SCIENTIFIC AMERICAN

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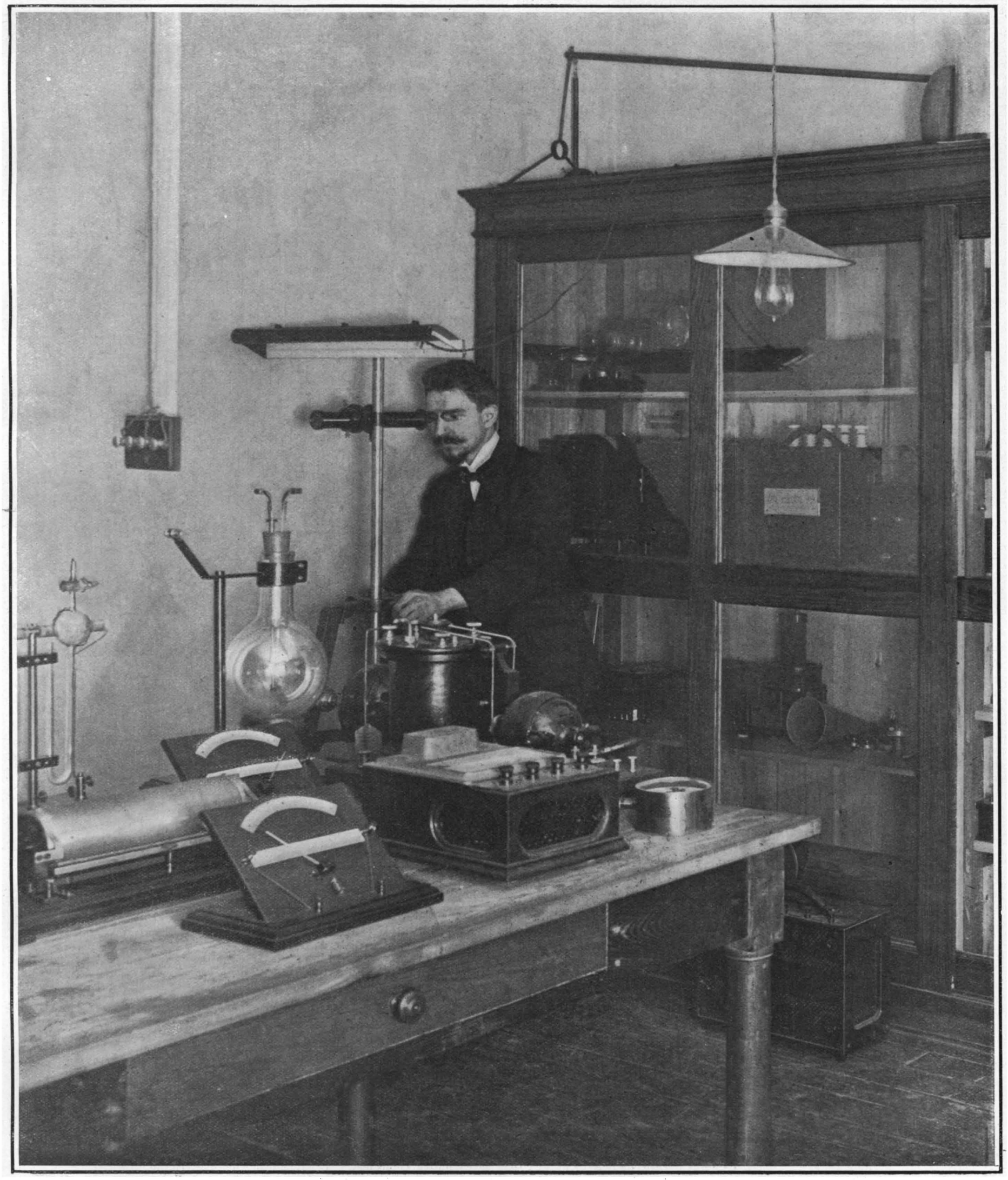
A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI.—No. 18. ESTABLISHED 1845. | NEW YORK, OCTOBER 30, 1909. | 10 CENTS A COPY $3.00 A YEAR.



Standardizing electrical meters.

A PUBLIC ELECTRICAL LABORATORY FOR BRUSSELS.—[See page 312.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) ..... $3.00 a year
Scientific American Supplement (established 1876) ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 30th, 1909.

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.

SLAG A CAUSE OF BROKEN RAILS.

The scientific investigation of the cause of broken rails has a strong claim on popular interest, and this for the reasons that we all are more or less frequent travelers by rail, and that the breakage of rails is one of the most fruitful causes of serious railroad accidents. The agitation of three years ago, which followed upon the publication by the State authorities of statistics showing an alarming increase in the number of broken rails, has been productive of excellent results. It has served to bring together the rail manufacturer and the railroad engineer in a joint endeavor to determine more exactly the causes of rail failure, and devise improvements in the methods of manufacture which will give a thoroughly reliable rail without entailing an undue amount of extra cost in the making.

During these intervening three years, a most exhaustive chemical and mechanical investigation of the subject has been made, and many hitherto obscure and little-understood facts have been brought to light regarding the mechanical condition and chemical composition of faulty rails; the causes which have produced these conditions; and the best methods of casting and working to produce a rail which will stand up under its work, without betraying that alarming liability to sudden fracture, which has caused so much loss of life and property during the past few years.

One of the latest papers on the subject was that presented by Messrs. Fay and Wint at the annual meeting of the American Society for Testing Materials, in which attention was drawn to the frequency with which rail breakages may be traced to the presence of slag. The investigation by these gentlemen of rails that had broken in the head shows the presence of excessive slag; a segregation of slag concentric with the rail section; remnants of slag in the large split portion of the head; and slag in those areas where flow of metal has occurred or where microscopic cracks have developed. While it is impossible from the evidence so obtained to state definitely the exact cause of fracture, it is highly probable that it is due to imperfectly welded blowholes or pipes. The investigation showed that at the point of fracture there is always to be found a large amount of slag; that cracks invariably begin in and follow from one slag area to another; and that cracks within the body of the metal produced by shrinkage strains will follow along the slag areas. Thomas Andrews, in his paper entitled "Microscopic Internal Flaws Inducing Fracture in Steel," considers it to be a most significant fact that in the various material he examined, almost without exception, there was a considerable slag area, in or near the fractured surface; and he says that the internal microscopic flaws which are almost invariably present in steel forgings constitute a chief source of initial weakness in axles, rails, shafts, heavy guns, etc.

The hard spots which have been observed in broken rails are apparently due either to imperfect mixing and solution of the ferro-manganese, or to the hardening of the surface of the metal due to slipping of the driving wheels, or to segregation in steel alloys. The first and second causes are not common, but the third, which is due to the imperfect melting of the alloy, is more serious. An examination of several nickel-steel rails which had broken in service showed streaks of very hard, medium hard, and soft metal, and it is the belief of the authors of the paper that this lack of uniformity is due to segregation of the nickel during the cooling of the ingot. It is suggested that the various defects above mentioned could be remedied, first, by using a specification asking for lower sulphur; secondly, by allowing more time between the addition of ferro-manganese to the hot metal in the ladle and the pouring of the metal into the ingot mold; and thirdly, by pouring the metal from the bottom of the ladle. Finally, although Messrs. Fay and Wint believe that electric refining will remove many of the difficulties attendant upon the present method, it must not be assumed that this would prove to be a panacea; since without competent control bad steel can be produced just as easily in an electric furnace as by any other method.

OUR VANISHING TIMBER SUPPLY.

When the adventurous navigators of three or four centuries ago skirted the coasts and entered the bays and rivers of this country, they were impressed with the extent and variety of the forests which everywhere spread their rich mantle over the country. And well they might be; for the original forests of the United States exceeded in the quantity and variety of their timber the forests of any other region of similar size on the globe. Nature was lavish when she laid out and planted the five great forests of this country; and lavish she was when she planned its noble watercourses, smoothed out the vast arable lands of its prairies and wide-spreading valleys, and stored below the surface its priceless wealth of iron ore, coal, oil, and precious minerals. Where Nature had been so prodigal of her supplies, it was perhaps inevitable that man should become equally prodigal in their use; and no doubt the extravagance and wastefulness which have become a national characteristic, are due largely to natural environment.

Of all the natural resources of the country, our forests have been one of the worst, if not the worst, sufferers from extravagance; and this is proved by the simple fact that we use (or waste) ten times as much timber per capita as they do in France, and are, consequently, cutting our forests three times as fast as they are growing. The original forests of the United States included five great forest types. The Northern forest reached from Maine through New England, New York, and Pennsylvania, to Georgia, and through central and northern Michigan and Wisconsin to Minnesota, and covered about 150,000,000 acres, mainly of cone-bearing trees. The Southern forest commenced in New Jersey, and reached from the coast far inland through Virginia, the Carolinas, Georgia, Florida, Alabama, Mississippi, and Louisiana, and portions of Texas, Oklahoma, and Arkansas. This is the great belt of the yellow pine. Its total original area was about 220,000,000 acres. The Central forest, which extended between the northern and southern forests from the Atlantic coast to the western prairies, is the great source of our supply of hard woods. Originally it included not less than 280,000,000 acres. Then to the westward was the Rocky Mountain forest, extending from Montana and Idaho to New Mexico. Here on the high plateaus and mountain slopes is a growth of coniferous trees, including western yellow pine, Douglas fir, larch, spruce, and cedar. Its original extent was at least 110,000,000 acres. Lastly, and the grandest of all, was the Pacific coast forest, extending through Washington, Oregon, and California, whose original area of at least 90,000,000 acres was covered with the most majestic growth of coniferous trees in the world.

Much has been said and written of late about the destruction of our for sts, and one of the latest and most illuminating pamphlets on the subject is that by R. S. Kellogg, Assistant Forester in the Forest Service of the Department of Agriculture, who tells us that, whereas, at a conservative estimate, these five great forests of the United States covered originally 850,000,000 acres and contained 5,200 billion feet of timber, at the present time their total area has been reduced to 550,000,000 acres, containing less than one-half as much standing timber than they did in their virgin state.

The total yearly drain upon our forests, not counting losses from fire, storms, and insects, is estimated to be about 20,000,000,000 cubic feet. Of our present forest area of 550,000,000 acres, 200,000,000 acres are roughly estimated to consist of mature forests, in which the annual growth is balanced by death and decay, and 250,000,000 acres consist of timber partially cut or burned over, on which with reasonable care there is sufficient young growth to produce ultimately a merchantable, but not a full crop of timber. The remaining 100,000,000 acres consists of forests so completely cut out and burned, that there is not sufficient young growth to pro uce another crop of much value. According to this estimate, the annual growth of all our forests is not over twelve cubic feet per acre, or a total of less than seven billion cubic feet. Since we cut yearly some twenty billion cubic feet over and above what is lost by fire and other natural causes, it follows that we are cutting out our forests three times as fast as they are grown. Just how unreasonably extravagant this country has been in using up its timber supply, is shown by comparison with the conduct of Germany and France. In Germany 37 cubic feet of timber per capita are taken annually from her forests; France is able to get along with but 25 cubic feet; while in this country the consumption is 250 cubic feet per capita. Germany, furthermore, has applied her scientific methods with such good effect, that her state forests are producing to-day an annual average of 48 cubic feet of wood per acre.

It is considered that the demand for more farm land may eventually lead to a further encroachment to the extent of 100,000,000 acres upon our present forests, reducing the total to 450,000,000 acres. The Forest Service considers, however, that it would be entirely possible, if the forest land is improved and the timber economically cut and completely utilized, to produce on the remaining 450,000,000 acres sufficient wood for a population much greater than we now have in the United States.

DEATH OF PROF. LOMBROSO.

Cesare Lombroso, certainly the most widely known if not the most authoritative criminologist of our day, died on October 19th, 1909, at Turin, Italy, at the age of sixty-four. If Lombroso had never written anything else than his "Criminal Man," his name would be handed down in the annals of psychology. Even though in his later years he was given, without careful investigation, to rather hastily fitting into his theory any newspaper story or fact that might have met his eye, it must be stated that his contributions to criminal anthropology are valuable and lasting. His theory that criminals must be regarded as mentally diseased persons, although not yet legally accepted by society as a whole, nevertheless finds favor with a large number of psychologists. No doubt his system of criminology is not so far developed that we are justified in abolishing prisons and treating criminals in insane asylums as Lombroso advocated, but at least it tends toward a scientific solution of the problems presented by crime and its punishment.

It was while he held the post of army surgeon that Lombroso's attention was first drawn to malformations of the skull. An executed murderer's cranium was so markedly malformed, that he was induced to make an investigation to ascertain whether or not the man's crime might not have been occasioned by his cranial defects. The rest of Lombroso's life was spent in piling facts upon that original fact. As a lecturer on psychology at the University of Pavia he later had abundant opportunity for studying inmates of the insane asylum there, and was impressed with the connection between nutrition and sanity. As a result of that study, he showed that a poor quality of maize was responsible for much of the pelagra from which Italian peasants were suffering. After a hard campaign he succeeded in inducing the authorities to take measures to reduce the disease. Lombroso's researches were extended also to the study of epilepsy and genius. His theory that genius was a form of insanity was widely heralded, and attracted not a little comment both hostile and favorable.

Recently Lombroso devoted much time to the study of spiritistic phenomena. He made an elaborate study of Eusapia Paladino, and was won over by her to a partial belief in the physical manifestation of spiritualism, yet he was never quite willing to accept spiritualism in the sense of preservation of personal identity after death.

COUNT DE LAMBERT'S FLIGHT OVER THE EIFFEL TOWER.

The most sensational flight ever made in an aeroplane was that accomplished by Count de Lambert with his Wright biplane on October 18th, when he flew from the aero rome at Juvisy, where an aviation meeting was in progress, to Paris and back, covering a distance of about 30 miles in 49 minutes and 39 seconds. After making two circuits of the aerodrome, Count de Lambert headed for Paris, and, continually rising, soon disappeared from view. He flew over Paris at a great elevation, and by the time the Eiffel Tower was reached, he had risen sufficiently to clear it nicely. He passed directly over the tower, which is 984 feet in height, turned his machine around, and headed back for Juvisy. He arrived and landed safely, and was greeted by Orville Wright, who had just arrived from Berlin after making a special flight for Emperor William—the first aeroplane flight the German Emperor had ever witnessed—a few days before. While in Germany, Orville Wright also made a record height flight, in which he reached an elevation of about 1,600 feet, as near as he could estimate. Count de Lambert's height was visibly demonstrated by his passing over the Eiffel Tower. At a height of 1,000 feet the principal sensation he experienced was that his aeroplane appeared to be scarcely moving. The time, he said, seemed interminable ere he finally reached his starting point. His average speed was about 37 miles an hour.

ENGINEERING

Work on the last section of the Jungfrau railway has progressed so well during the recent summer, that it will probably be opened next year from Eismeer to Jungfrau Joch. A station at the former place has been hewn out of the solid rock at an altitude of 3,153 meters, capable of accommodating 200 persons.

Buenos Ayres, the name of which suggests palm trees and sunshine and the transaction of business with sub-tropical leisurely haste, is getting sufficiently busy to demand subways. A bill is pending in the Argentine Legislature to authorize the construction of underground electric railways operating in connection with existing surface lines.

The Wolseley Motor Car Company, leading makers of "all-British" automobiles, are giving special attention to aeroplane engines and have delivered several V-type 50-horse-power machines to intending aviators. These motors, although they weigh only 300 pounds, are claimed to be capable of delivering as high as 75 horse-power. One of them was recently installed in a new Voisin biplane.

The Austrian government appears to be divided upon the "Dreadnought" question, the proposed expenditure upon naval construction for next year having been reduced by $5,000,000. A torpedo cruiser named "Admiral Spaun" will be launched about the end of this month, the first ship of the Austrian navy to be equipped with Parsons turbines, with an estimated speed of 26 knots.

It appears that the Siberian railroad is beginning to show the inevitable results of the haste and cheapness with which it was constructed. The sharp curves and heavy grading have put serious limitations upon traffic, and for great distances the reconstruction will involve an entirely new location. The road is to be changed from single to double track, and the officials are greatly regretting that the large and costly bridges were built to accommodate one track only. On the level plains the double tracking will not be such a serious matter; but in the heavy cuts of the mountain division, and where the steel bridges over the wide rivers will have to be rebuilt, the cost will be very high.

The rapid advance of aviation to the dignity of a science is indicated by the fact that the University of London has arranged for a special course on aeronautics, to be conducted by Mr. A. P. Thurston, one of Sir Hiram Maxim's engineers. It will consist of a series of lectures followed by drawing office practice in the design and construction of aeroplanes. The syllabus of the lectures is as follows: (1) The normal and inclined plane. (2) Stream-line surfaces, center of pressure and resistance of bodies. (3) The propeller and helicopter. (4) Calculations applied to a flying machine. (5) The biplane. (6) The monoplane. (7) Aeronautical engines. (8) Automatic stability and control. (9) Dirigible balloons.

