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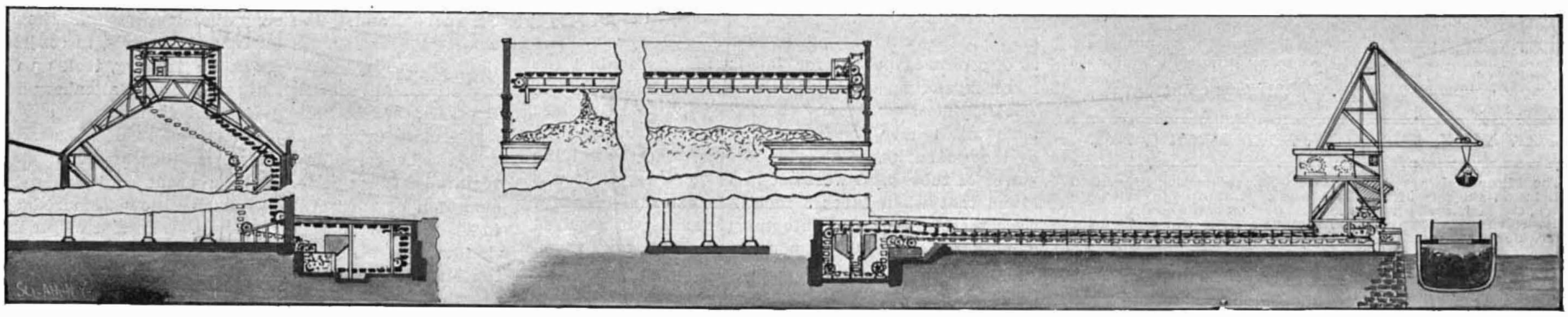
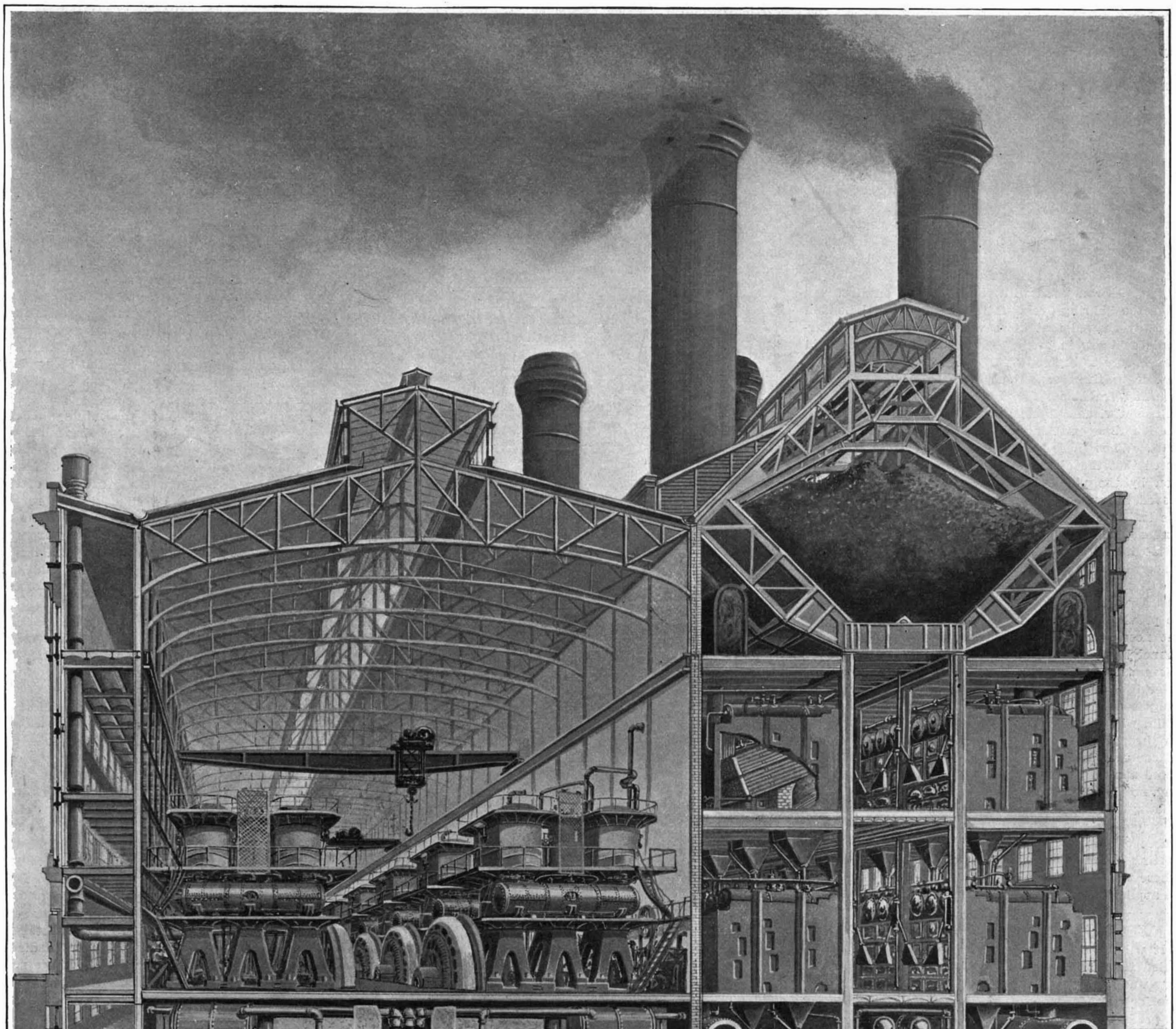


