy top, W. A. Wilkins ... 749,008
Building block, F. B. Henry ... 748,603
Building block, O. H. Bolen ... 749,020
Burial casket, W. C. Booth ... 748,692
Button, A. P. Ward ... 748,673
Button blank cutting machine, J. W. Miller 749,079
Calendering machine, L. Eck ... 748,593
Camera, photographic, F. W. Bherm. 749,126, 749,127
Can loader, J. D. Martinez ... 749,073
Canning factory corn and syrup feeder, J. M. C. Jones ... 748,744
Cap, projectile, Wheeler & McKenna ... 748,827
Car body bolster, railway, J. M. Hansen ... 749,133
Car brake, A. S. Hodges ... 748,605
Car brake, W. House ... 748,735
Car brake, W. J. Russell ... 749,102
Car coupling, W. L. Jacoby ... 748,740
Car coupling, D. P. Moran ... 748,874
Car coupling, emergency, Carlisle & Elder ... 748,927
Car door, A. G. Abizaid ... 748,909
Car door, grain, M. Mehan ... 748,630
Car plow, electric, W. F. Taylor, Jr ... 748,810
Car, railway, C. Vanderbilt ... 748,895
Car seat, H. Witte ... 748,903
Car seat, Repsdorph & Burton ... 749,097
Cars, etc., automatic guard or life saver for tram, D. Maxwell ... 748,628
Cars, combined friction and direct acting spring draft rigging for railway, T. B. Hunt ... 748,951
Carpet stretcher, T. J. & Z. T. Sheets ... 748,664
Carriage, collapsible, H. M. Hull ... 748,869
Cart, dumping, W. E. Harris ... 749,057
Cartridge, blasting, T. F. Durham ... 748,935
Case hardening compound, J. Cadotte ... 748,842
Casem cellulose composition and producing same, H. V. Dunham ... 748,709
Cask tilter, G. Sanders ... 748,658
Cast off, A. M. Ziegler ... 748,908
Cattle guard, J. L. Campbell ... 749,024
Cell case, H. Selsor ... 748,663
Cement, manufacturing hydraulic, J. Gresly 748,943
Cementitious product or artificial stone, making, W. E. Jaques ... 748,611
Centrifugal machine basket, E. C. Kuchenmeister ... 748,756
Centrifugal machine, electrically driven, H. G. Morris ... 748,771
Chart or pattern for crochet work, E. C. Faust ... 748,939
Chatelaine, R. R. Debacher ... 748,846
Cider press, G. L. Munk ... 748,633
Cigar box, R. W. Hardie ... 748,863
Cigar box filler, H. J. Lewis ... 748,624
Clamp. See Rubber dam clamp.
Clasp, M. B. Hammond ... 748,724
Clock case, Woodruff & McCabe ... 748,679
Clothes line fastener, H. Kleinfeldt ... 748,622
Clutch, friction, A. R. Anderson ... 748,569
Cob pipe filler, J. H. Chapman ... 748,582
Cock and faucet mantle guard, P. F. Glazier ... 748,720
Coffee urn, F. Acker ... 748,910
Coin, automatic apparatus for delivering articles in exchange for, R. W. Vining 749,003
Coin sorter, C. S. Batdorf ... 748,836
Coins, machine for operating upon, J. E. Doldt ... 748,934
Coke drawing machine, J. A. Hebb ... 749,058
Color blending wheel, C. Scott ... 748,661
Concentrator, L. R. Tulloch ... 748,819
Concentrator, L. F. Schoenefeldt ... 749,104
Contact shoe, W. F. Taylor, Jr ... 748,813
Conveyor, pan, J. M. Dodge ... 749,038
Conveyor, pivoted bucket, E. Bivert ... 748,576
Conveyors, etc., tripper for bucket, E. Bivert ... 748,577
Cope, W. Leahy ... 749,069
Copper ores, treating, A. M. G. Sebillot ... 748,662
Corn ears, machine for picking, W. C. Sabin 748,656
Corn shocker, T. L. Creath ... 748,932
Corset spring, C. D. Wood ... 748,830
Cotton gin, Von Oven & Boesch ... 748,780
Creaming can, F. G. Fortney ... 748,598
Cultivator, weeder, and furrow maker, combined, T. J. Hubbell ... 748,737