During the past season the old, deep-keel, narrow-beam English cutter "Bloodhound" has been scoring some remarkable wins in races against cutters of the most modern design. Commenting on her performances, the Yachtsman of London says that opinion has been expressed that many present-day designers do not know their business, and adds: "Speaking for ourselves, we say without hesitation that they do not. . . . It is not by any means our purpose to eulogize the performances of the 'Bloodhound' unduly, but we repeat that there is something wonderful in the fact that a yacht so antiquated in shape was able to beat two modern cruisers of fifty per cent over her tonnage." Of course, the feat was performed in strong winds and under reduced canvas. It is in light weather that the modern yacht is so greatly the superior to the older craft.

Tests have recently been concluded by Messrs. Burstall and Monkhouse, of London, of a portable combined boiler and engine, the economy and efficiency of which are so remarkable that we shall hope to describe the tests more in detail either in the SCIENTIFIC AMERICAN or SUPPLEMENT in the near future, limitations of space preventing their adequate discussion at present. The engine is a so-called "locomobile," built by the Wolf Engineering Works of Magdeburg-Buckau, but it must not be confounded with the automobile of that name, as it is not strictly an automobile engine. It consists of a locomotive type boiler, from which the steam is conducted through a superheater in the smokebox directly to the high-pressure cylinder of the engine, which is tandem compound and mounted directly on the boiler under the same jacket, so that the cylinders are surrounded by the flue gases. Such is the heat economy effected by this arrangement, that this commercially constructed "stock" engine and boiler, adaptable to threshing, plowing, sawing, or any of the ordinary work of a portable engine, develops 1 brake horse-power with 1.05 pound of coal and 8.81 pounds of water. The efficiency is very little reduced by running the engine with 20 per cent above its economical load or 30 per cent below.

ELECTRICITY

A contract has just been given by the Brazilian government to a French telegraph company to erect a wireless telegraph station on a small island 200 miles off the coast of Rio Grande do Norte, the easternmost point of South America. The island is 400 miles from Pernambuco. The station will have an operating radius of 1,000 miles. It will be connected by an auxiliary station at Pernambuco with the Brazilian telegraph system.

The city of Baltimore has adopted an ordinance which requires the testing of every electric meter by the Department of Lamps and Lighting, before the meter may be installed. A charge of ten cents is made for each inspection. Any consumer who is suspicious of his meter may have it examined by the department. A charge of $1 is made for this service, which is borne by the consumer if the meter is registering properly, or by the company if the meter is found to be at fault.

The recent announcement of the British Welsbach Company that it has entered the electrical field, and is manufacturing metallic-filament electric lamps, has caused quite a stir in England. Many look upon this news as a blow to the gas business. Welsbach mantles have heretofore made it possible for gas to compete with electricity as an illuminant, but the fact that the Welsbach Company is taking up the manufacture of electric lamps would seem to indicate that the gas mantle cannot compete with the metallic-filament lamp.

Electric railways frequently require an extra supply of power owing to a holiday rush or some unusual event which crowds their cars to the utmost capacity. Some of the roads have built their own portable substations, consisting of cars provided with rotary converters or motor generators, transformers and switchboards. Recently one of the large electric manufacturing concerns has put out a stock portable substation of this type, which may be moved to any section of the line and made ready for use at a moment's notice by connecting it to the high-tension line.

The annual Electrical Show at Madison Square Garden which was brought to a close last week was notable for its decorations. Nearly 40,000 yards of orange and white bunting were used to decorate the building. The whole interior of the building was draped with bunting. There was a canopy ceiling which was divided into panels, and candelabra were hung from the intersections of the panels. Each candelabrum contained a cluster of twenty-two 25-watt tungsten lamps encircled with amber-colored 40-watt lamps. Six large chandeliers were placed over the center of the arena. These chandeliers were ten feet in diameter, made up of art glass. Altogether the effect was superior to that of any previous exhibition.

At the recent meeting of the International Association of Municipal Electricians, a resolution was adopted favoring the grounding of secondaries in alternating-current systems. The resolution calls attention to the fact that life and property have been destroyed from high voltages on alternating-current secondary systems, because of the failure of insulation between primary and secondary circuits, and that such dangers may be obviated by grounding the secondary, and it demands the enactment of legislation requiring all alternating-current secondary systems to be grounded, when by so doing the voltage between the earth and any part of the secondary systems will not exceed 250 volts.

A German investigator has found that the insulation resistance of coils made from bare aluminium wire depends upon the compression of the wire, and also on its thickness. The smaller the wire, the less its insulation resistance. This he thinks is due to the fact that the thick wires are soft, while thin wires are hard drawn. He also finds that the resistance is considerably reduced while the coils are wet. He therefore suggests that in making coils of bare aluminium wire, the windings should be separated by non-hygroscopic material. Before winding the coils, they should be wet, so as to oxidize the aluminium. After several days they should be dried in a vacuum, and lacquered.

The following method of impregnating field coils was recommended at the recent convention of the American Street and Interurban Engineering Association. The wire is insulated with asbestos, held in place by a cotton covering. The coil is wrapped with porous tape, and then placed in an air-tight chamber, and heated. The air in the kettle is exhausted, and when the proper vacuum has been obtained, melted asphaltum is permitted to flow in, after which air pressure is applied, forcing the material into the interstices of the coil. When the coil is nearly cool, it is brought to proper shape by means of clamping plates. When the clamps and tape are removed, the coil is covered with an insulation of varnished cambric.

SCIENCE.

Evelyn Briggs Baldwin, the Arctic explorer, recently stated that he intended to make another trip to the Arctic and go on the ice drift over the apex of the earth and return between the east coast of Greenland and the west coast of Spitzbergen. It is a distance of two thousand miles, and as a progress of no more than two miles a day can be made, the journey will consume four years.

Certain minerals exhibit the curious optical property known as asterism. That is to say, they show a star-shaped figure when light is reflected from them or transmitted through them. This is seen, for example, in the star stone, a sort of sapphire, and in the star ruby. A note in Knowledge describes the asterism of mica. The photograph of a lamp flame taken through a plate of mica shows a six-rayed star, with six fainter radiations between. Outwardly star mica resembles the ordinary form, and shows the same phenomena under polarized light. When examined under the microscope, however, the star mica is found to contain fine needles of another mineral, and these are regularly arranged at angles of 120 deg. To these needles the star seen by transmitted light is due. Star mica has been found in the State of New York, and at Burgess Hill, Ontario.

Henry Gannett, chairman of the United States Geographic Board; Rear Admiral Colby M. Chester, U. S. N., formerly superintendent of the Naval Observatory; and O. H. Tittmann, superintendent of the United States Coast and Geodetic Survey, will compose the membership of the committee of the National Geographical Society which will pass on the records and proofs submitted by Robert E. Peary to substantiate his claim that he reached the North Pole on April 6th, 1909. At a meeting of the board of managers of the National Geographical Society on October 20th the records and observations furnished by Commander Peary were presented, and Mr. Gannett, who had previously been appointed chairman of the committee on polar research, named Admiral Chester and Mr. Tittmann as the other members of the committee to determine Commander Peary's claims.

In order to produce a cadmium spectrum of sufficient intensity for polarimetric work advantage is taken of the favorable properties of the silver-cadmium alloys, by Dr. T. Martin Lowry. On account of their isomorphism the two metals form an excellent series of alloys which are characterized by good mechanical properties and very high melting points. (An alloy with 60 per cent Cd melts as high as 700 deg. C.) In striking contrast to the behavior of the pure metal, the alloy gives a steady arc which can be kept true to center by rotating the electrodes in opposite directions. The spectrum shows the silver as well as the cadmium lines, but these are so far separated that even with a low resolving power the slit of a spectroscope can be opened to its full width without any overlapping of the brilliant "blocks" of light which take the place of the usual "lines."

Arrangements are being perfected in New York for the incorporation of the American Radium Institute, to be devoted to the treatment of cancer and similar diseases. The institute will be conducted much on the same plan as similar ones in Paris and London. The work will be divided into various sections, such as chemical, physical, medical, and botanical, with an expert in charge, and it is believed that for experiments the laboratories of the Rockefeller Institute will be available. Supplies of pitchblende for manufacture are to be drawn from Colorado and other Western localities, where the initial processes of extracting the radium will be conducted. It is announced that the institute is not in any sense commercial and that several of the scientists who are interested in it are not only giving their services free, but are contributing from their own means to the fund which will be required to establish the plant.

The observatory of Treptow has opened an international competition for the best photographs of the Leonid meteors taken from the car of a balloon between November 13th and November 16th, 1909. The developed plates should be sent to the observatory anonymously, but accompanied by a symbol which is repeated in a sealed envelope containing the place, date, and hour of exposure, the name and elevation of the balloon, names of constellations in which meteors have been observed, names of camera and lens, with focal length and aperture, and the length of exposure. The plates should reach the director of the observatory, Dr. F. S. Archenhold, before January 1st, 1910. The results of the competition will be published in the journal Das Weltall. Three prizes, consisting of a telescope and publications, are offered, but it is stipulated that the prize pictures shall become the property of the observatory. The competition would have a better prospect of success if all photographs of the Leonids had been admitted. Balloons are still so rare that it is quite possible that not a single plate will be submitted.

THE BRUSSELS POPULAR ELECTRICAL LABORATORY.

BY DR. ALFRED GRADENWITZ.

Owing to the ever-increasing importance of the applications of electricity, it is small wonder that electrical laboratories should have been founded everywhere to afford a means of completing practical instruction. In fact, technical colleges and schools of all degrees are at present equipped with such laboratories.

However, the institute recently founded at Brussels by Dr. Robert Goldschmidt, the well-known inventor and scientist, is of an absolutely novel kind. Realizing the inadequacy of book study and oral explanation for conveying a thorough understanding of experimental electricity, Dr. Goldschmidt provides an opportunity for experiment accessible to the general public desirous of observing the electrical phenomena, which are so important for modern industry. To attain this end he has created a popular laboratory of remarkably clear and simple disposition where lay people, by starting from the most elementary facts, will be able to acquaint themselves with any scientific problems relating to electricity.

The original intention was to create some sort of museum of electrical invention and discovery, organized on similar lines to the general museums of painting, natural history, and industry. This, however, would have been quite insufficient, as the object of any piece of apparatus exhibited would rarely be immediately apparent to the observer. What was to be shown was not the principle itself, but its demonstration, and the method of conducting an experiment, to demonstrate it, and the best means of teaching the student this is to let him conduct the experiment himself. This task was an extremely difficult one, entailing as it did a rational classification of experiments such as should render them comprehensible. In fact, the main defect of any previous attempts in the same direction (made at London, Berlin, and Munich) had been the lack of plan and co-ordination.

Every experiment had to be designed with a view to its being accessible to everybody, in addition to forming part of a graduated course of inter-connected experiments. Most of the apparatus used in connection with the Popular Laboratory had to be designed and constructed especially for the purpose, and with a view to simplicity, safety, and solidity.

On the ground floor of the laboratory (which was opened on the occasion of the recent twenty-fifth anniversary of the foundation of the Society of Belgian Electricians) are installed apparatus for the fundamental experiments constituting the basis of modern electrical science. These are performed with relatively simple means. Visitors thus pass from the magnet stone to the properties of electro-magnets and the explanation of electro-motors, from the generation of static electricity by the friction of glass and wax on to the working of Wimshurst machines on similar principles and to induction coils; they then proceed to familiarize themselves with the phenomena of electrical discharge in various media (cathode and radium rays, etc.).

In the gallery are installed those apparatus which are required for the demonstration of the principles of electrical induction, alternate currents, and methods of electrical measurement.

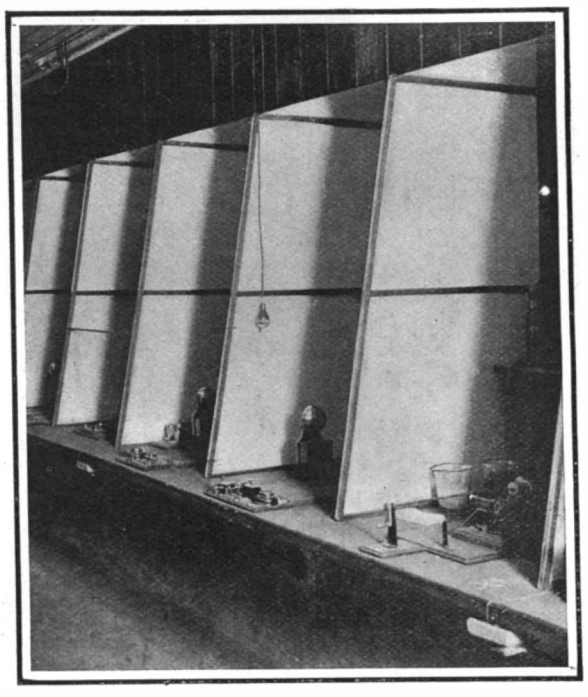
Each apparatus installed in these two departments of the laboratory is located in a glass case, leaving free to the experimenter's hands only the instrument required for performing the experiment, and thus avoiding any unnecessary contact liable to endanger the apparatus. In three adjoining rooms are united the apparatus of precision and investigation as well as measuring instruments, the handling of which requires a thorough knowledge of all the preceding, comprising photometers, precision bridges, standards of measurement, galvanometers, wattmeters, etc.

On the ground floor in the center of the building are found such apparatus as will allow the visitor to familiarize himself with the most important measurements relating to motors and dynamos. These two departments are different in character from the two preceding. In fact, visitors here find themselves in a laboratory where measurements and tests are performed by competent men. By watching their work, they will be able to grasp the mechanism of the experiment without being capable of performing it themselves. Should, however, somebody sufficiently well instructed wish to experiment himself, he would be allowed to do so under the supervision of an experienced operator.

To the laboratory is connected a lecture hall, behind which is installed a projector allowing visitors at any moment to inspect on the screen an extensive series of hundreds of views relating to scientific novelties. This is actuated by a push button.

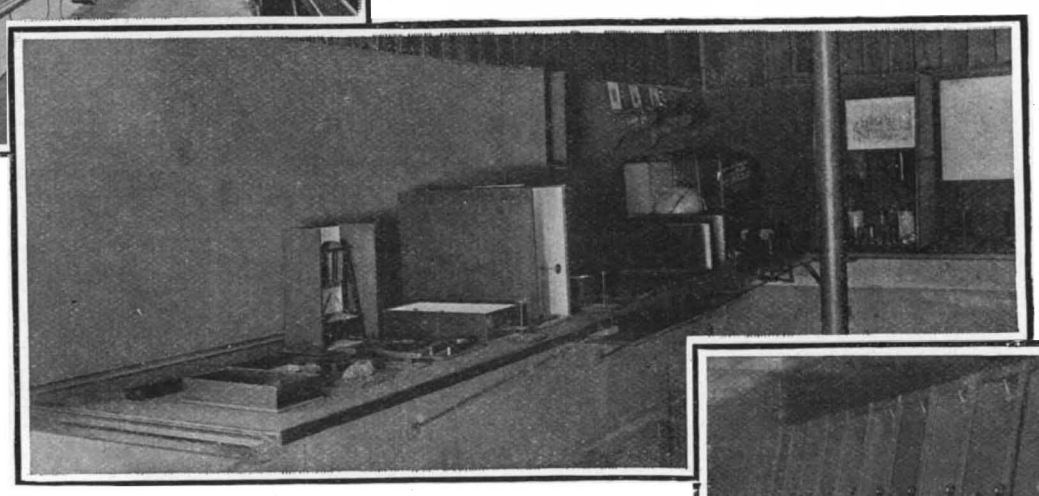
A special hall is set apart for industrial men to exhibit their products free of charge, and a library containing the most important books, periodicals, and bibliographical files enables visitors to supplement by theoretical study the practical knowledge acquired in the laboratory.

A mechanical workshop initiates those seeking such information in the construction of electrical apparatus. Finally, four small laboratories situated in the front building are to be placed at the disposal of specialists for use in original research work.