Diagram Showing System of Conveyors for Transferring Coal from the Barge to the Storage Bin.



THE NEW YORK EDISON POWER STATION. MAXIMUM CAPACITY, 125,000 HORSE POWER.—[See page 152.]

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 6, 1902.

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.

VENTILATION OF UNDERGROUND ROADS.

The New York Subway, which gives every indication of being in regular service by the close of next year, will have a distinct advantage over the majority of the London tunnel roads in the fact that the greater part of it lies very near the street surface. This advantage will be felt both in respect of the ease of access (elevators being necessary only at a few stations) and in respect of that most important point, ventilation. The official investigations which have been recently carried out to test the quality of the air in the London tunnels possess considerable interest for the residents of this city, although we have every reason to expect that the air in our Subway will be purer and sweeter. The tests referred to show that in the London "tubes" there is normally 100 per cent more carbonic acid gas than the law recognizes as healthy and allowable in English factories and workshops, where the maximum amount permitted is seven parts in 10,000. At street level the average is four in 10,000. As compared with this, the tests on air taken from the Charing Cross station of the Central London Railway showed that there were 13.8 volumes of carbonic acid gas in every 10,000, while in the crowded cars it rose as high as 27.5. While there is no special danger in these conditions, it is considered that in granting franchises for future underground roads it will be advisable to call for better provisions for ventilation than exist in those which have been already built. When these roads were constructed it was supposed that the air would be kept in constant circulation by the piston-like effect of the trains as they moved through the tunnels. It was found that while the trains do keep the air in circulation they have no tendency to draw in fresh air, or expel that which is vitiated. With a view to meeting this defect the engineers who have made the investigation suggest the provision of special outlets, placed where they will best serve their purpose. Special air inlets are also to be provided at each station; and in order to produce the necessary suction to draw the pure air into the tunnel behind a train it is proposed to provide trapdoors at each station, which can be closed immediately after the last car of a train has left it. By this arrangement each length of tunnel, with its moving train, will form a sort of mammoth air pump, and the air throughout the whole system will be in a condition of constant renewal and purification. The plan proposed appears to be thoroughly practicable and simple, and no doubt it will command the attention of our Subway engineers. Of course it would be impossible to adopt this system on the main four-track road, where the tracks are only separated by lines of supporting columns; but on those portions of the road where the track lies in single tube this method could be applied, no doubt, with good results.

WEST POINT METHODS FOR SANDHURST.

It will be remembered that one of the most undisputed facts brought out by the recent South African war was that while the British officers were conspicuous for courage, many of them were woefully lacking in professional ability. The reforms which have been brought about by the war in the British army have included the appointment to the command of the Staff College at Sandhurst of Colonel Kitson, an officer well known in this country, who has always been a great admirer of West Point methods, and who, indeed, since his appointment has openly announced his determination to remodel that institution on the lines of our own military academy. Americans have always been proud, and justly so, of this famous and historic institution, and it is distinctly gratifying to know that the methods which have made this institution known the world over are to be adopted by the leading nation of the Old World. Hitherto, Sandhurst has been more a social and aristocratic institution than a military one; certainly it has never been noted for the hard work and severe curriculum for which West Point is renowned. Should Col. Kitson succeed in infusing into the pupils at Sandhurst the principles and *esprit de corps* that characterize West Point graduates he will have earned the lasting gratitude of the British nation, and will be found to have done more to promote the efficiency of the British army than any military man in England since the days of Cromwell.

A POINT IN BOILER CONSTRUCTION.