Currycomb, D. M. Friedt ... 749,052
Currycomb, T. A. Howes ... 749,064
Cuspidor, C. E. Bertels ... 749,019
Designs, ornamentations, or letters on articles, material for producing, R. K. Duncan ... 748,851
Developing and fixing device, pocket, R. R. Lutz ... 748,964
Diaphragm indicating, controlling, and measuring appliance, Grouvelle & Arquembourg ... 748,944
Dish washing machine, J. H. Griswold ... 748,859
Disinfectant receptacle, W. L. McDonald ... 748,636
Display truck, couch, H. J. Montgomery ... 748,770
Distance or range finding instrument, T. Adamson ... 748,567
Door closer and check, E. Cliff ... 748,929
Door gage, D. Millspaugh ... 748,873
Door opening and closing device, mechanical, W. F. & J. Drieschman ... 748,848
Door operating mechanism, L. A. Shepard ... 749,108
Door or window trimming, F. C. Walbridge 749,118
Door support, adjustable sliding, T. C. Prouty ... 748,787
Dough or like plastic materials, apparatus for dividing and compressing or molding, J. Callow ... 749,023
Draft equalizer, J. B. Hayden ... 748,730
Draft evener, F. Rosenow ... 749,100
Drafting appliance, garment, J. Robberts ... 748,792
Dredging machine, Smyth & Bowers ... 748,804
Drying moist material, apparatus for, E. N. Trump ... 748,893
Dumping apparatus, C. G. Foote ... 749,139
Duplicate engine, J. W. Neil ... 748,975
Dynamo or motor with alternating field, electric, R. Ziegenberg ... 748,907
Ear, C. E. Carll ... 748,581
Electric arcs for heating and lighting, apparatus for producing, J. I. Ayer ... 748,574
Electric circuit closer and breaker, T. H. McQuown ... 748,638
Electric coupling, G. A. Le Fevre ... 748,961
Electric motor switches, automatic brake for controlling, Muschenheim & Hendry 748,635
Electric signal, B. H. Scott ... 749,105
Electrical cut out, C. B. McPherson ... 749,085
Electrodes for storage batteries, producing, F. A. Feldkamp ... 748,940
Electrolier, adjustable, G. Andersen ... 749,138
Elevator boots, device for relieving choke in, I. Lutz ... 749,071
Elevator fender, H. L. Conary ... 748,702
Embroidering machine, Escuder & Forest ... 749,044
End gate, J. M. Groff ... 748,860
Engine. See Duplicate engine.
Engine feed regulator, gasoline, H. H. & C. B. Segner ... 748,990
Engine reverse motion, steam, F. Meanley ... 748,629
Engine wheel, traction, H. F. Krueger ... 749,068
Engines, fuel feed device for gasoline or vapor, E. Prouty ... 748,883
Engines, gas generating and feeding mechanism for gas, C. K. MacFadden ... 748,763
Envelop or card delivering cabinet, T. A. Matthews ... 748,966
Envelop, safety, J. F. Young ... 749,010
Ether, manufacturing, O. Meyer ... 748,078
Exhibiting mechanism, animal, W. D. Carson ... 748,700
Fabric cutting machine, H. Faltermayer ... 748,853
Fabric marking machine, M. J. Fisher ... 748,854
Fastening device, barbed, R. W. Meily ... 749,077
Fat cutter, C. Burnett ... 748,841
Feed trough, J. J. Smith ... 748,802
Feed trough attachment, T. L. Peacock ... 748,647
Fence post, G. W. Todd ... 748,817
Fence post, H. Hansberger ... 748,946
Fence post, J. K. Harris ... 749,056
Fence structure, S. L. Bailey ... 749,015
Fence, wire, S. S. Withington ... 749,137
Fertilizer distributor and cotton planter, I. C. Clyburn ... 748,843
File, combination credit, W. D. Mitchell ... 748,631
File, paper, C. C. Boykin ... 749,021