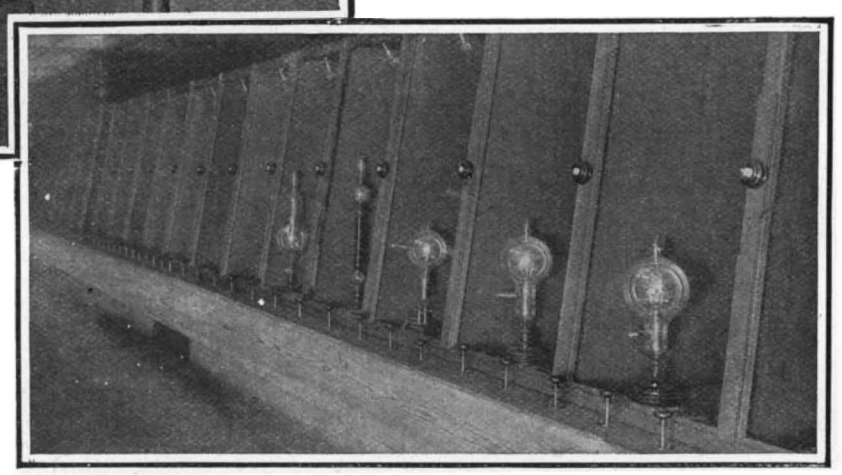


Apparatus for demonstrating current effects.

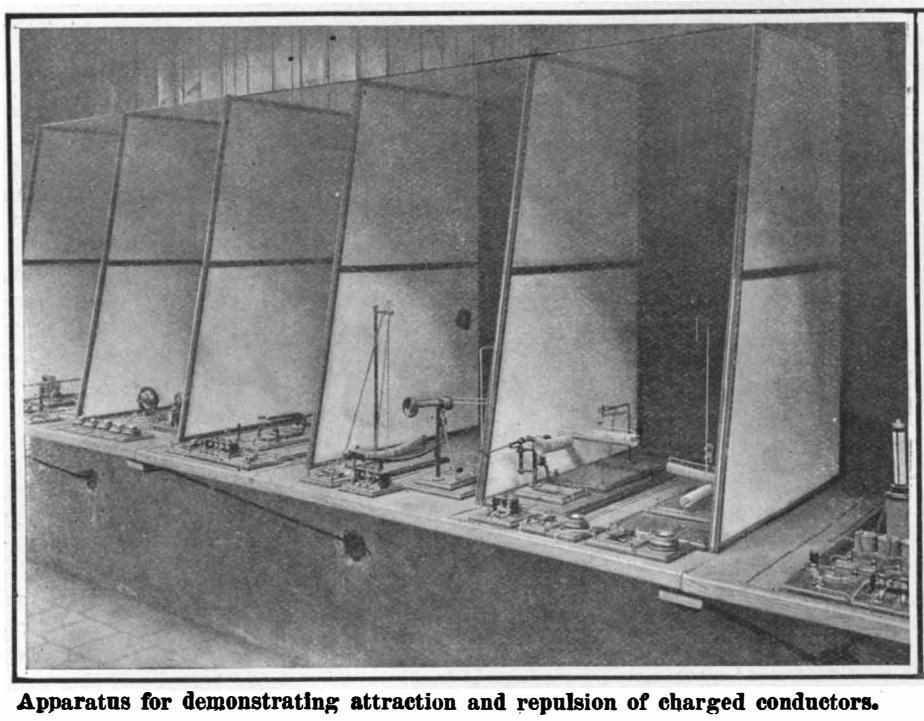
A row of static electrical machines.



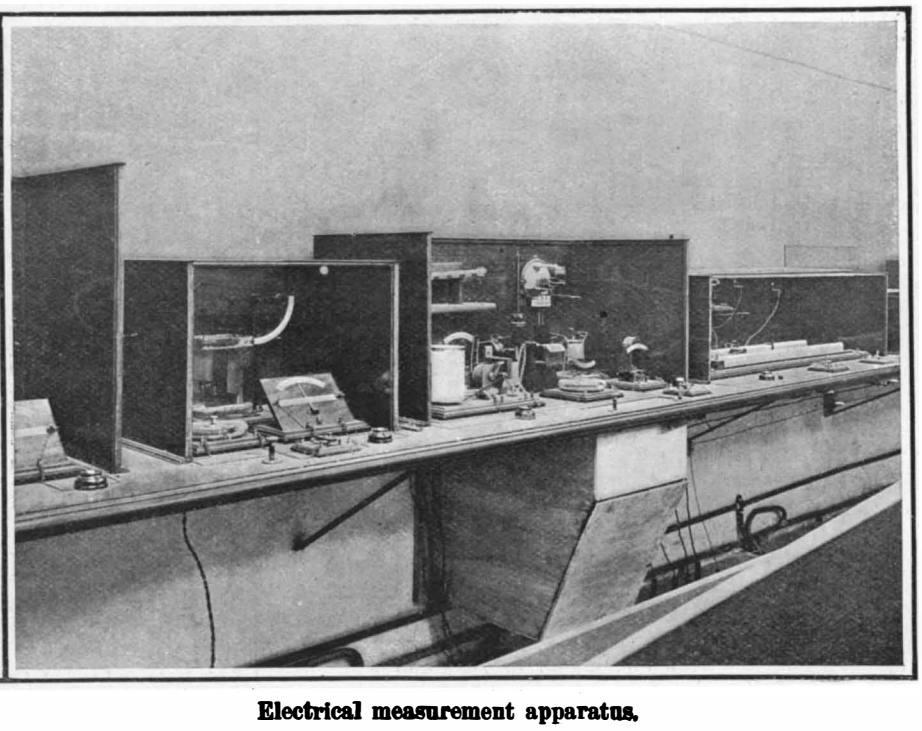
Apparatus for the study of natural and permanent magnets and terrestrial magnetism.



Apparatus for the study of radiation phenomena.



Apparatus for demonstrating attraction and repulsion of charged conductors.

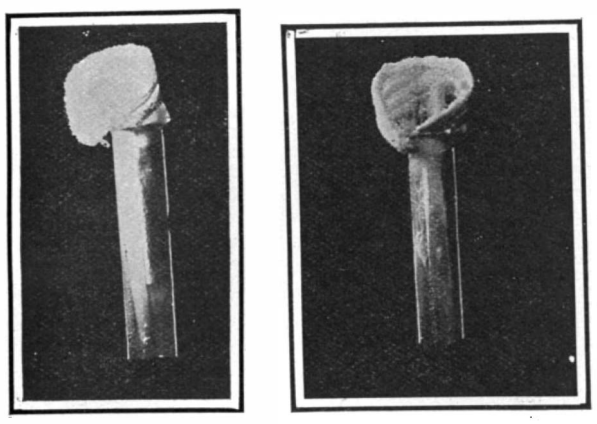


Electrical measurement apparatus.

THE BRUSSELS POPULAR ELECTRICAL LABORATORY

A CURIOUS CHEMICAL GROWTH.

In the course of some experiments in qualitative analysis in the High School at Medford, Mass., a test



CURIOUS CHEMICAL GROWTH.

tube containing solutions of several salts to which had been added hydrochloric acid and ammonium sulphite was set away in a closet for a few days. Projecting vertically from the tube was a small piece of filter paper. When the tube was removed, a peculiar calash-shaped hood of ammonium chloride crystals was found resting on the paper.

PLAYING WITH FIRE.

A can of gasoline can be handled as safely as a can of oil, for liquid gasoline does not explode. It is the gasoline vapor that is highly explosive when properly mixed with air. The accompanying illustrations show the safety with which burning gasoline may be handled. Fig. 1 shows a man pouring burning gasoline from one can into another. In Fig. 2 he is blowing into the spout of a can of gasoline to which a match has been applied. The little blue flame that ordinarily plays around the mouth of the can is transformed into a burning torch. Fig. 3 shows a pool of burning gasoline on the floor, and two gasoline cans aflame, but there is no explosion.

MEASURING HOLES BY ELECTRICITY.

One of the employees of a Chicago firm dealing in perforated metal to be used in flour mills has devised a simple measuring device for readily matching samples brought in by customers. A tapering needle, which is pushed into one of the perforations as far as it will go, carries a brush that passes a series of electric contact pieces. The latter are connected to a set of solenoids, and when the circuit is closed by pressing a button, one of these solenoids operates to uncover a number indicating the correct size of the hole.

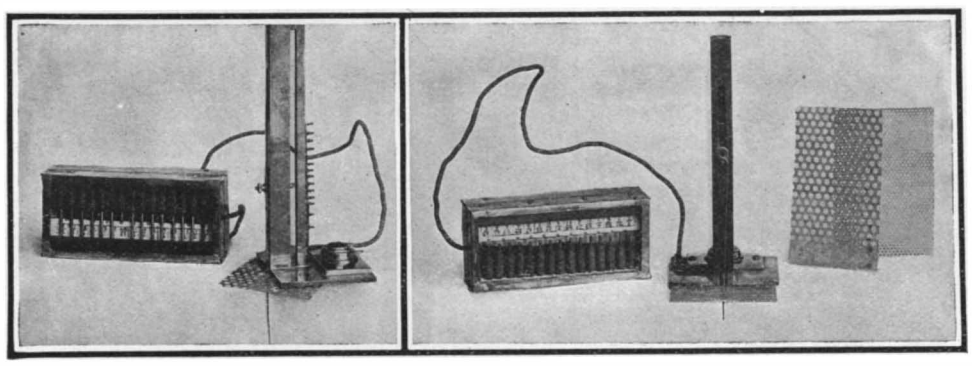
DIFFERENTIAL SPEED INDICATOR.

The well-known British naval architect Sir John 1. Thornycroft has designed an ingenious device for use on twin-screw torpedo boats to indicate the relative speeds of the two propeller shafts. A sphere is supported on and rotated by two cylinders, whose axes meet at a point below the sphere. The axis of rotation of the sphere varies its position with the relative speed of rotation of the cylinders. A roller engaging the sphere tends to find a position where it does not slide. In other words, the axis of the roller moves into the plane of the axis of the sphere and a finger connected to the roller indicates the position of the axis of the sphere, and thereby shows the difference of speed of the two shafts.

Measurement of Distance by Aerial Electric and Sound Waves.

Debrix has invented a method of measuring a ship's distance from a shore station, by taking advantage of the difference between the velocities of sound and electric waves. A bell is set ringing and wireless electric waves are generated simultaneously on the ship. The electric waves arrive almost instantaneously at the shore station and there set in motion a stop-clock. The distance of the ship can be computed from the number of seconds indicated on the dial when the sound of the bell is first heard. The computation is facilitated by the use of a table, in which, if necessary, allowance may be made for the fraction of a second consumed in the operation of the receiving and clock-starting apparatus. In this way the distance of the ship can be obtained, but not its direction or exact position. If, however, the ship's auditory and electric signals are simultaneously received at two stations connected by telegraph, the exact position of the ship on the chart will be found at the intersection of two circles, drawn round the stations as centers, with radii respectively equal to the ship's ascertained distances from those stations. The general introduction of this system would greatly increase the possibility of aiding ships in distress.—Prometheus.

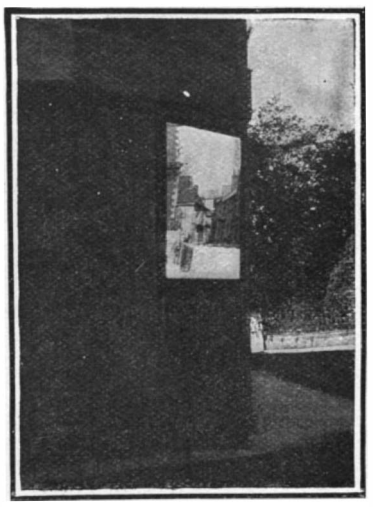
PLAYING WITH FIRE.



MEASURING HOLES BY ELECTRICITY.

ACCIDENT PREVENTER.

Attached to the wall at the corner of a narrow street leading into the market place of Woodbridge, Suffolk County, England, is a mirror which makes it possible for automobilists coming from either direction to look around the corner and thus avoid collisions. The idea is being copied quite extensively by other English towns.



MOTORISTS ACCIDENT PREVENTER.

Castings of Chloride of Zinc.

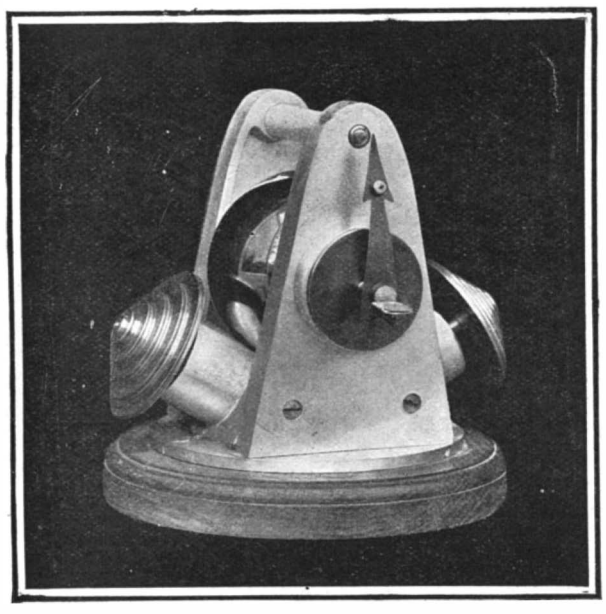
By mixing a concentrated solution of chloride of zinc, which must be of at least 55 deg. Bé., with highly heated zinc oxide, we obtain a mass that is admirably adapted for the casting of various art objects.

This preparation is at least equal in hardness to marble and takes a high polish; as regards its behavior to exterior influence, it excels marble altogether in its power of resistance, being unaffected by the action of severe cold, moisture, or even boiling water, and it is also fairly indifferent to the effects of very strong acids.

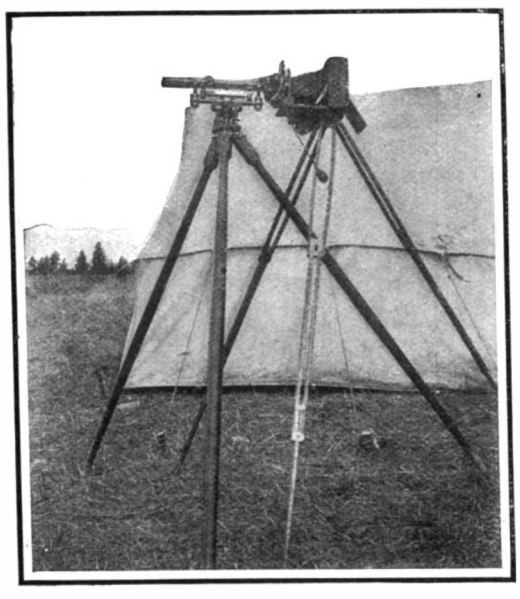
This excellent casting mass is best produced by taking 2 parts of zinc white which has been highly heated (calcined), and after cooling, kept in air-tight glass vessels until needed, and mixing it with 1 part of chloride of zinc solution of 55 deg. Bé. To effect the mixture, we use a porcelain vessel, in which we place first the zinc oxide, then pour in the chloride of zinc solution and, by stirring with a flat spatula, produce a uniform mixture. In mixing, great care must be taken that no air bubbles occur in the mass, for these would give rise to imperfect or defective castings. The well-stirred mixture is allowed to stand until it begins to become more fluid, and it is then poured into molds in which it is permitted to harden. If the zinc oxide, before using, is mixed with ground glass or with colors that exercise no chemical effect on zinc oxide (English red, manganese, chrome green, red lead), colored castings can be produced.

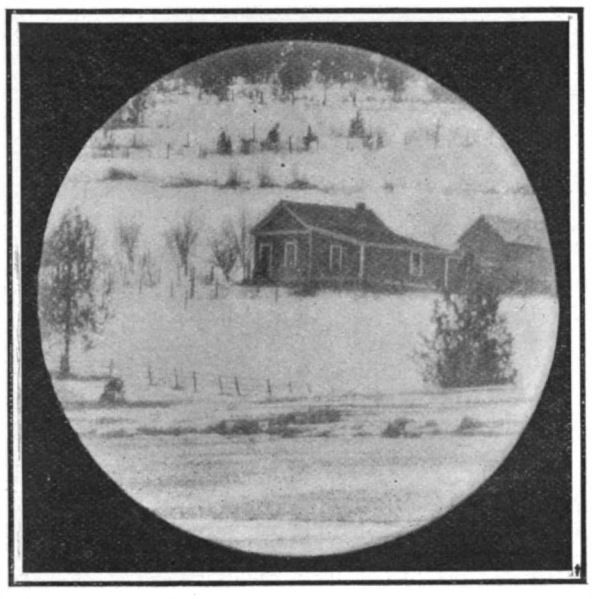
A SURVEYOR'S TELEPHOTO.

The view herewith reproduced was photographed at a distance of a mile with a surveyor's level set up in front of a 4 by 5 camera. The two instruments were connected light-tight by winding a dark cloth around the contiguous parts. An exposure of twenty seconds was made, as the weather was cloudy. It is somewhat surprising that no trace of the cross wires of the telescope appear on the picture.



DIFFERENTIAL SPEED INDICATOR.





A SURVEYOR'S TELEPHOTO.

HIGH-SPEED DESTROYERS FOR THE UNITED STATES NAVY.