Filter, R. J. Goade ... 748,857
Filter press, E. B. Hack ... 749,140
Finger nail clipper, H. C. Hart ... 748,864
Firearm, C. J. Hamilton ... 748,723
Fish catcher, H. C. Reichardt ... 748,884
Fish nets, means for facilitating casting and drawing, L. Einarson ... 748,710
Fish trap, D. B. Roberts ... 748,654
Floor drain and backwater trap, combined, F. C. Edelen ... 748,936
Floors, paneling, etc., fastening means for parquet, W. S. Kelsey ... 748,746
Fodder fork, W. Giles ... 748,601
Folding or collapsible box of cardboard, etc., A. R. Buckton ... 749,125
Folding table, H. Johnson ... 748,956
Food cutter, C. J. Shirreff ... 748,665
Furnace, C. J. Andrus ... 748,833
Furniture tip, L. C. Matlack ... 748,965
Fuse, electric circuit, T. Nagel ... 748,639
Game apparatus, J. J. Wyly ... 748,680
Game apparatus, H. Ramme ... 748,788
Game board, L. J. Magie ... 748,626
Garment fastener, J. C. Christensen ... 749,026
Gas, apparatus for the manufacture of, R. Dempster ... 748,933
Gas burner, A. E. Howard ... 748,607
Gas engine, W. R. Kahlenberg ... 748,615
Gas, generating, F. H. Bates ... 748,687
Gas generator, H. W. Webb ... 749,006
Gas generator, acetylene, W. D. Packard ... 748,781
Gas generator, acetylene, H. W. Webb ... 749,007
Gate, J. Meyer ... 748,769
Gate automatic attachment, J. H. Jones ... 748,614
Gear, variable speed and reversing, H. C. Sheppard ... 748,799
Gear wheel, F. A. Richter ... 748,653
Gelatinous product and producing same, insoluble, H. V. Dunham ... 748,708
Generator. See Gas generator.
Glassware, etc., ornamented or lettered, R. K. Duncan ... 748,849
Glue from hides, making, E. R. Hewitt ... 748,866
Go cart, F. E. Southard ... 748,994
Go cart, or child's chair, J. Weber, Jr ... 749,119
Golf ball, etc., C. J. Grist ... 749,053
Governor and speed gear mechanism, combined, N. V. Johnson ... 748,958
Governor, engine, E. Hudson ... 748,738
Governor regulator, C. J. Koch ... 748,751
Grading machine, B. A. Karr ... 748,616
Grain binder, C. Colahan ... 748,587
Grain drill, H. Funk ... 748,717
Grain shoe, self-adjusting, J. T. Jardine ... 748,741
Grinder, twist drill, A. H. Reimann ... 748,651
Grinding machines, apparatus for feeding abrasive materials to, I. Flexner ... 748,855
Hand press, J. F. Helmold ... 748,947
Harness, Haller & Baker ... 749,054
Harrow, H. A. Brixen ... 748,837
Harvester, J. C. Parker ... 748,782
Harvester binder tension device, J. F. Harnish ... 749,055
Hat, sportsman's convertible, E. E. Hodshon ... 748,949, 748,950
Hay knife, W. S. Shippy ... 748,991
Heater, C. R. Bannihr ... 748,835
Heating apparatus, J. C. Nace ... 749,086
Heating system, electrical, E. H. Kitfield ... 748,749
Heddle, W. Fehr ... 748,713
Hinge, gate, J. H. Vandever ... 748,670
Holdback, breeching strap, T. Nichols ... 748,976
Horse head controller, B. W. Kindig, Jr ... 748,747
Horse shoe nails, machinery for the manufacture of, J. M. Laughlin ... 749,135
Hose coupling, J. Jeffrey ... 748,742
Hose, manufacturing, Shepard & Fish ... 748,798
Hot water and steam, apparatus for supplying, J. F. Connell ... 748,845
Hub attaching device, S. S. Thomas ... 748,892
Hydrocarbon burner, C. A. Hammel ... 748,862
Hydrocarbon burner, J. A. Walkley ... 748,897
Hydrometer, H. E. Broestler ... 748,838
Hydroxids and oxids of metals by electrolysis, production of, F. F. Hunt ... 748,609
Illuminating body, M. Korff ... 748,753
Ingots or like pieces under the hammer, machine for handling, G. P. Toy ... 749,049
Ink well, S. G. Reynolds ... 749,098
Internal combustion engine, E. Korting ... 748,959
Invalid sling, P. W. Atkinson ... 749,014
Jar closure, C. H. Nicholson ... 748,642
Jars, etc., packing for fruit, G. D. C. Coddington ... 748,586
Jars, etc., stoppering device for preserve, H. Martini ... 749,074
Knitting machine, circular, H. A. Houseman ... 749,062
Lacing, P. J. Congdon ... 748,703
Ladder, extension, M. J. Lewis ... 749,070
Lamp burner attachment, Stockman & Friel 748,889
Lamp burner, central draft, J. Gregory ... 749,132
Lamp, electric arc, Wirtz & Hamilton-Adams ... 748,904
Lamp, electric arc, E. H. Belden 748,915, 749,016 to 749,018
Lamp extinguisher, H. D. Hinks ... 749,061
Lamp hanger, extension, F. H. Geisler ... 748,718
Lamp, miner's safety, Moore & Sage ... 748,632
Lamp socket, incandescent electric, H. A. Framburg ... 748,599
Lamps, magnetic lock for miners' safety, A. Wiedenfeld ... 749,123
Latch, door, Quick & Smith ... 749,094
Laundry, portable, W. A. Roberson ... 748,986
Leg fastening, A. Ow ... 748,877
Lifting jack, M. M. Moore, Sr ... 748,972
Lifting jack, W. C. Smith ... 748,992
Liquid meter, Drisko & Berrenberg ... 748,707
Liquid mixing and spraying apparatus, W. H. Millspaugh ... 748,971
Liquors, clarifying, E. R. Hewitt ... 748,865
Load retaining stakes, position governing means for, W. M. Cain ... 748,698, 748,699
Lock. See Window lock.
Lock, E. Muhlinghaus ... 748,772
Locomotive signaling apparatus, H. Stadelmann, Jr. ... 749,111
Loom shuttle and quill, narrow ware, E. H. Sawyer ... 748,887
Malt turner and aerator, J. Mueller ... 748,875
Marker, stock, L. J. Davis ... 749,035
Marking and cutting device, C. C. Stange ... 748,997
Marking tool, cattle, H. A. Jones ... 748,613
Marlinespike, H. Fesenfeld ... 748,714
Match safe, J. R. Thomas ... 748,891
Match safe and lighter, C. F. A. Cammann 748,925
Measure, liquid, H. J. & J. C. Brantley ... 748,694
Measures and funnels, automatic valve for combined, E. D. Schafer ... 748,988
Measuring tank, liquid, E. O. Linton ... 748,761
Megaphone, C. Melville ... 748,969
Metal beating machine, F. W. Grempler ... 748,722
Metal boring tool, Taylor & Newbold ... 748,890
Metallic formed sheet, Murphy & Camp ... 748,634
Meter registering mechanism, L. H. Nash ... 748,778
Milk can, W. J. Snow ... 748,805
Mining hoist safety appliance, J. Lewis ... 748,962
Mold, J. F. Spencer ... 748,996
Monkey wrench, N. D. Fairchild ... 748,938
Motion transmitter, V. J. Dolechek ... 749,039
Motor sparking plug, J. S. Foley ... 749,045
Music turner, sheet, J. W. Collier ... 749,028
Musical instrument self-playing attachment, J. Courville, reissue ... 12,189
Musical instrument tracker bar, J. T. Sibley 748,801
Noodles, etc., machine for cutting, C. Hurt. 748,952
Nozzle, J. Hueni ... 748,608
Nut lock, S. C. Crow ... 748,588
Nut lock, A. C. Fletcher ... 748,942
Nut, lock, Peters & Bellamy ... 748,882
Oil supply system, H. C. Hanson ... 748,727
Optometrist's trial frame, C. L. Hogue ... 748,732
Ornamented or lettered articles, manufacturing, R. K. Duncan ... 748,850
Oxalates, making, Rieche & Saame ... 748,791
Pad hook, O. H. Muntz ... 748,773
Paper from old newspapers, books, magazines, etc., making, Meixell & Holt ... 748,968