There was a time when the contractors of the United States seemed to be unable to live up to the exacting requirements of the government for the construction of torpedo boats and destroyers. There is no class of naval construction that calls for such high-class work as the building and equipment of a destroyer of 30 knots speed or more; and when our first destroyers were built, most of the contractors failed to get the contract speed out of the boats.

These failures, however, belong to the past; and there is every reason to believe that the later destroyers built for our navy are fully up to, if they do not exceed, the standard of the best foreign work, not even excepting the British.

Evidence of this is afforded by the phenomenal speeds that have been realized in the recent trials of the "Flusser" and the "Reid," which made respectively 30.41 and 31.85 knots as the mean of a four-hour trial, the contract speed for which was only 28 knots, and made their fastest miles respectively at a speed of 33.67 and 34.55 knots.

The "Flusser" and "Reid" are two of the five destroyers, bids for which were opened in September, 1907, and which were awarded as follows: The "Flusser" and "Reid" to the Bath Iron Works, Ltd., Bath, Me.; the "Smith" and "Lamson" to the William Cramp & Sons Ship and Engine Building Company, Philadelphia, Pa.; and the "Preston" to the New York Shipbuilding Company of Camden, N. J.

The hulls of the "Flusser" and "Reid" were designed by the Bureau of Construction and Repair and are of the following dimensions:

Length between perpendiculars...	289 feet
Length over all.....	293 feet 10½ inches
Breadth molded at trial waterline.	25 feet 11¼ inches
Breadth molded, extreme.....	26 feet 4½ inches
Breadth extreme over guards.....	27 feet
Trial displacement	700 tons
Trial draft at this displacement..	8 feet ½ inch

The contract allowance for machinery is 255 tons, a penalty being assessed if this weight is exceeded. The machinery, however, with water and spares carried on board, weighed 228 tons; so that the trial displacement was reduced by this saving of 27 tons, less a hull overweight of 4 tons, or a net weight saved of 23 tons. The trial displacement therefore was fixed at 677 tons, but on all of the trials of these vessels they were slightly deeper than this.

The machinery was designed by the Bath Iron Works and consists of five Parsons marine steam turbines on three shafts; the main high-pressure being on the center shaft; the starboard low-pressure and I. P. cruising turbines, together with the starboard backing turbine, being on the starboard shaft; and the port low-pressure and backing turbine and the high-pressure cruising turbine being on the port shaft. The steam piping was so arranged that any of these turbines would run as the initial turbine. All of these turbines are in one compartment.

The two condensers were built up of plate, each containing 4,000 square feet of cooling surface, measured on the outside of the tubes. The tubes were curved and expanded into the tube sheets, no packing being used. The circulating water is provided by scoops into which the sea water rushes at great velocity when the vessel is under way, this method proving extremely satisfactory. Small circulating pumps, however, were provided for use when the vessel is still in the water, or in getting under way. There are the usual air pumps, feed pumps, fire and bilge pumps, and oil pumps, etc., and an evaporating distilling apparatus was also provided with these pumps. All lubrication is forced, two duplex oil pumps being provided, together with an oil cooler.

The boilers, four in number, of the Normand return-flame type, are placed in two water-tight compartments, there being a smokepipe for each of the four boilers. The total grate surface is 346.67, and the total heating surface is 16,177 square feet. Normand feed-water heaters were also provided for each fireroom, and proved very efficient. In each fireroom are two blowers, designed and built by the contractors and fitted with forced lubrication. These blowers give most excellent service, and have shown themselves capable of delivering air at 9 inches pressure in necessary volume. Further than this, each fan, with its engine complete, weighs less than 900 pounds.

The contract specified that the vessels should be given standardization trials of not less than twenty runs over the mile, a four-hour full-speed trial, on which the speed shown should average not less than 28 knots per hour; a twelve-hour trial at 24 knots and a twenty-four trial at 16 knots; and that the water consumption per shaft horse-power should not exceed 25.2 pounds on the 16-knot trial; 16.5 pounds on the 24-knot trial; and 15.5 pounds on the full-speed trial; all of these guarantees being met with a comfortable margin.

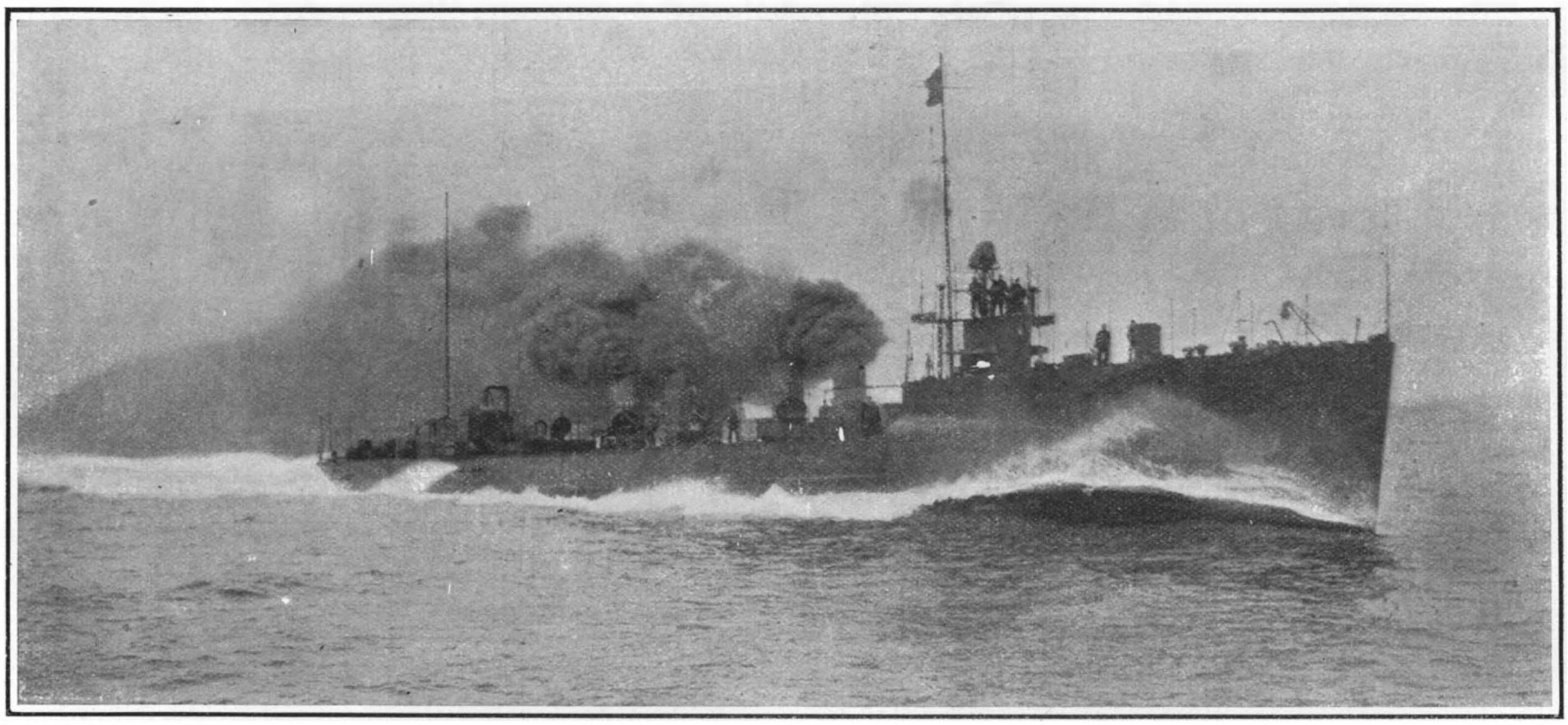
The following table gives the results of these trials:

	"Flusser."	"Reid."
Speed, fastest mile.....	33.67 knots	34.55 knots
Mean speed five high runs..	32.67 knots	33.75 knots
Maximum shaft horse-power developed	14,400	15,140
Mean speed four hours.....	30.41	31.85
Speed best 15 minutes four-hour run	30.85	32.25
Revolutions necessary for 28 knots	706	700
Revolutions maintained four hours	801	846
Shaft horse-power four-hour trial average	11,541	12,564
I. P. C. auxiliaries four-hour trial average.....	301	310
Total horse-power four-hour trial average	11,842	12,874

No limit was placed upon air pressure on the standardization trials. The contract provided, however, that an average of 5 inches could not be exceeded on the four-hour trials, and the 5-inch average was maintained but not exceeded on both vessels.

Both the "Flusser" and the "Reid" are equipped with Parsons vacuum augmenters, built by the Bath Iron Works, which performed very satisfactorily, as vacuums were maintained on both vessels, at all speeds, of between 28½ and 29.9 inches.

The horse-power developed (maximum) per ton of machinery is the highest we know of, namely, 68 on the "Reid" and 64.7 on the "Flusser." It should be noted the weight of machinery (228 tons) includes every part coming under cognizance of the United States Bureau of Steam Engineering, namely, the machinery complete, with tools, water in boilers, condensers, filter tank and piping, floors, gratings, ladders, handrails, steam heat, non-conducting corking and lagging, and evaporators and distillers.



Copyright 1909 by N. L. Stebbins.

Length, 293 feet 10½ inches; beam, 26 feet 4½ inches; draft, 8 feet; displacement, 700 tons; horse-power, 15,140. The motive power consists of five Parsons turbines driving three propellers. The "Flusser" (sister boat) on her trials reached a maximum speed for one mile of 33.67 knots.

THE "REID," FASTEST OF OUR DESTROYERS, MAKING 34.55 KNOTS ON HER TRIAL TRIP.

The November Number of American Homes and Gardens.

The current issue of American Homes and Gardens contains many interesting features. Mr. Barr Ferree continues his series on notable homes and describes Villa al Mare, the country home of George Lee, Esq., at Beverly Farms, Mass. John A. Gade contributes a very interesting article on the beauty and economy of stucco in the construction of the country house, or in the transformation of the old house. This article is illustrated by photographs showing the transformation of an old farm house into a habitable dwelling. One of the most interesting subjects in the issue is that prepared by Francis D. Nichols on a group of modern houses costing from $1,000 to $5,000. This article is profusely illustrated with photographs and plans, and is particularly interesting to the man of modest means who wishes to build a home of modern style at small cost. Ralph C. Davison writes on concrete ornaments for the garden and how to make them. Kate Greenleaf Locke's article descriptive of four California bungalows is interesting, while Fritz Morris tells about the American Shetland pony. S. Leonard Bastin presents an article on a farming experiment by women. Louise Shelton describes the garden of Hamilton House, and Robert Thompson tells of the beauties of "Pine Haven," the summer home of Thomas B. Van Buren, Esq., at Kennebunkport, Maine. Alice M. Kellogg solves some problems in home furnishings, and Charles Downing Lay tells about garden work around the home.

Prize for a Safety Automobile Crank.

A French association for the prevention of accidents in industrial work has offered $300 in prizes for a crank or safety device for hoists, cranes, and all forms of lifting apparatus, and also for explosion motors which shall, in the first case, automatically stop the descent of the load, or in the second case, throw out of gear the driving action when not required. The invention remains the property of the competitor, who must himself be responsible for its due protection by patents. Drawings of competitive devices should be sent to the office of the Association des Industriels de France contre les Accidents du Travail, 4 Boulevard Saint-André, Paris, France.

Correspondence.

THE INVENTOR OF THE STEAMBOAT.

To the Editor of the SCIENTIFIC AMERICAN:

I am indebted to a friend for the information contained in a recent issue of your journal relative to the Hudson-Fulton celebration in New York, in which under Fig. 1 you give a sketch of Jonathan Hulls's steam tug or boat, which you describe as being "proposed, but never built." With this statement I beg to differ, as it is quite contrary to actual facts.

You admit that the "complete description" is "of a practical steamboat," therefore I contend that the planning of a practical steamboat constitutes inventorship, if nothing "practical" existed previously. This seems only fair argument; but I go further. I am in the position to prove that the boat was actually built, from an official document, viz., Jonathan Hulls's treatise, published in 1737, as in this it is stated:

"Whereas our Trusty & well Beloved Jonathan Hulls hath by his petition humbly represented unto Our most dearly beloved Consort the Queen, Guardian of the Kingdom &c. That he hath with much Labour and Study, and at Great Expense *Invented* and FORMED a Machine for carrying ships & Vessels out of or into any Harbour against wind & tide, &c." And "the Petitioner hath made oath that he is the Sole inventor," etc., and he concludes his treatise by stating:

"There is nothing in it but what is necessary to be understood by those that desire to know the Nature of that Machine which I now offer to the World; and I hope that, through the blessing of God, it may prove serviceable to my Country."

Now to prove practical results. I find in "The History of Progress in Great Britain," published in 1859, the following:

"Thus we arrive at the time when in 1736 Jonathan Hulls' steam boat took a Sailing Ship in tow, and amid the wonder, doubts and jeers of the spectators made a great splash, a loud noise and a black smoke, yet managed to haul the cumbrous hulk along, and gave promise that the child, which had distinguished itself by such an unheard of feat, would one day become a giant of great strength."

What further or more convincing proof that the boat was actually built and proved practically successful can be required?

I would here mention that I have made a careful study of the claim of the many claimants from 1543 to 1807, a very lengthy period, and I challenge anyone to produce proof that will controvert Jonathan Hulls's right to the honor of being the inventor of the steamboat in 1736.

My proofs consist of, among many others:

1. Jonathan Hulls's specification No. 556 (1736) old Law Series.

2. Jonathan Hulls's treatise, written by himself (1737). Both still in existence at the British Museum and Patent Office Library.

3. "History of Progress in Great Britain," published in 1859. Etc.

If you wish to pursue the subject further, I shall be pleased to submit many convincing proofs that the steamboat existed on this side, as also in America, long before the "Clermont," which undoubtedly was not an invention of Robert Fulton's but merely the outcome of the inventive genius of one of Jonathan Hulls's methods of steamboat propulsion.

I would be pleased to have a copy of your Hudson-Fulton issue if you have a spare one, as I find some difficulty in procuring one here, and in return I will assist you in reaching the actual indisputable facts as to who was the "inventor" of the steamboat.

J. HOOPER HULLS.

Manor Park, Essex, England.

LEDUC'S FIGURES.

To the Editor of the SCIENTIFIC AMERICAN:

In the number dated August 14th, 1909, you give a description of M. St. Leduc's experiments for obtaining plant-like forms.

I believe I was the first, some thirty years ago, when I showed these forms to my friend Sir William Crookes, and explained to him how such experiments can be conducted. Any of your readers having at his disposal some solution of silicate of potash or of soda and some metallic salts crystallized, sulphate of iron, of copper, of nickel, etc., can reproduce the experiments.

By filling a glass two-thirds with a solution of one of these silicates, then adding distilled water to the very top, and throwing some small pieces of the metallic salt (which will fall to the bottom of the glass) into the solution, he will see, in a short time, plants growing in different forms, sizes, and colors, according to the salt employed. The copper one will give a blue, the iron a dark green, the nickel a light green, and a beautiful plant will be obtained with chloride of cobalt.

By varying the density of the silicate solution, different effects in form, size, and color will be obtained.

If the solution containing the plants is kept well sheltered from the air by a good covering of the glass, these plants will keep any length of time.

Paris, France. GEORGES FOURNIER.

WHY DO WATCH SPRINGS BREAK?

To the Editor of the SCIENTIFIC AMERICAN:

The mainspring of a watch does not unwind at a uniform rate, but intermittently. It is subjected to a sudden jerk at every tick—four times per second for my Elgin watch. This makes 345,600 times per day, and over 126 million times per year. This operating condition is analogous to others discussed in Kent's "Mechanical Pocket-Book" under the heads of "Relation of the Elastic Limit of Endurance under Repeated Stresses" and "Resistance of Metals to Repeated Shocks."

Among other things, it says: "Another long-known result of experience is the fact that rupture may be caused by a succession of shocks or impacts none of which alone would be sufficient to cause it. Iron axles, the piston-rods of steam hammers, and other pieces of metal subject to continuously repeated shocks, invariably break after a certain length of service. They have 'a life' which is limited." Wöhler found in testing iron by repeated stresses (not impacts) that in one case 400,000 applications of a stress of 500 centners to the square inch caused rupture, while a similar bar remained sound after 48,000,000 applications of a stress of 300 centners to the square inch. (One centner = 110.2 pounds.)

The mainspring of a watch is not only under a considerable tensile stress but also under a bending stress when suddenly released, then immediately stopped by the escapement mechanism. It is then probable that its molecular cohesive power deteriorates in a manner similar to those quoted. HENRY GETAZ.

Pittsfield, Mass.

A MAGIC SQUARE.

To the Editor of the SCIENTIFIC AMERICAN:

The appended magic square is remarkable as containing the odd numbers in regular progression with-

26	20	14	1	44	38	32
34	28	15	9	3	46	40
42	29	23	17	11	5	48
43	37	31	25	19	13	7
2	45	39	33	27	21	8
10	4	47	41	35	22	16
18	12	6	49	36	30	24

in the inscribed square. So far as I know it has not been published before. WILLIAM P. DOYLE.

Los Angeles, Cal.

THE BREAKING OF MAIN SPRINGS IN STORMS.

To the Editor of the SCIENTIFIC AMERICAN:

Respecting the breaking of main springs now discussed in the SCIENTIFIC AMERICAN, it may be interesting to note what an old French watchmaker has to say regarding the rupture of springs in storms. The following is a translation:

"The influence of storms on the breaking of springs is certain; many watchmakers have observed it; even ordinary rains may produce this effect. I have noticed it personally in quite a regular manner in the months of April and September, which are generally rainy months; thirty per cent of the springs which I change in the course of the year are destroyed in these months by the influence of the rain. This barometric influence acts much more on new springs than on those that have been working for a considerable time, and these months are a critical period for testing their elasticity. I have often been obliged, after a short time, to replace a spring that had thus been changed. In one case I was obliged to renew the spring three times in the same day, though the springs had been carefully fitted."

Many of the watchmakers can cite cases of springs broken, not in a couple of pieces, but in ten or a dozen fragments, as if they had been divided by a saw. Thus we come into the domain of electricity, and watchmakers may be supposed to notice the effect without determining the cause.

The quality of steel employed in the manufacture of springs and the care devoted to their tempering and annealing must be among the causes, and it is for the makers of springs to give us information.

Close observation has led me to believe that the contact of benzine or extreme oiling of the springs in stormy weather may not be completely foreign to their tendency to break.

Thus, when I change a spring during the critical period, I avoid passing it even rapidly into benzine. I clean it by rubbing with a piece of peg-wood and a rag slightly wet with fresh olive oil. I do not wipe it, and put it in without oiling, as customary in ordinary weather. I endeavor to substitute a slight lubrication for the oiling.

This appears to me to be advantageous, but I must acknowledge that it is not an infallible panacea. It is to be hoped that other members of the profession will give the results of their experience.

Brooklyn, N. Y. CHARLES A. BRASSLER.

AN OPTICAL PHENOMENON.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 4th, 1909, page 156, heading, "A New Speed Indicator for Marine Engines," a device is necessary to enable engineer to correctly and intelligently interpret signals from the pilot or captain. The camera device, as described in a recent issue, used on submarines when partly or wholly submerged, would, it seems, put the engineer in a position which would enable him to interpret the signals by a visual comprehension of the location.

The cost of installing one of the cameras on the upper deck, so arranged as to give a clear front and rear view of the ship's situation, with a reflection in the engine room, should be inconsiderable.

We must concede that there are times when the camera might be obscured by fog or smoke, etc. At that time, if serviceable, its utility might be greatest; but that is a time when attention is tense, and is but a small proportion to the number of times when it would be effectively serviceable. The obscurity of the reflection, *ipso facto*, would be notice to the engineer to proceed cautiously, and in case of doubt to ring for a repetition of signals.

This letter is suggested by an experience I once had. I was sojourning in the country, in the lean-to room of a log house. The protection from the elements was a thin weather boarding. As the fleecy flakes beat through the cracks and nail holes and with the cutting wind discomforted me, I thought of a device whereby, if I could not entirely obstruct, I could at least reduce the force of the wind. The next morning I bought and tacked some white drilling on the uprights about four inches from the weather boarding. I was engaged in a perilous occupation and had been warned not to light my lamp without first lowering the shade, in order that some unscrupulous "owl meeting" participant might not make me the target of a 0.45 caliber Colt. I neglected to reraise the shade, and reentering my room, my attention was arrested by a spot of green on the drilling. Close investigation revealed in perfect miniature a reproduction in part of the landscape outside, but reversed. A small nail hole was the medium. Though I have never experimented, I conclude the effect might be reproduced by tubes, mirrors, lenses, etc., so as to effectively show the surroundings of the ship in the engine room, the engineer thus being partly in possession of the same information as the pilot or captain. This suggestion is given for what it may be worth to you.

Houston, Tex. G. O'C. MACMANUS.

[This suggestion and the experience from which it originates are very interesting. The phenomenon described is that of the camera obscura, and can be as well produced with a "pinhole" camera as with a lens, hence the result from the hole in the roof. A similar effect may be observed if a sheet of paper be held a few feet away on the dark side of a door which is opposite the window of a room, a picture of the window, and the scene outside if the light is good, appearing inverted on the paper. There are only two objections to the use of such apparatus in a ship's engine room; one is that the enginer is unaccustomed to observing the effect upon the ship of the speed he is getting out of his engines, and the other is that he has enough to do in regulating his engines to give the speed desired by the pilot without also having to gage and decide upon the necessary speed. Also such a camera could hardly be arranged to look forward and aft simultaneously without complicated piping, with a mirror at each bend to avoid the ship's gear, and we should say it would not be desirable to remove the navigating responsibility from the bridge to the engine room. In the case of the submarine it is different; the navigator cannot be above deck when submerged, so uses the periscope, but he is still responsible for gaging the desired speed and instructing the engineer.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1765, opens with an elaborately illustrated and exhaustive article on the recent Paris aeronautic exhibition. Mr. F. W. Harbord's article on iron and steel and their relation to other industries, is concluded. An extract is published of an interesting report on the advantages of treating the water in swimming baths with electrolytic fluid. The mechanicians and especially the watchmakers of three or four centuries ago invented many ingenious mechanisms which have been forgotten. Some of these are described in the current SUPPLEMENT. The dome just erected over the four great arches of the Cathedral of St. John the Divine is an engineering feat of note, and is described and illustrated.

HOW GERMANY MAKES FORESTRY PAY.

BY FREDERIC BLOUNT WARREN.

Germany has the highest developed system of forest management and conservation. It has nearly 35 million acres of forest, of which 31.9 per cent belongs to the State, 1.8 to the Crown, 16.1 to communities, 46.5 to private persons, 1.6 to corporations, and 2.1 to institutions and associations.

For each citizen there is a little more than three-fifths of an acre of forest; and though 53 cubic feet of wood to the acre is produced in a year, wood imports have exceeded wood exports for more than forty years, and 300,000,000 cubic feet, valued at $80,000,000, or more than one-sixth of the home consumption, is imported each year.

In forestry, Germany has always led in scientific thoroughness; the scientific knowledge has been applied with the greatest technical success; and it has procured an increasing forest output together with an enlargement of profits. It will be interesting at the outset to state the European forestry theory, the basis on which Germany and other nations have conducted their conservation work, and statistics and summaries to come later to show that there has been a profit in the practice of the theory.

In the cultivated forests of Germany the absence of underbrush and decayed logs and limbs, the density of the forest, and the even distribution of the trees, often planted in long straight rows, immediately arrest the attention. One can walk with ease, or drive anywhere among them, except where the hills are too steep or stony or where the trees stand too closely together, this always being the case in young woods. The trees are not permitted to reach the full limit of their life and then, as the result of decay, to fall and remain rotting on the ground. They are considered as wood capital, which adds interest to itself as long as the trees continue to grow, at first slowly when the trees are small, more rapidly when they are of medium size, and more slowly again when they become large. When the trees die the wood interest ceases entirely, and as they decay the capital is reduced. The forester leaves this wood capital as long as the interest continues satisfactory. Then, when the growth declines, it is removed, the forester taking the trunks and limbs, and the peasants gathering up the brush and often digging up the stumps, although these, too, are frequently taken care of by the forester and sold in the market to pay the cost of their removal. In some German districts all the products are marketed. In Mecklenburg a good layer of leaves and moss sells for $16 an acre. In some sections a nominal sum is charged for brushwood; in the Spessart, Bavaria, it has long been the right of peasants to gather the forest litter without charge. Sometimes this permission applies to the gathering of nuts, which are used as food for domestic animals.

The United States has 164,000,000 acres of land in the 165 national forests, besides 2,722,726 acres of State-owned forests and 40,000,000 acres of woodland in the Philippines. And the table below, taken from official government statistics in a United States Forest Service bulletin, is what our national forests return as a federal investment, compared with the Saxon figures.

In this statement the American may learn the difference between advanced European forestry at almost its highest profit and the lesser profit just beginning to accrue to the United States as a result of its endeavor to foster its wood-producing resources. Saxony's total area amounts to 5,789 English square miles, of which almost one-half is covered with private and governmental forest. The last the State treasurer places as the highest revenue producer after the State railway, and they exceed the revenues from all other sources, taxation included. The total quantity of timber cut in 1906 is estimated at 1,231,472 cubic yards (33,250,497 cubic feet), representing woods used for fuel and for all other purposes. To this must be added a yield in brushwood cut and sold for fuel use principally of 190,415 cubic yards (5,140,906 cubic feet), raising the total quantity of timber and brushwood cut and sold to 1,421,887 cubic yards (38,391,403 cubic feet), for which $3,374,385 was obtained. This amount was increased by additional revenues from the leasing of meadows, hunting privileges, and other rights to the total of $3,483,616. Deducting from the total figures the cost of forest cultivation, with salaries and wages of the entire service included, amounting to $1,357,580, the net profit of $2,126,036 was added to the treasury in 1906. There is nothing unusual in this result, as the ten preceding years show equally high figures, a few slightly exceeding the 1906 revenues, and others being lower in a very slight degree.

More and more accustomed to weighing questions, whether national or individual, in dollars and cents, there is contained for the American public in the above official statement the most potent argument for increased conservation of forest lands. Systematic state

Country.		Total Net Revenue from Government Forests.	Expended per Acre.	Net Revenue per Acre.
Saxony		$2,299,000	$2.05	$5.30
United States	1905–6	12,000*	0.007	*0.0001
	1906–7	128,659	0.0093	0.00086

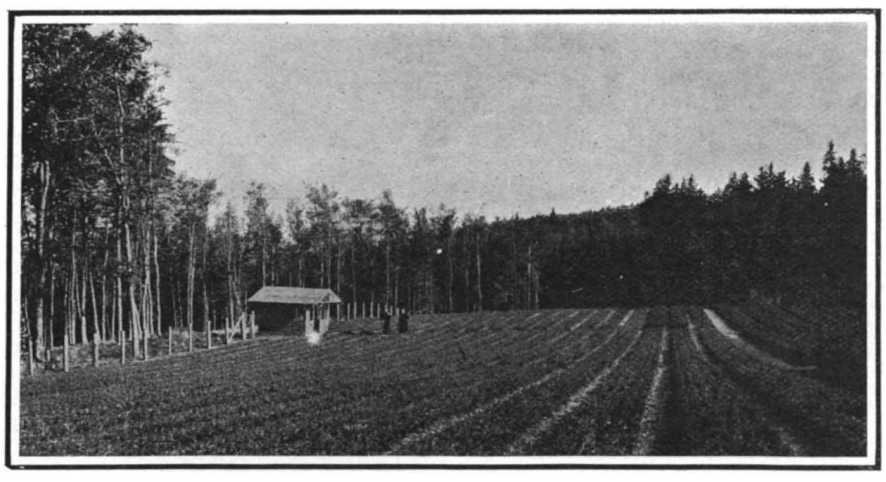
* Represents deficit.

Part of forest tree nursery, Thüringen, Germany.

forestry began in Germany 150 years ago, when the country felt the pinch of a wood shortage, but there were also contributory causes, such as the effect upon agriculture and stream flow, due chiefly to erosion. Just across the border, France, denuded of its forests, was having trouble with its mountain torrents, and the Germans opened their eyes to the dangers of floods in their own lands. Protective forests were provided for by Bavaria in 1852, by Prussia in 1875, and by Württemberg in 1879. Now all of the German states practise forestry with success.

In Prussia the forests cover nearly 7,000,000 acres, and methods of management adopted call for a sustained yield. In consequence, the productivity has been multiplied threefold in seventy-five years. In 1830 the yield was 20 cubic feet an acre; in 1865, 24 cubic feet; in 1890, 52 cubic feet; in 1904, 65 cubic feet.

Saxony has 430,000 acres of State forests, and its



Forest tree nursery in the Thüringen Wald, Saxe-Gotha.

yield rose 55 per cent between 1820 and 1904. It is now 93 cubic feet an acre. These increases are not limited to Germany, since other European nations, notably Italy and Switzerland, are now reaping large revenues from their timber lands.

Where Saxon forests are yielding $5.30 an acre, those of Württemberg yield a net annual revenue of $6, and those of several smaller administrations exceed this! There are also a large number of private forests managed with great success, whose revenues equal or exceed $6 an acre. For 15,600,000 acres of state, municipal, and private forests included in a canvass, it was found that the average net annual revenue an acre—from good, bad, and indifferent land—was $2.40.

The forests are managed largely in compartments, each of which, when the mature trees are considered ready for removal, is cut clean and planted with a new crop. Sometimes the compartments are located so that the cutting proceeds regularly in one direction as a protection against the prevailing winds, and at intervals of perhaps ten years, in which case the forest shows distinctly ten or twelve "age classes," arranged in a series of progressive heights. If a compartment is harvested and restocked each year, the number of age classes will of course equal the age to which the trees are allowed to grow. "Cutting clean" is most commonly in use in pine and spruce forests of Germany. These trees are mostly started in nurseries where the seeds are sown. In two years they are transplanted when six inches high. They grow in two or three years more to be twelve or fifteen inches tall, and then they are moved again to denuded fields and replanted about four feet apart, so that in a short time they will begin to crowd each other. This condition compels the trees to grow tall and slender and to shed their lower branches, thereby permitting a growth of timber free of knots. The trees are usually planted in straight rows, and in about twenty years a thinning is necessary. In spruce forests sometimes more than half of the trees are removed at the first "thinning." These are sold for firewood, poles, and various other uses. The fuel wood, laid at the roadside, brings about $2.25 a cord. Subsequent thinnings are necessary about every ten or fifteen years. Building material laid at the roadside brings nine cents a cubic foot; good spruce fuel wood, $3 a cord. On the poor sandy soil of Mecklenburg a thinning in Scotch pine, when the trees are twenty years old, yields only about $2 an acre; when forty, $5; when sixty, $10; when one hundred, $30. In the Erz Mountains, Saxony, thinnings when twenty years old bring $4; when forty, $15; when sixty, $80.

Every product of the forests of Germany and southern Europe finds ready utilization. This is due to the good market, population, low wages, and good roads. The effect of the market is everywhere apparent in the great economy of wood. In hotels heat is a luxury for which guests often pay an extra charge. Village and forest houses are seldom constructed of wood. Walls of plaster or cement are the rule. Floors are made of stone in many cases, and tiles and iron take the place of shingles. Wooden fences, board sidewalks, and block pavements are uncommon.

Yet the forests, which cover one-fourth of the area, fall far short of the requirement. Germany imports more than 300,000,000 cubic feet of timber, paying the duty of 28 cents for every 210 pounds of rough timber or logs and $1.15 for every 210 pounds, or one cubic meter (35.3 cubic feet) of dressed timber. Germany's own production of timber amounts to more than 600,000,000 cubic feet. If Germany were to supply the deficiency from its own soil, it would need an additional 20,000,000 acres. The percentage of forestry soil would be increased from 26 to 40 per cent of its area. It is doubtful if there are more than 2,500,000 acres for this purpose. If every available spot were utilized, and all the waste lands that are not well adapted for agriculture were planted in pine, spruce, fir, and other trees, it would require fifty years for them to be ready for market, and then the supply would not equal the demand. Only Bavaria and Württemberg have a surplusage of home timber.

It is the custom to buy individual trees rather than forests. There is a market unit of volume by which timber is generally purchased, called the "festmeter." It is a cubic meter (35.3 cubic feet) and is equivalent to 1.44 markets, or 19-inch standards, or about 288 feet board measure. In America large and small logs are scaled and sold together. In Germany, when the trees are felled, each one is marked with a number stamped in the butt. They are then sold by number in five or six classes according to size.

Recently in the Hartz, $22.65 a thousand feet, board measure, was offered for spruce tree trunks containing more than 300 feet; $18.56 for trunks containing from 150 to 300 feet, and for smaller sizes about $15. The live market for wood appears also in the number of metal railroad ties, being used in one-fifth of the entire mileage. The use of wooden ties in recent years has been greatly encouraged, however, by the discovery of methods of impregnating wood with such preservatives as creosote, chloride of zinc, or sulphate of copper.

As the forests are to be lumbered perpetually, the roads are made for permanency. They consist often of stone, laid with much expense and not infrequently

macadamized. In 1903 Saxony spent $175,000 on forest roads, and larger sums have been expended since by several States in the German federation. The roads at Geroldsau, in the Schwarzwald, are especially fine for forest hauling.