Paper handling machinery, sheet calipering device for, Dexter & Hallstream ... 749,037
Paper machine, H. A. Moses ... 748,973
Paper making machinery, H. Parker ... 748,645
Paper sheets, device for holding or binding loose or removable, R. G. Whitlock ... 749,122
Paper tube making machine, C. Frerot ... 749,051
Pasteboard making machine, P. Priem ... 748,983
Pencil sharpener, H. L. Adams ... 749,011
Penholder, C. J. Dahlgren ... 748,589
Pessary, F. L. Priest ... 748,650
Pianos, action for mechanical playing attachments for, G. S. Williams ... 748,828
Pick, mining, G. T. White ... 748,901
Pile point, R. S. Davis ... 748,705
Pin hook, G. W. McGill ... 749,084
Pipe bending machine, H. F. Condon ... 749,029
Pipe elbow machine, J. Baeumle ... 748,686
Pipe joint, lead, G. Bryar ... 748,579
Pipe joint or coupling, A. Spratt .. 748,807, 748,808
Piston joint, G. C. E. de Bonnechose ... 748,916
Planter marker lifter, corn, Harter & Doak 748,728
Plow attachment, E. H. Allman ... 748,682
Plow, disk, O. E. Ellison ... 749,043
Plow, ditching, J. S. McCants ... 749,082
Plow or cultivator, W. B. McKinley ... 748,774
Plow, reversible, H. E. Kreuter ... 748,623
Plow, sod cutting, J. F. Weber ... 748,675
Post. See Fence post.
Printing book backs, machine for, Northcott & Flora ... 748,643
Printing device mechanical movement, O. Tyberg ... 749,000
Printing machine, J. H. Reinhardt ... 748,886
Printing machine rollers, machine for cleaning, E. T. Cleathero ... 748,583
Printing machine, stencil, W. D. Sternberg 749,113
Printing press, C. H. Johnson ... 748,743
Printing press, automatic controlling mechanism, Dexter & Hailstream ... 749,036
Printing presses, metal holding apparatus for flatbed lithographic, W. J. Leyer ... 748,871
Printing surfaces, mechanism for preparing, B. A. Brooks ... 748,578
Pulley covering, J. F. Webb ... 748,674
Pump, air, G. W. Kellogg ... 748,617
Pump, duplex, P. F. Oddie ... 749,089
Pump or vacuum chamber, automatic suction, C. H. Wettlin ... 749,121
Pumping engine, De Laval & Aborn ... 748,758
Punching and shearing machine, etc., R. Norrie ... 748,979
Quartz mill, C. J. Hodge ... 748,867
Rail and conductor point operating mechanism, C. G. Goord ... 748,721
Rail cover, third, H. F. Duffy ... 748,591
Rail joint, A. L. Vinyard ... 748,672
Rail joint for tracks and especially for field railways, W. Weiss ... 748,826
Rail protector, third, H. F. Duffy ... 748,592
Railway block signal and switch, W. F. Taylor, Jr. ... 748,815
Railway, electric, C. J. Kintner ... 748,619, 748,620
Railway rail and joint therefor, J. Mallat ... 748,764
Railway safety system, electric, C. J. Kintner ... 748,621

Railway service safety device, E. B. Powers 748,649
Railway switch operating device, street, H. T. Young 749,009
Railway switch, street, W. J. Bell 748,688
Railway system, electric, W. G. Lowrie 748,872
Railway system, electric, W. M. Eader 749,042
Railway tie, J. Horr 748,606
Raising or hoisting apparatus, E. Lorin 748,762
Raker gage and jointer, J. P. Olson 749,090
Range hot water heater, kitchen, P. H. Werner 748,899
Reaper evener, L. Krauss 748,754
Recording instrument record sheet, W. H. Bristol 748,918
Register faceplate, H. J. Valentine, 748,668, 748,669, 749,116
Rivet holder, E. F. Terry 748,816
Rock drill, power driven, W. A. Box 748,693