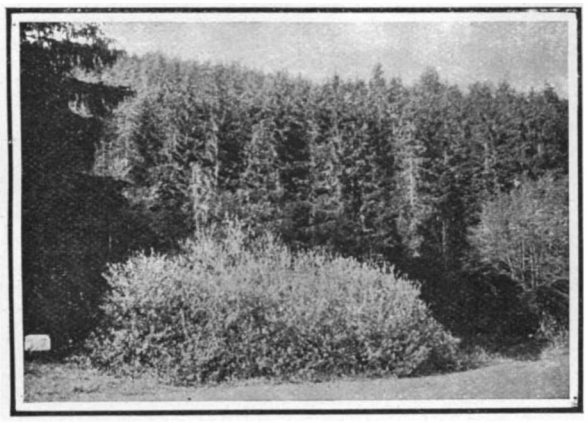
Germany's sawmills are usually small. Most of them would not cut more than 25,000 feet, board measure, in a day of ten hours. Almost any fair-sized American sawmill cuts 100,000 feet a day. But the small mill of Germany is permanent, being supported by perpetual crops of timber hauled to it by wagon or shot down streams. While some railroads carry logs, and rafts are still floated down the Rhine, Elbe, and other rivers, the method of hauling is very largely by wagon or by the old-fashioned American "carry-log." Along the Enz River in the Black Forest are located some of the largest mills, and to these the stock comes mostly on the railroad in long large logs, much of it being brought from Württemberg and Swabia. For each load of logs two cars are necessary.

In Austria there are 24,000,000 acres of forest, of which 7 per cent belongs to the state. Private owners hold 58 per cent. As Austria has been independent of the German Federation only since 1866, its forestry system, in the main, has followed German lines. Private forestry is encouraged by a system of taxation which relieves forests in which forestry is practised. The total net annual state forest revenue is $5,000,000. The net yearly revenue of 21 cents an acre is comparatively low, due mainly to the facts that only 56 cents an acre is expended, and that most of the area is located in the rugged Alps and Carpathians, where administration and logging are costly. The forest department was started in 1872, and reorganized in 1904 into three departments—administration proper, reforestration, and the correction of torrents and forest protection. Forestry is successfully practised on 60 per cent of all the State forests, and on 82 per cent of the private forests. The most conspicuous fruit of the State forestry is the restoration of the "Karst," a stretch of barren lands in the hilly country of Istria, of Trieste, Dalmatia, Montenegro, and neighboring territory along the Adriatic Sea. It comprises 600,000 acres. This work has been carried on by the Forest Protective Service, which was first created for Tyrol in 1856.

In Hungary there are 23,000,000 acres of forest, of which the State owns 16 per cent, corporations 20, other institutions 7.5, and private persons 56.5. From ten to twelve million dollars' worth of wood is annually exported, and the State forests yield $600,000 revenue. Austria exports 3,670,000 tons of wood, the greater part of it going to Germany. About half of all the Hungarian forests is under working plans, by which the annual cut of 1,000,000,000 cubic feet is regulated. Forest planting is encouraged by the State nurseries, at which 10,000,000 seedlings are raised each year for free distribution, and by bounties paid for forest plantations on private waste lands.

Since dead timber is not left in any forests, there is but little loss from fires. In Saxony this is rarely more than $300 a year; Württemberg, about $650; and the Duchy of Baden, with 240,000 acres, had only 99 acres burned in nine years. Fires are started mostly by careless smokers and workmen. Locomotives cause about ten per cent. In many places along the forested side of a railroad track there is a ditch about eight feet wide which is kept free of vegetation. Frequently a strip of forest about a rod wide, running parallel with the railroad, is prepared in the following manner: A path along the edge of the woods is spaded about four feet wide. In the forest, about a rod from this and running parallel with it, a second path is made. Cross paths are made at intervals of about a rod. These paths are free of vegetation, and the ground in the strip is raked of leaves and twigs.

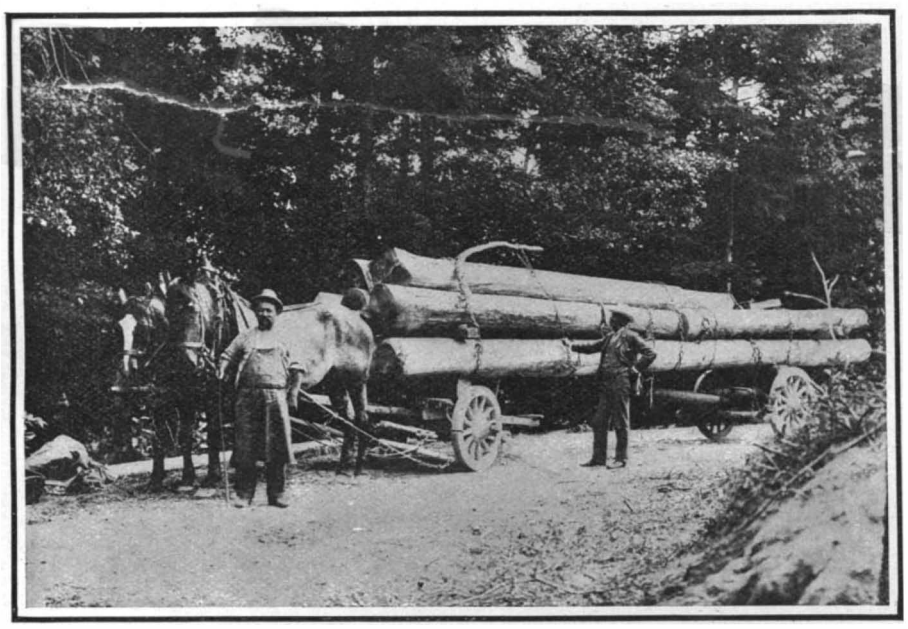
In Germany forestry is a well-established profession, for which the candidates must prepare themselves thoroughly. They must learn the science in a forestry school, where the course of study requires much hard labor. After graduation they must practise the science under masters for several years. These masters are usually officers having charge of ranges. A candidate takes first a position called in Germany "Forstreferender," at a salary of about 1,200 marks ($286). In two or three years he is advanced to that of "Forstassessor," at 3,000 marks ($714). With successful service he may then be promoted to the position of "Oberförster," with a salary of 4,500 marks ($1,071), and a dwelling especially suited to his needs.



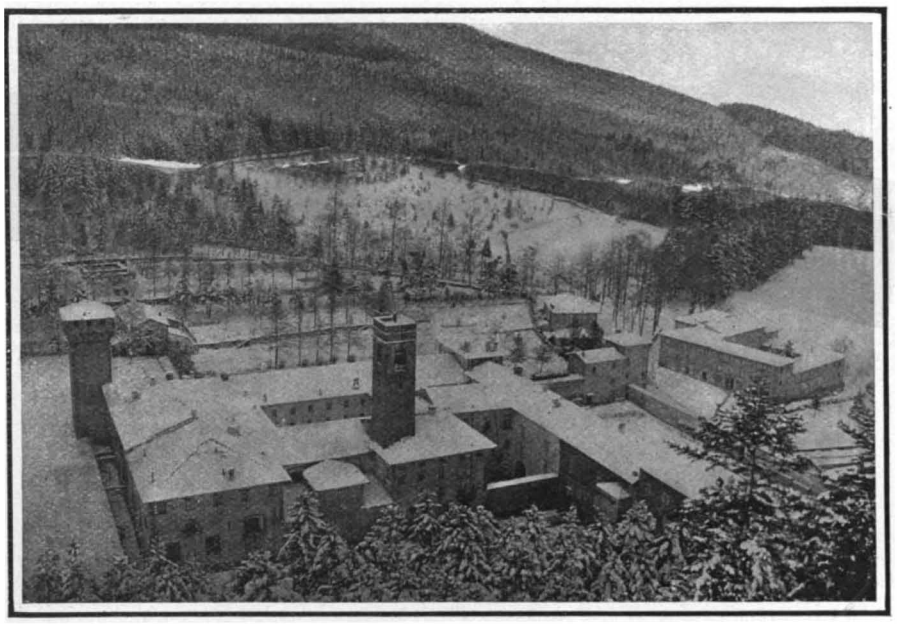
A good seed year for Norway spruce near Eisenbach, Thüringen Wald.

Prince Bismarck's forest at Friedrichsruh, North Prussia. Fire lane.

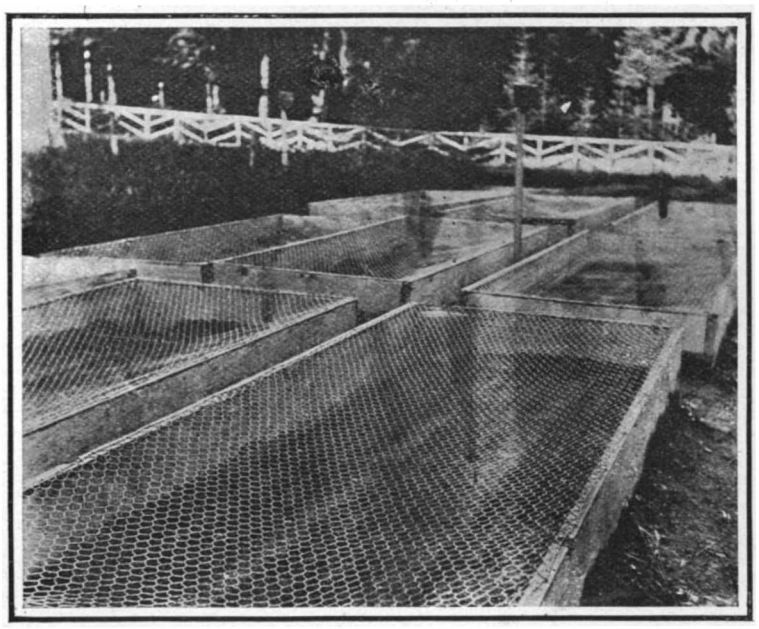
City forest of Grabow, Mecklenburg, Germany.



Hauling timber in the Schwarzwald, Geroldsau, near Baden-Baden.



Royal forestry institute, Vallombrosa, Italy. Nursery in the background.



Forest tree nursery near Gerardmer, France.

Preparing ground for a forest plantation in the Spessart, Northern Bavaria.

HOW GERMANY MAKES FORESTRY PAY.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

THE principal astronomical news of the past month has been the finding of Halley's comet, which was announced by Prof. Wolf of Heidelberg, who succeeded in photographing it on September 11th. Faint images of the comet were later found on photographs taken at Greenwich two days before, which were given relatively short exposures to avoid the danger of fogging by moonlight. If the moon had been out of the way, the comet might have been observed a week or two earlier.

It is still an extremely faint object, a mere nebulous disk, with no trace of a tail, visible only in very large telescopes, and will remain faint until next spring.

At the time of discovery it was more than 300 million miles from both the earth and the sun. It is now approaching them, and moving slowly westward in the heavens, on the boundary of Taurus and Orion. On December 1st it will be in opposition, but will be too faint for small telescopes (about the 12th magnitude). It will continue to approach the earth until December 18th, when its distance from us will be about 125 million miles. After this it recedes from us, as its motion about the sun is retrograde (i. e., in the opposite direction to that of the earth) and passes on the far side of the sun about March 24th, 165 million miles from us. Then it advances to meet the earth, passes between us and the sun, about May 17th, and a few days later comes very near us, within about 12,000,000 miles. At this time the comet will be well observable in the early evening, and in all probability an impressive object. In a few days more it will double its distance from us, and later it will gradually diminish in apparent size and brightness till it fades from view, though it should be telescopically visible until the end of 1910.

It is not usual that the motion of a comet can be so accurately foretold within a few weeks of its discovery; but Halley's comet has not really been discovered at all this time; it has only been re-observed, after an interval of more than seventy-three years since it was last seen; and after this long interval the time of its return was predicted with an error of about one day. This would be a perfectly easy matter if the comet moved under the influence of the sun's attraction alone; for then it would return at exactly equal intervals. But the attraction of all the planets comes in to modify its motion, and may alter its period by several years, so that the actual calculation of a return is no easy problem, and the success attained in this instance by the English astronomers Cowell and Crommelin (who have made an exhaustive investigation of the subject) is one of which science may legitimately be proud. They have been no less successful in unraveling the past history of this remarkable member of our system; but the story of that must wait till next month.

Next among the events of the month, from our standpoint, must be mentioned the observations of Prof. Campbell on Mount Whitney, California. These show no perceptible difference between the intensity of the absorption bands due to water vapor in the extreme red end of the spectra of Mars and of the moon. It follows that the amount of water vapor in the atmosphere of Mars must be small compared even with that in the rarefied and remarkably dry air above the mountain at the time of observation.

Prof. Lowell's observations, which indicated a perceptible amount of water vapor in the Martian atmosphere, were made under conditions which, though very favorable, appear to have been hardly as good as those on Mount Whitney. What is the cause of the discrepancy it is too early to say; but it is just by the investigation of such differences that the art of observation is perfected; and it is not unreasonable to hope that the study of this case may lead us, not only to more definite conclusions concerning the atmosphere of Mars, but to still better methods of investigating the problem in future.

THE HEAVENS.

Turning to our map of the sky, we find Cassiopeia almost overhead. The five brightest stars of this constellation, forming a group which looks like a badly dilapidated letter W, can be immediately identified.

With the aid of the fainter star $\varkappa$, we can see a resemblance to a rather less dilapidated chair, with its feet away from the pole; but the conventional figure of the "Lady in the Chair" is turned just the other way, with feet toward the pole; and our initial illustration is one more example of the large share of the imagination in forming the constellation figures.

Several individual stars deserve notice. The line through the Pole star and β Cassiopeiæ points almost exactly toward the vernal equinox. It may therefore be used as an indicator to estimate the sidereal time —remembering that it is above the Pole at sidereal noon, to the left at 6 h., below at 12 h., and to the right at 18 h. With a little practice it is possible to read the sidereal time from this celestial bow band within about fifteen minutes. Then, by recalling that the sidereal clock agrees with the mean solar clock on March 22nd (or thereabout) and gains at the rate of two hours a month, one can pass to ordinary solar time. This is the simplest way to tell the time by looking at the stars.

β Cassiopeiæ is also notable as a fairly near neighbor of ours, having a parallax of about 0.10 sec., corresponding to a distance about two million times that of the sun, or 32 light years. Two other naked-eye stars near by are nearer. One of them, η is marked on the map, between α and γ. This is a well-known binary, with a period of over 200 years and a parallax of 0.19 sec., corresponding to a distance of 17 light years.

The other, μ Cassiopeiæ, is the southern and fainter of a pair of stars which lie near the other corner of the parallelogram whose vertices are α, γ, and δ. Its parallax is about 0.11 sec. and its distance 30 light years. It is notable for its great proper motion, 3.7 sec. per year, which corresponds to an actual velocity in space of 100 miles per second.

The familiar winter constellations are beginning to return to the evening sky. At our hour of observation, Taurus is well up in the east, and Orion is rising. Gemini too is on the horizon; and Auriga is well up in the northeast. Perseus, Andromeda, and Pegasus extend upward from this to the zenith, and beyond it.

The southern constellations are inconspicuous, but Mars and Saturn, the first near the meridian and the other east of him, add luster to the otherwise vacant region. The variable star Mira (o Ceti) is now near maximum. It may easily be found with the aid of the map.

The two bright stars below and to the west of Saturn and Mars are β Ceti and Fomalhaut, which are much more nearly equal in brightness than the map would indicate.

Another group of bright stars lies in the west. Deneb, in Cygnus, is highest up. Altair is on the left, and Vega, the brightest of the three, below the first.

The Great Bear is low on the northern horizon, almost out of sight. Draco and Ursa Minor are above, and Cepheus higher still, close to Cassiopeia.

THE PLANETS.

Mercury is morning star throughout November. He is best visible at the first of the month, when he rises about 5:15 A. M. By the middle of the month he has drawn nearer to the sun, and rises about 6 o'clock; and soon after this he becomes unobservable without a telescope, with which he is best seen in broad daylight.

Venus is evening star, a long way from the sun, but very far south, so that she sets before 7:30 P. M.

Mars, though past opposition and receding from us, is splendidly conspicuous in the evening sky, coming to the meridian about 9 P. M. at the beginning of the month, and 7:30 at its close.

Jupiter is morning star in Virgo, and rises at about 3 A. M. in the middle of the month. Saturn is in Pisces, about an hour east of Mars, and is on the meridian at 9:30 P. M. on the 15th.

Uranus is evening star in Sagittarius, setting too early to be well observable. On the 23rd he is in conjunction with Venus, being 2½ deg. north of the latter.

Neptune is in Gemini, and comes to the meridian about 4 A. M. during the middle of the month.

THE MOON.

Last quarter occurs at 4 P. M. on November 4th, new moon at 9 P. M. on the 12th, first quarter at noon on the 20th, and full moon at 4 A. M. on the 27th, during the total eclipse of that date.

This lunar eclipse is visible throughout North America and the adjacent regions, but at an inconvenient time for the amateur, in the small hours of the morning.

The moon enters the earth's penumbra at 1:12 A. M. eastern standard time, and first reaches the full shadow at 2:11. At 3:14 she disappears completely in it, and does not begin to emerge till 4:37. This is an unusually long duration, due to the fact that the moon goes almost centrally through the earth's shadow, which itself is larger than usual, as the moon is near the earth.

At 5:38 the moon finally leaves the shadow, and exactly an hour later she gets clear of the penumbra, and the eclipse is over.

The moon is nearest to us on the 25th, and farthest off on the 9th. She is in conjunction with Neptune on the 2nd, Jupiter on the 9th, Mercury on the 11th, Venus on the 16th, Uranus on the 17th, Mars on the 22nd, Saturn on the 23rd, and Neptune once more on the 30th.

Princeton University Observatory.

NIGHT SKY: OCTOBER AND NOVEMBER

At 11 o'clock: Oct. 7.
At 10½ o'clock: Oct. 14.
At 10 o'clock: Oct. 22.

At 9 o'clock: Nov. 7.
At 8½ o'clock: Nov. 15.
At 8 o'clock: Nov. 23.

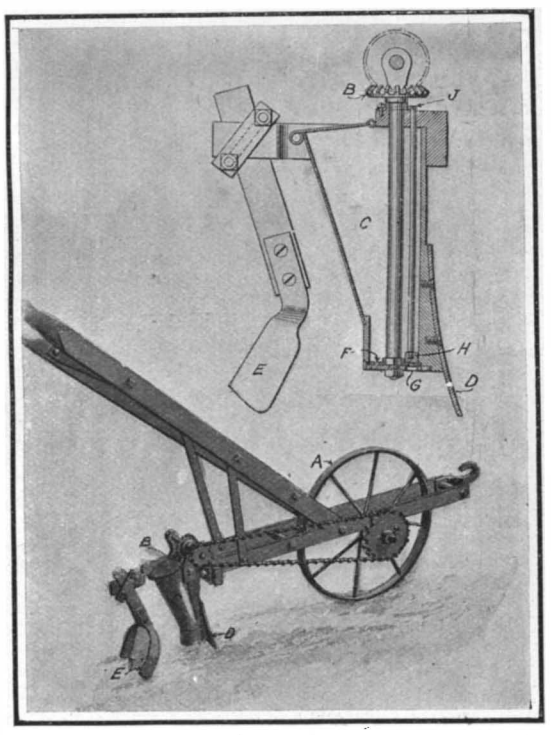
At 9½ o'clock: October 30.

Carbon Safety Ink.—This ink is really no more than a sort of India ink kept in solution. It may be made by rubbing down 10 parts of lampblack, 10 parts of gum, 5 parts of oxalic acid, and 200 parts of water, taking at first but little water and only adding the remainder after the thick mass has become uniform.

Patent Department

AN IMPROVED PLANTER.

Pictured in the accompanying engraving is a planter provided with a seed box, in which there are no springs to become chocked or gummed by seed or dust. The seed-distributing mechanism is adaptable for seeds of different sizes, and may also be adjusted to plant seeds at greater or shorter distances apart. The seeds leave the box so close to the ground that there is no danger of their becoming scattered. The frame of the machine is supported on a traction wheel *A*, which, through the medium of suitable gearing, operates a bevel gear *B*, affixed to a vertical shaft which runs through the seed box *C*. Secured to the forward part of the seed box is a share *D*, which plows a furrow in advance of the seed box, while a pair of hoes *E*, converging rearwardly, serve to cover the seed with the earth plowed up by the share. A disk *F* is secured to the shaft which runs through the seed box and is adapted to rotate in contact with the bottom plate of the seed box. The disk is provided with a series of perforations, adapted to be brought successively into engagement with an aperture *G* in the bottom of the seed box. A cut-off *H* bears against the disk *F*, immediately above the aperture *G*. A rod attached to the cut-off *H* extends through the top of the seed box, and is normally pressed downward, by means of a spring *J*. As the disk *F* revolves, it carries one seed at a time to the opening *G*, through which the seed falls into

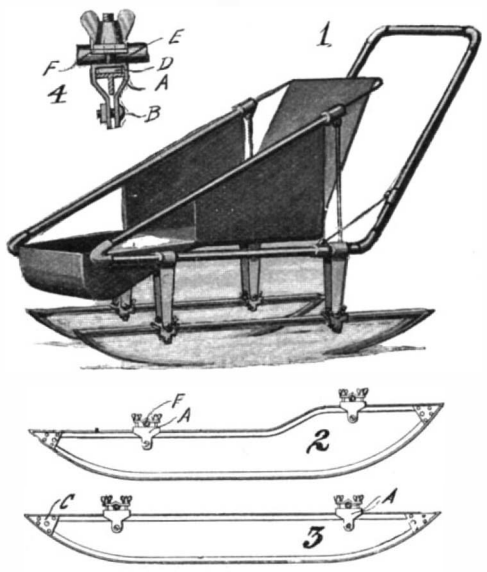


AN IMPROVED PLANTER.

the furrow. The machine is supplied with disks, having perforations of different sizes, suitable for seeds of various sizes, and the intervals between the perforations vary in the different disks to provide the proper spacing of the seeds planted. If desired, two or more seed boxes may be connected to the traction wheel, so that a number of rows may be planted at the same time. The inventor of this planter is Mr. August Brinkoeter, Floresville, Texas.

SLEIGH-RUNNER ATTACHMENT FOR BABY CARRIAGES.

A patent has recently been issued disclosing a new form of sleigh-runner attachment for baby carriages, which may readily be applied to an ordinary go-cart or baby-carriage or a child's wagon, to permit of using it over snow-covered walks. The accompanying engraving indicates the form of this attachment. The runners, which are made of T-iron, consist of a horizontal upper and lower member, with the ends of the lower member curved upward and braced by means of plates *C*. The axles of the carriage are made fast in a pair of saddles mounted on each runner. The form of the saddle is shown to better advantage in the cross-sectional view, Fig. 4. It consists of a yoke *A*, which fits over the horizontal portion of the T-iron, and it is made fast by means of a bolt *B* on the under side. A pair of bolts *D* with flat heads *E* resting on top of the runner project upward through the yoke to receive a strap *F*, which is clamped down on the axle by means of a pair of thumb nuts. When it is desired to attach the runner to a folding go-cart, a sleeve is preferably fitted over the axle, and this sleeve is clamped between the strap and the yoke. Fig. 3 shows a form of runner used on vehicles which have rear wheels of larger diameters than the front ones. It is quite essential to have the rear as well as the forward end of the runners curved, because this enables one to lift the forward end of the baby carriage when mounting a curb, or when it is desired to make a sharp turn. It also permits of lowering the carriage from a step or the curb. The runners may be quickly applied or removed by merely turning the thumb nuts,

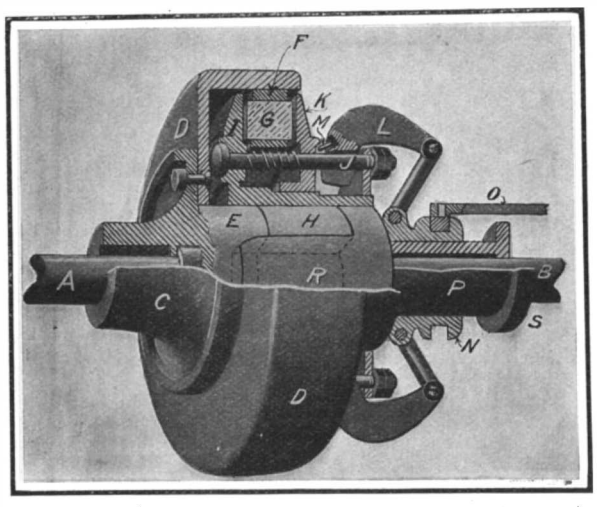


SLEIGH-RUNNER ATTACHMENT FOR BABY CARRIAGES.

and they are applicable to any type of go-cart, owing to the fact that the saddles may be adjusted along the upper member of the runner, and made fast at the desired point by tightening the bolt *B*. The inventor of this attachment for baby carriages is Frederick C. Kengeter, 2656 Pitkin Avenue, Brooklyn, N. Y.

COMBINED FRICTION AND JAW CLUTCH.

The principal advantage of a friction clutch is that it permits the shaft under load to be brought gradually up to the speed of the power shaft, thus eliminating the shock of starting. However, the friction surfaces are liable to wear out, rendering the clutch useless in a short time. Except for starting and stopping, the jaw clutch is better, because it provides a positive engagement of one shaft with the other. The accompanying engraving illustrates a clutch in which it is aimed to combine the advantages of both forms. The power shaft is indicated at *A*, and the load shaft at *B*. Mounted on the shaft *A* is a hub *C*, formed with a flange to which the disk *D* is bolted. Projecting through a central aperture in the disk *D* is an annular jaw *E*. The disk *D* at its periphery is formed with an annular flange, which incases part of the clutch mechanism. A ring *F* is fitted within this flange and keyed to it. The ring has openings at suitable points to receive wooden blocks *G*, which protrude from the opposite faces of the ring. Keyed to the shaft *B* is a member *H*, on which is fitted a sleeve *I* formed with a flange at its inner end. A series of bolts *J* are fitted between this flange and a ring at the opposite end of the sleeve. A ring *K* is mounted to slide on the sleeve *I*, and the bolts *J* pass therethrough, while coil springs on the bolts *J* bear against the ring *K*, tending to press the latter outward. The flange of sleeve *I* and ring *K* have annular bearing surfaces adapted to engage the blocks *G* at opposite sides. They are pressed into engagement by means of levers *L* fulcrumed to the ring at the end of the sleeve *I*, and links *M* are fitted between the levers *L* and the ring *K*. The levers *L* are connected by links to a sliding collar *N*, operated by a lever *O* fitted with



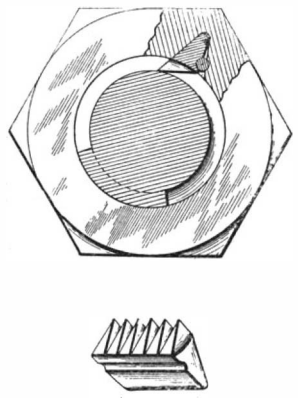
COMBINED FRICTION AND JAW CLUTCH.

a split collar in the usual manner. The collar *N* slides on a sleeve *P*, which at its inner end is provided with jaws *R*. These jaws are adapted to slide in recesses at opposite sides of the member *H* and the jaw *E*. In operation, when it is desired to separate the jaws, the lever *O* is operated to draw the collar *N* back on the sleeve *P*. This serves to press the flange *I* and ring *K* against the friction blocks *G*, thus taking the load off the jaws; and when the collar *N* comes into contact with the flange *S* at the end of the sleeve *P*, the jaws *R* are withdrawn from engagement with the clutch member *E*, after which the friction surfaces are released, owing to the toggle action of the links connecting to the collar *N*. When throwing the clutch into engagement, the reverse takes place. The friction surfaces are first thrown into contact before the jaws *R* move into engagement with the recesses in the clutch member *E*. It will be understood that the frictional engagement is only momentary, serving to bring the load shaft approximately up to speed, and thus obviating the shock of starting and the danger of breaking the clutch jaws. The inventor of this combined friction and jaw clutch is Mr. Charles Stewart Hook, 79 Victoria Street, Toronto, Ontario, Canada.

A PERFECTED FORM OF LOCK NUT.

Of the many kinds of lock nuts which have been, or are at present manufactured, few have the simplicity and surety of the one recently patented by Mr. William Jacobus, and soon to be placed on the market. The accompanying engraving shows at a glance the extreme simplicity of this invention, which consists in cutting from an ordinary nut a small wedge-shaped section that, when it is put back in place and the nut is screwed up, jams tightly against the thread as soon as an effort is made to unscrew it. When it is desired to remove the nut, the wedge can be released by a pin or piece of wire and the nut can be unscrewed.

Two capital advantages of this new nut are that it practically is in one piece, resembling in general appearance any ordinary nut, and secondly, the fact that vibration tends to tighten instead of loosen it. An excellent demonstration of this latter fact was given

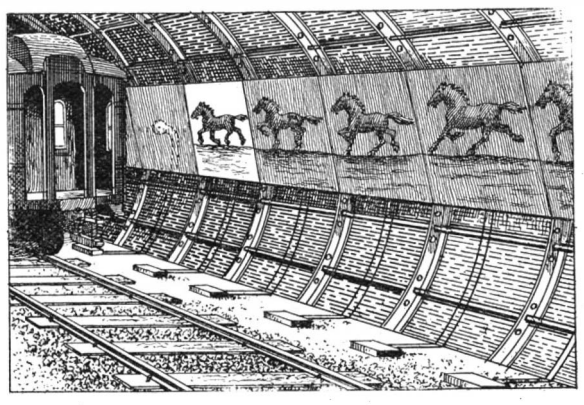


A PERFECTED FORM OF LOCK NUT.

us by the inventor, who placed a nut about half way up the thread of a bolt, and by jerking the bolt up and down on the end of a string, caused the nut to travel to the end of the thread, where it was effectually locked.

ODDITIES IN INVENTION.

MOVING PICTURES FOR SUBWAYS.—Moving pictures are produced, as is well known, by a film traveling with intermittent motion before a projector or lantern which throws successive views on the screen. The same result could be obtained if the pictures were stationary and the audience itself were in motion, so as to view the pictures successively. An ingenious inventor has



ARTIFICIAL LIVE SCENERY FOR SUBWAYS.

hit upon this scheme to relieve the monotony of subway travel. He proposes to mount a continuous band of pictures at each side of the subway, and have these pictures successively illuminated, by means of lamps placed behind them. The circuits of the lamps would be successively closed, by means of a shoe upon the subway car engaging contact plates at each side of the track. The accompanying illustration indicates the method of accomplishing this result.

Fluid Siccative.—60 parts of old linseed oil are boiled with 3 parts of carbonate of manganese until viscid. The temperature required is about 536 deg. F. (280 deg. C.). The mass should then be dissolved in 120 parts or more of oil of turpentine.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TROUSERS-SUPPORTER.—S. Levin, New York, N. Y. In this construction an elastic belt is wholly contained within the trousers, and has wire loops or their equivalent attached to its opposite ends and adapted to engage over a button at the front of the trousers in holding them in place. The invention also provides in connection with the belt, adjacent to its ends, drawers supporters which engage with the supporting loops of the trousers when the ends of the belt are detached, and prevent the passage of the ends therethrough.

Electrical Devices.

ELECTRIC SWITCH.—H. D. Grinnell, New Bedford, Mass. The switch is more especially designed for turning on or off the gas supply for the lamps of an automobile or other motor vehicle, and at the same time controlling the igniting devices for said lamps. The result is obtained by the use of a manually-controlled switch shaft, having an arm carrying a pinion in mesh with an internal gear wheel formed of alternating insulated and contact-making sections.

ELECTRICALLY-OPERATED AUTOMATIC SWITCH.—W. A. Lacke, Chicago, Ill. One advantage in this device is the fact that the solenoids are dead at all times except when in the act of moving the damper in case a contact closes, and the damper regulating mechanism is in consequence actuated, the closure thereafter of the same contact will have no effect and will not waste any current. It is only when another contact is closed and current is needed for moving the damper in the opposite direction that any current whatever is able to flow.

ELECTRIC-LIGHT BRACKET.—E. I. Drent, New Orleans, La. The invention relates more particularly to brackets which include a body provided with a bulb-carrying socket, clamping jaws for removably securing the feed wires in place on the body, and a ring, the latter serving removably to engage the jaws to fasten the same firmly in place.

Of Interest to Farmers.

ATTACHMENT FOR RIDING-CULTIVATORS AND OTHER AGRICULTURAL IMPLEMENTS.—C. N. Simpson, Bryan, Texas. This attachment may with slight changes in the implement be placed upon a riding plow, a riding cultivator, or a planter, and enable an exact control, so that the plows proper, or cultivator blades may be instantly changed in adjustment, to lower or raise their points in conformity with changes in inclination of the surface of the ground, thus insuring equal proper depth of furrow, or agitation of soil, in level and undulating ground, and when the implement is turned at a fence row.

COTTON-MARKER FOR BALES.—G. W. Long and E. Otidys, Lindsay, Okla. In the present patent the invention is an improvement in cotton markers for use on bales of cotton whereby the bale when being tied out will operate to permanently bind the marker to the bale by the ties, which hold the bale in compression.

Of General Interest.