Rock drilling machine, A. Fauck 748,712
Rolling pipe couplings, etc., machine for, H. W. & J. A. Hock 748,948
Rosette covers, device for removing, F. L. Bryant 748,923
Rotary engine, P. A. Anderson 748,832
Rotary engine, A. Guindon 748,861
Rotary motor, J. M. Benjamin 748,689
Rubber dam clamp, F. H. Nies 748,977
Ruling machine, K. Daut 749,034
Sad iron, revolving, A. D. Mahony 748,627
Safety can, W. H. Pearson 748,784
Satchel, J. Sandberg 748,657
Saw sharpening machine, A. Andersson 748,685
Saw swage gage, A. O. Reppeto 748,790
Scoop, T. D. Owens, Jr 748,878
Scouring machine, A. Pietsch 748,786
Screw driver, G. E. B. Parkin 748,879
Screw machine, Stitmann & Pitt 748,667
Seed huller, S. J. Ellis 748,852
Semaphore mechanism, W. F. Taylor, Jr 748,814
Sewing machine thread cutting device, E. B. Allen 749,012
Sewing machine threading device, S. B. Battey 748,914
Shade bracket, F. J. Nichols 749,088
Sharpener, disk, Melvin & Brusseau 748,768
Sharpener, disk, E. Pierson 748,785
Sheaf tie, J. C. Parker 748,783
Sheep dipping machine, R. J. Winnie 748,829
Sheer pole support, E. G. Lamb 748,960
Sheet metal wares, machine for beading, Paton & Taylor 748,982
Shock binder, P. H. Fontaine 749,047
Shuttle, C. & G. Brun 748,920 to 748,922
Shuttle, D. J. Carey 748,926
Shuttle threader, O. R. Jacques 748,954
Signal. See Electric signal.
Signal system, electric, H. A. Fessenden 748,941
Signaling apparatus, automatic, I. A. Michael 748,970
Signaling apparatus, wireless, L. de Forest 749,131
Signaling device, wireless, L. de Forest 748,597
Sleeves, couplings, or the like, machine for forming, A. A. Anderson 749,013
Slotting machine, L. H. Colburn 748,844
Solar heater, J. M. Browning, Jr 748,696
Soldering iron, electric, J. I. Ayer 748,571
Sound record, double faced, A. N. Petit 749,092
Sound reproducing record and making same, T. A. & J. B. Connolly 749,030
Spacing table, L. D. Weaning 748,823
Square, carpenter's folding, W. Steers, Sr. 749,112
Squares, machine for rolling carpenters', H. K. Jones 748,870
Stack covering, W. D. Carson 748,701
Stacker, pneumatic, E. O. Berg 748,575
Stacker, pneumatic straw, N. L. Nelson 748,640
Stamp mill attachment, L. R. Tulloch 748,820
Stationery cabinet, T. A. Matthews 748,967
Steam boiler, S. L. Marple 748,765
Steam superheating means, H. F. Wallmann 748,822
Steam trap, W. M. Still 748,888
Steel and ingot iron, manufacture of, Talbot & Gredt 749,115
Steel, angle, H. G. M. Howard 748,736
Stereopticons, magic lanterns, etc., slide carrier for, H. W. Force 749,048
Stereoscope, Folmer & Lawrence 749,046
Stereoscope lens setting, H. C. White 748,676
Stereotype block, C. N. Field 748,596
Sterilizer, A. Castle 749,128
Stone, brick, etc., waterproofing and finishing the surface of, N. Farnham 748,595
Stone molding machine, artificial, J. Sinclair 748,666
Stove, F. J. Pioch 748,648
Stove, C. Schweizer 748,796
Stove, Helwig & Montague 749,059
Stove, heating, J. T. Smith 748,803
Stove, heating, N. R. Spaulding 748,995
Stove, magazine, Kendall & Cowdin 749,067
Strainer, G. L. Wackerow 748,821
Switch, W. F. Taylor, Jr 748,811
Switch operating device, J. T. Carmody, Jr 749,025
Switch throwing mechanism, W. F. Taylor, Jr. 748,812
Telegraph apparatus, F. G. Creed 749,031
Telegraphic receiving apparatus, F. G. Creed 749,033
Telegraphy, perforating, F. G. Creed 749,032
Telephone book support and note paper supply device, combined, A. D. Irving 749,141
Telephone exchange, N. E. Norstrom 748,980
Telephone transmitter, C. F. Bennett 748,690
Tent, A. F. McGrath 748,974
Testing machine, coin controlled, C. E. Amond 748,683
Thermometer shield, clinical, F. O. Koeneman 748,752
Thill coupling, H. C. Ingraham 748,610
Threading device, S. B. Battey 748,913
Ticket, pin, M. S. Johnson 748,957
Tiles, interlocking building, J. Schall 748,989
Time recorder, Shilling & Dieter 748,800
Tire cover, elastic, Gray & Sloper 748,858
Tire for vehicles, spring, A. Schwieger 748,797
Tire rolling machine, P. Eyermann 748,594
Tires in rim channels, tool for seating rubber, W. S. Jacobs 748,953
Tobacco pipe, I. L. Hauser 748,729
Toboggan slide, B. B. Floyd 749,130
Tongs, household, J. H. Spangler 749,110
Tool and back rest holder, B. M. W. Hanson 748,726
Tool, electrically heated, J. I. Ayer 748,573
Tool holder, B. M. W. Hanson 748,725
Tool or cement house, portable, W. H. McDonald 748,637
Tool, pneumatic, R. L. Ambrose 748,568
Tools, apparatus for controlling current supply to electrically heated, J. I. Ayer 748,572
Torch, safety, C. H. Brown 748,839
Torpedo, automobile, F. M. Leavitt 748,759
Towel rack, P. H. Germain 748,719
Towel rack, E. D. Mullen 749,081
Traction wheel, metal, A. C. Rogers 748,793
Train orders, messages, etc., device for delivering, W. H. Pickett 749,093
Transferring and printing, Hesse & Paraf-Javal 748,604
Transmitter, E. E. Yaxley 748,906
Trap. See Fish trap.
Treating material, E. N. Trump 748,894
Trolley harp, E. D. Rockwell 748,987
Tube or roll forming machine, Surmann & Douglas 749,114
Tunneling apparatus, R. Stone 748,809
Turbine, H. Wolke 748,678
Type holder, H. S. Folger 748,715
Type mold, C. R. Murray 748,876
Typewriter, N. L. Anderson 748,831
Typewriter carriage construction, J. Alexander 748,681
Typewriting machine, W. J. Barron 748,912
Typewriting machine, O. Tyberg 749,001, 749,002
Typewriting machine, C. H. Shepard 749,106
Umbrella, J. B. Rohrer 748,655
Valve, fluid pressure motor, C. A. Carlson 748,928
Valve gear, engine, G. F. Conner 748,931
Valve, hydraulic, W. G. Ward 749,005
Valve, hydraulic, Lewis & Dick 749,136
Valve, locomotive relief, K. Rushton 749,101
Vehicle brake, T. Treloar 748,818
Vehicle brake, W. U. Wadsworth 748,896
Vehicle brake, M. Jewell 748,955
Vehicle, motor, L. Renault 749,096
Vehicle seat, G. R. Brown 748,695
Vehicle steering gear, motor, L. Renault 748,984
Vehicle wheel, Andersen & Wells 748,684
Vehicle wheel, F. E. Southard 748,993
Vending machine, E. S. Scheble 748,795
Vending machine, coin controlled perfume, Richie & Jamison 748,652
Vertical boiler, G. F. Spencer 748,806

Vessel mooring and warping device, J. Kidd 748,618
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Warm air furnace, O. L. Badger 748,834
Warm air register, T. E. Hunt 749,065
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Watchcase, W. W. Dudley 748,590
Water, apparatus for separating oil or grease from, C. Oliver 748,981
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Weave for shades, etc., A. C. Hough 748,734
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Weighing machine, automatic, J. F. Clarke 749,027
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Wheel. See Color blending wheel.