ENVELOP.—N. J. Macdonald, Irish Cove, Nova Scotia, Canada. This invention refers to certain improvements in envelops, and more particularly to a special flap construction, whereby after the envelop is sealed, it is very difficult, if not impossible to gain access thereto without leaving evidence of the fact that the envelop has been tampered with.

APPARATUS FOR THE BACTERIOLOGICAL TREATMENT OF SEWAGE AND THE LIKE.—G. A. Lucas, 75 Rue Voltaire, Levallois-Perret, Seine, France. The invention is an improvement in apparatus for the bacteriological treatment of sewage, fecal matters, domestic waste water and the like. It may be installed in dwelling houses, thus permitting the destruction on the spot and in a complete manner of the organic germs contained in sewage. It is an improvement over a prior patent granted to Mr. Lucas and treats sewage successively by anaerobic and aerobic fermentation and oxidation.

FURNACE FOR SMELTING ORES.—W. Kemp, Tucson, Ariz. Ter. This invention relates to furnaces, and admits of general use, but is of peculiar value in furnaces provided with water jackets and adapted to be used in connection with burners for smelting ores. Upon actual test this furnace has proven more efficient than the old style furnaces.

HOLDER.—I. Herzfelder, New York, N. Y. The object here is to provide a holder or box for containing court plaster, postage stamps and like articles, and arranged to accommodate a large number of articles in a comparatively small space, to allow convenient removal of an article as required and to protect them against deleterious influences of moisture.

BALE-TIE.—H. O. Fry, Bridal Veil, Ore. The purpose of the invention is to provide novel details of construction for a bale tie, especially well adapted for holding a wire strand bound tightly around a bundle of shooks, lath, shingles or other material, to adapt such material for convenient handling and transportation.

FIRE-EXTINGUISHER.—D. H. Conkling, Fort Pierce, Fla. The invention relates to improvements in extinguishers in which a mixture of sulphuric acid and bicarbonate of soda is combined to form carbonic acid gas which possesses powerful extinguishing properties. Means are provided whereby the extinguisher may be instantly and automatically recharged by the returning of the extinguisher receptacle to its normal or upright position.

TYPE-WRITER CABINET.—J. D. Cleaton, Atlanta, Ga. The object of the inventor is to provide an office desk of the usual form with a compartment at one side of the central knee space with means to assist in lifting the typewriter from the compartment, up through the top of the desk and to dispose it over the knee space to be further shifted if desired to a more central position.

NON-REFILLABLE BOTTLE.—J. S. Bromhead, New York, N. Y. The invention provides a bottle arranged to insure a steady flow of liquid from the bottle when tilting the same, and prevents refilling of the bottle by unauthorized persons after the bottle is once emptied of its original contents. It relates to non-refillable bottles, such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Bromhead.

Hardware.

FLUSHING DEVICE FOR WATER-CLOSET TANKS.—J. F. Young, Owatonna, Minn. The purpose of this inventor is to provide an independent automatic locking device, adapted for use in connection with the customary float locking supply valve, and which, although it may be used for other purposes, is especially designed to be employed in water-closet tanks.

SOCKET-PIECE FOR STUDDING, ETC.—W. P. Rice, Lowell, Ohio. The object of the invention in this case is to provide a device especially adapted for securing the beveled end of a piece of timber against the side of another piece, as, for instance, in securing the legs of trestles to the body portion.

RAZOR-BLADE SHARPENER.—D. M. Perine, Pittsburg, Pa. An object of this improvement is to provide a device by which the blade may be sharpened evenly, such result being obtained by disposing the blade holder on a pivot centrally located between two sharpening disks.

STRAP-SEAL.—S. Baruch and M. Dessauer, New York, N. Y. The invention comprehends a fastening for holding together the ends of the strap or straps to be connected, and a seal comprising a plate of sheet metal bent around the overlapping portions of the strap or straps and secured by aid of eyelets so as to conceal and protect the fastening.

PADLOCK.—L. A. E. C. Byrne, Lahor, Punjab, India. More particularly the invention relates to a padlock of the kind comprising a casing, a rotatable shackle mounted to project partly from the casing, a slidable member, which in a predetermined position holds the shackle against movement, and key-operable tumbler levers controlling the slidable member.

Heating and Lighting.

FURNACE FOR UNIFORMLY HEATING METALS.—W. N. Best, New York, N. Y. The invention has reference to certain improvements in furnaces adapted for use in heating forgings, castings, or the melting of metals, and the object of the inventor is to so construct the furnace that the temperature of all parts of the heating chamber will be the same.

Household Utilities.

STRAINER.—G. F. Grimm, Evansville, Ind. The main object in this case is to provide a device by which a strainer may be supported on a coffee pot of ordinary construction without changing the latter in the least. A further object is to provide an adjustable support which may be applied to pots of different sizes.

CUSPIDOR.—J. H. Gregory and F. M. Shumway, Farwell, Mich. The invention has in view a cuspidor having side portions hinged at the top to swing outwardly from the base, and provided with a hopper bottom inclining from the center toward each hinged side portion, to insure ready discharge and easy cleansing.

Machines and Mechanical Devices.

MECHANISM FOR THE PRODUCTION OF A CONSTANT MIXTURE OF GAS AND AIR.—F. W. Wolff, 22 Melancthonstrasse, Berlin, Germany. This mechanism is for use for the production of a constant mixture for illuminating purposes, with the employment of a suction and forcing apparatus, the action of which is regulated in dependence upon the consumption, and which produces and sucks the mixture at iow pressure, and sends it at an increased pressure into the service pipe.

PHONOGRAPHIC REPRODUCER.—R. B. Smith, New York, N. Y. Primarily the invention pertains to phonographic reproducers, but may also be used in connection with phonographic records and generally in all relations where there is a stylus lever controllable by, or employed for the purpose of controlling a diaphragm in order to record or reproduce sounds.

DISPENSING-MACHINE.—C. M. Jewell, Canastota, S. D. This machine is particularly adapted for dispensing sheets, envelops, pictures, cards, packages of cards, or similar sheet material, and relates more particularly to the operating and controlling means for delivering the articles to be dispensed to the discharge opening.

COMBINATION HARNESS AND WARP STOP-MOTION.—H. Anner and M. J. Marnel, Phillipsburg, N. J. The invention refers to looms and provides motion arranged to stop the loom in case a warp thread breaks, the breaking of a warp thread allowing its heddle to drop and close an electric circuit at the time the heddle frame moves into lowermost position, the electric circuit controlling an actuating device for the usual stop motion of the loom.

DOGGING DEVICE.—O. M. Krebs, Memphis, Tenn. The logs being sawed are secured by dogs to knees adjustable upon head blocks. After each cut these knees are advanced on the head blocks so as to present the log to the saw to saw another plank. The log is held to the knees by dogs. The dogs used in practice do not hold the logs rigidly on the carriage and are apt to become dislodged. The object here is to provide a device which will enable the logs to be securely held against the knees.

Musical Devices.

SELF-PLAYING PIANO.—F. B. Long and E. A. Tappe, Los Angeles, Cal. The intention here is to provide an effective connection between the pneumatic and the hammer action, to allow playing the piano automatically or by hand power and without interference by the connection. This is obtained by use of a lever, connected at one end with the movable member of the pneumatic, and an auxiliary lifter rod for engagement with one of the members of the hammer action, to lift the rod resting on the free end of the lever.

SOUNDING-BOARD FOR PIANOS.—F. B. Long, Los Angeles, Cal. In this patent the purpose of the inventor is to provide a new and improved sounding board for pianos, provided with manually adjustable devices for maintaining the original crown of the sounding board and for increasing the singing quality and the volume of the tone.

Prime Movers and Their Accessories.

BELT-GUIDE.—G. H. Tenpas, Sherman, N. Y. The invention relates to belt guides, the more particular purpose being to provide an efficient form of belt guide for use in connection with portable engines and including means whereby, in a few minutes, various adjustments may be made relative to the position occupied by the moving belt.

Railways and Their Accessories.

RAILROAD-TIE AND RAIL-FASTENER.—J. P. Donovan, Georgetown, Ky. This tie is provided with rail-seats which serve to prevent lateral movement of the rails, and the improved rail-fastener prevents vertical separation of the rails from the ties. Thus the fastener coacts with the ties in holding the rails secured against both integral and vertical movement of the rails relative to the ties.

CONCRETE RAILWAY-TIE.—J. P. Donovan, Georgetown, Ky. The invention comprises a tie with raised shoulders on the upper side which are separated to provide rail-seats, and with transverse openings below the seats, for receiving rail-fastenings, and reinforcing members arranged longitudinally of the tie in two horizontal sets, one near the base, the other near the top of the tie, and comprising metallic rods having end disks, wholly imbedded in the concrete.

APPARATUS FOR MOLDING CONCRETE RAILWAY-TIES.—J. P. Donovan, Georgetown, Ky. Mr. Donovan's invention is embodied in a box-like body or mold proper provided with certain accessories whereby concrete railway ties, also fence posts, building blocks, and the like may be produced with facility and despatch. Ten molds may be used for each shift so that concrete may take initial set in the first of the series while concrete is being placed in the last.

Pertaining to Vehicles.

VEHICLE-WHEEL.—J. H. Scott, Jersey City, N. J. This is an improvement in wheels in which a resilient connection between the spokes and the rim of the wheel is effected in order that the use of pneumatic or cushioned tires may be unnecessary. To this end a wheel is provided, a hub having a series of radiating spokes secured thereto, a rim, and a cap fitting over the outer end of each spoke having a curved spring attached intermediate its length, with its free ends connected to the rim.

ATTACHMENT FOR AUTOMOBILES.—H. S. Delamere, Ferndale, Cal. The aim here is to provide an attachment for automobiles by means of which one or both of the driving wheels will actuate a removable drum upon which a line can be wound up, to draw the automobile out of a mud hole or sand pit, and up steep grades or hills.

WHEEL.—A. C. Gillam, Hicksville, Ohio. The object here is to provide a pneumatic wheel with a punctureless tire. The annular pneumatic tubes are protected from injury, being housed in by an inner ring and body plates and are subject only to pressure strain and not to frictional wear. This permits the inventor to make the air chambers of the pneumatic cushioning tubes relatively large, it being understood that these tubes may be made of any suitable material.

Designs.

DESIGN FOR WINDOW SHADES AND THE LIKE.—A. A. Boeck, New York, N. Y. Mr. Boeck has designed ornamental patterns for fabric for window shades of three different types which display artistic and original taste and form of varied and beautiful effects.

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.

NEW BOOKS, ETC.

THE POE CULT AND OTHER POE PAPERS. By Eügene Didier. New York: Broadway Publishing Company, 1909. 16mo.; 301 pp. Price, $1.15.

The twenty-three separate articles comprised in this volume have been published in various American magazines during the last thirty-five years. Among the subjects treated are "The Poe Cult," "Poe: Real and Reputed," "The Boyhood of Edgar A. Poe," "Poe's Female Friends," "The Loves of Edgar A. Poe," "The True Story of Poe's Death," "The Poe Monument," "Portraits of Poe," "The Poe Mania," "The Truth about Edgar A. Poe," "Recollections of Poe by the Witnesses of His Life," "The 'Discoverer' of Poe," "Poe and the University of Virginia," "The Centennial of the Birth of Edgar A. Poe." The book is a very interesting one, and reflects great credit upon the author and shows an extraordinary grasp of the whole subject of Poe.

THE SOLICITOR'S PATENT PRACTICE. By George Frederick Emery. London: Effngham Wilson, 1909. 16mo.; 245 pp.

The aim of this book is to provide a handbook for ready references on British patent law for the use of solicitors, it not being the purpose of the author to include subjects which would make it of particular value to the patent agent. Much general information is contained in the book but it is of course impossible for the author in a little over two hundred pages to treat fully the many questions in patent law which a solicitor must be informed concerning, and on the principle that a little knowledge is dangerous it would not be wise for a solicitor to place the volume on his shelf except with more comprehensive works. When referred to in connection with some standard work, "The Solicitor's Patent Practice" should prove useful.

STATICS BY ALGEBRAIC AND GRAPHIC METHODS. By L. J. Johnson. New York: John Wiley & Sons, 1909. 8vo.; 170 pp.; 13 plates. Price, $2.

The former edition of this work is so well known as one of the first treatises on statics to include in a complete and practical way the valuable graphical method, that it is only necessary now to remark upon the additions and alterations. These include a detailed scheme tested by the author in his classes, for assigning individual data for the exercises and a copious collection of practice problems with answers. A short syllabus is also added to facilitate review and enforce certain points. The author's arrangement is well calculated to give a facility in applying the subject valuable in engineering practice.

STRENGTH OF MATERIALS. By Arthur Morley, M.Sc. London and New York: Longmans, Green & Co., 1909. 8vo.; 480 pp.; fully illustrated with diagrams. Price, $2.50.

This book, like the foregoing, is intended primarily for engineering students and differs from other works on the subject principally in the completeness with which demonstrations involving even simple mathematical problems are worked out: in many books the method is indicated and a good deal then left to the imagination, which is sometimes confusing to those whose mathematics are limited or out of practice. The result of important recent research work bearing on strength of materials has been included, reference being given to more complete records of the tests. Other important subjects are more fully treated than usual, such as the strength of rotating disks and cylinders, the bending of curved bars with application to hooks, links, etc., and the stresses and instability arising from certain speeds in running machinery, all of which are of practical application and valuable to the engineering practitioner.

ROBERT FULTON AND THE CLERMONT. The Authoritative Story of Robert Fulton's Early Experiments, Personal Effects, and Historic Achievements. Containing Many of Fulton's Hitherto Unpublished Letters, Drawings, and Pictures. By Alice Crary Sutcliffe. New York: The Century Company, Pp. xv, 367; 8vo.; cloth. Price, $1.20.

Among the many lives of Fulton which have been written, this by his great-granddaughter is unique, because of the many hitherto unpublished letters of Fulton which it contains; letters which throw much new light on the work and aims of that distinguished man. It also contains reproductions of several drawings, which are of great interest and even future value in establishing certain disputed facts about the engines of the "Clermont."

These drawings are from four folios of Fulton's original drawings now in the New Jersey Historical Society's possession. The work throws much light upon the nineteen years which Fulton spent in Europe, and it brings us into intimate touch with the personal life and the private character of the inventor. Judged from the standpoint of strict originality, we consider that Fulton's work in the development of submarines and submarine mining was far superior to his work in the development of the steamboat, a fact which the letters published in this book and in various magazines of the past few months abundantly substantiate. The book is a most valuable contribution to historical engineering literature.

THE PRINTING ART. Edited by Henry Lewis Johnson. Vol. XIII. March, 1909—August, 1909. Cambridge, Mass.: The University Press, 1909. 4to.; 376 pp.

The Printing Art is one of the most welcome visitors to the Editor's table, bringing as it does the very essence of good typography reproduced in concrete and useful form. There is hardly a mechanical process which is not adequately represented in the beautiful volume before us. The Printing Art has done more for American typography than anything else which this century has produced so far. Each number is filled with actual examples of properly printed illustrations and text. The latter is of the very best, and the illustrations are largely taken from work which has been actually executed and is therefore of double value. In the bound volume before us all the advertisements including the cover are bound in. This is a very wise precaution. We do not see how anyone who is binding this beautiful publication would "strip it," as a great deal of the practical value of the book is in the advertisements and inserts. There is no bad printer that this book will not improve, and there is no good printer who cannot be assisted by it. The printing art is young, and the time is not far distant when the public taste will actually demand the very highest resources of plate making and printing, and this publication will go a long way toward furnishing a clearing house for the dissemination of fairly up-to-date ideas. We cannot comment too favorably on some of the examples of job printing, particularly the programme title pages, many of which are superb. We shall preserve this volume for reference with a good deal of pleasure.

SHEET METAL WORK. By William Neubecker. Chicago: American School of Correspondence, 1909. Large 8vo.; 270 pp.; fully illustrated with diagrams. Price, $3.

This is one of the best publications of the American Correspondence School that we have seen for some time. The author is evidently a thoroughly practical workman but from his experience as a teacher has more facility for telling what he knows than most good workmen possess. His explanation of the methods adopted especially in laying out patterns is thoroughly practical and clear. Just as much elementary descriptive geometry is included as is necessary for the understanding of the underlying principles, but no apprentice who desires to improve himself need be alarmed by that term if he knows nothing of the subject as it is given in a disguised and practical form on the lines of "reading without tears." Methods are given for the layout of every conceivable form of sheet metal from simple stove-pipe bends, joints and changes of diameter to the most ornate cornice work, and we cannot imagine a workman being confronted with a problem to which he cannot find an analogy in this book. The form of the book is homologous as to printing and binding with the School's library and contains the usual foreword with no particular reference to this volume, but the diagrams are more than usually limited to those essential and applicable to the text.

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