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Wheels, peripheral structure for, F. Pawel 748,880
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Window parting strip, C. W. Wright 748,905
Window, revoluble, E. C. Somers 749,109
Wire connector, J. S. Ford 748,716
Wire covering machine, J. C. Anderson 748,911
Wire stretcher, C. Bush 748,697
Wood carbonizer, F. M. Perkins 749,091
Wood, treating, K. Wadamori 749,004
Woodworking machine chip breaker, C. D. Marsh 749,072
Wrench, A. L. Vinyard 748,671
Wrench, N. C. Hyman 749,134
Yeast extracts, preparing alimentary, M. Elb 748,711

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Buckle plate or similar article, C. C. Penfold 36,725
Charm or similar article, R. E. Fisher 36,723
Comb, pompadour puff, B. W. Doyle 36,727
Comb, pompadour puff, F. H. Rowley 36,728
Spoons, forks, or similar articles, handle for souvenir, J. E. Straker, Jr 36,726
Type, font of, W. D. Orcutt 36,729
Watch charm, N. B. Levy 36,724

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Antiseptics and germicides, M. W. Savage 41,815
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Brushes for toilet purposes, Florence Manufacturing Co. 41,833
Candy, F. Laurent & Sons 41,822
Castings, steel, Baldt Steel Co 41,846
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Corsets, Globe Corset Co 41,799
Disinfectants and deodorizers, Schulke & Mayr 41,814
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Files, pocket letter, Cooke & Cobb Company 41,841
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Kalsomine or water paints, Water Paint Company of America 41,839
Knit goods, certain named, W. C. Gallagher 41,800
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Oil, healing, M. W. Savage 41,817
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Perfumes, toilet waters, and sachet powders, Ladd & Coffin 41,834, 41,835
Pianos, miniature grand, Wm. Knabe & Co. Mfg. Co., of Baltimore City 41,842
Powder, worm, M. W. Savage 41,816
Razors, Moshy & Rahaim 41,830
Remedies for internal use, proprietary, C. Civita 41,812
Ribbons, black, F. Loeser & Co 41,801
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Rice, Joseph Heap & Sons 41,829
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Silk piece goods, Gilbert Manufacturing Co. 41,802
Soap, Puck Manufacturing Co 41,837
Soap, laundry, F. P. Garrettson & Co 41,838
Soap, toilet, F. M. Coulter 41,836
Stoves or ranges, furnaces, and parts thereof, heating and cooking, Sill Stove Works 41,843
Tonics and bitters, Fairchild Bros. & Foster 41,819
Whisky, S. Westheimer 41,821
Wire, John A. Roebling's Sons Co 41,844
Woolen piece goods, F. Almy 41,803

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"American Glory Seven Oils," for medicinal oils, J. D. Drennan 10,659
"American Kid," for cigars, C. B. Henschel Mfg. Co. 10,649
"Aztec Pile Cure," for medicine, Aztec Pile Cure Co. 10,653
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"Iduna," for medicine, A. Lind 10,655
"Kalo's Ruby Oil," for medicine, Mentho-Jell Co. 10,658
"Kennelworth Flea Killer," for a preparation for cleaning animals, W. N. Seary 10,660
"Klenzene," for washing powder, Jarrell & Turner 10,646
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"Rheumol, The Monarch Cure," for medicine, J. H. De Giorgi 10,654
"San Toy," for cigars, J. Ditz 10,650
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"The Tramp $2.50," for shoes, May Co. 10,644
"Vaughan's Pink Cream," for medicine, J. C. Vaughan 10,656

PRINTS.

"Daintiness," for fruit syrups and extracts with and without ice cream soda, H. Curiel 877
"Lead Seal," for wire, John A. Roebling's Sons Co. 873
"The Tramp $2.50," for shoes, May Co. 876
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