In an article in which it was shown that flaring the tubes after they have been expanded in place increases the holding power about 300 per cent, a strong plea is put in for the flaring, as against the mere expanding, of boiler tubes by our contemporary, The Locomotive. Among the many valuable full-sized tests which have been carried out from time to time by that journal, was a series to determine the holding power of tubes that were set in various ways. It was found that when tubes 3 inches in external diameter were merely expanded into the tube-sheet it required a pull of about 6,300 pounds to withdraw them, whereas it took about 19,700 pounds to withdraw those which were expanded and flared. From these data it is shown that a 4-inch tube, running under a pressure of 200 pounds per square inch, and merely expanded into place, has a factor of safety of 2.5, which our contemporary considers to be entirely too small. With the tubes properly flared, the factor of safety under like conditions would be 7.8, which is considered to be quite large enough. While it is admitted that there are many water-tube boilers that are running satisfactorily to-day with tubes that are merely expanded into place, it must be remembered that there has been a great rise in pressures of late years, and that constructions which may have been thoroughly up to the standard fifteen or twenty years ago are considerably below it in this day of pressures of 200 pounds to the square inch and upward. These conditions, we think, should render the practice of flaring the tube ends an indispensable feature of first-class modern boiler construction.

OUR FASTEST BATTLESHIP.

For the first time in its history the American navy possesses a battleship with a speed of 18 knots and over. The distinction belongs to the new "Maine," which, on August 23, was sent over the Cape Ann course for her official speed trials. The contract calls for a speed of 18 knots an hour on a run of four continuous hours. The lowest speed on any stretch of the trial was on a 6-mile leg on which she averaged only 17.35 knots an hour, while the fastest stretch was made at a speed of 18.9 knots. The result was that the mean speed developed, disregarding tidal allowances, was announced as 18.3 knots an hour. These figures, however, were made by the builders of the boat, and are subject to correction when the official results are made known. Although the "Maine" has slightly exceeded her contract speed, the result for an American warship was rather disappointing, for the reason that our battleships have been accustomed to exceed their contract trial speeds by a knot or more an hour when steaming over the Cape Ann trial course. Thus, the "Oregon" made 16.8 knots an hour, or 1.8 knots more than the contract speed; the "Iowa" showed an advance of 1.1 knot, and the vessels of the "Alabama" class are 1.1½ knots faster than their trial requirements. On the other hand, we understand that the trial of the "Maine," unlike those of some of her predecessors, was carried out under normal conditions as regards coal and stokers, and, therefore, the speed achieved is more likely to be maintained when this vessel is in regular service than that of vessels whose trials were run under abnormal conditions.

ELECTRIC GLASS SMELTING.

A large electric installation for the smelting of glass by the electric current, which is being erected at Deutsch Matrei in Tyrol, will be in working order in the course of a few months. These are the first works constructed for the manufacture of glassware by electricity; though several experimental plants have been laid down, and the electrical process of glass-making has been practised for some time past at Plattenberg in Westphalia, where there is an installation of 2,000 horse power, water and steam combined, for supplying the necessary current. The first successful attempts at glass manufacture by the aid of the electric current were made some four years ago at Cologne by F. Becker, a glass-maker. Glass-making by electricity is rather a difficult process, since there is a great danger of devitrification through the heat generated by the arc being too intense. To surmount this difficulty Becker devised an ingenious arrangement of a series of arcs, and the glass in a molten state followed into crucibles which were heated by coal or some other means. But Becker found this process of combining electrical and ordinary heat unsatisfactory. Volker, his collaborator in these experiments, suggested another process by which he to a certain extent availed himself of the conductivity of the glass. On each side of the receptacles he ranged electrodes, and by this means kept the glass in a molten condition for some time. But in this system there was the danger of the glass being deteriorated by the crumbling carbon, by which its purity was ruined, and it was rendered unsaleable. To obviate this difficulty the electrodes were placed behind perforated diaphragms. Völker also devised a system by which he could melt the glass, not with the arc, but by a direct current of high resistance, by making briquettes of the smelting materials and the carbon, and thus fusing the components. The Industrie Verriere et des Dérivés of Brussels, in conjunction with the glass works at Plattenberg, took up the invention and reduced it to practice at Plattenberg and Brussels; but at first it was not found to be a very satisfactory process. The consumption of the current was too heavy. For example, a kilogramme of glass required 4 horse-power-hours to produce it. This consumption of current, however, has now been reduced to 1½ and 1¼ horse-power-hours. The cost of production will be still further cheapened at the works of the Matrei Compagne, the electric furnaces for which are to be simpler and more durable. A potential of 3,000 electric horse power will be utilized. Whether this electric process of manufacturing glass will become of any commercial utility it is yet too early to say; but the material at present produced by the electric current has no special advantages over that made by the conventional smelting process to recommend it.

THE EMERALD INDUSTRY OF COLOMBIA.

The British Foreign Office has published an interesting report concerning the emerald mining industry of the Republic of Colombia. According to this report the finest emeralds are discovered at the mines of Muzo and Coscuez, the property of the Colombian government. They are at present rented to a British company. Up to the year 1875 all the emerald mines in the country were the property of the nation. After that date the government granted the right of exploration and working to private enterprises, reserving only the right to the two foregoing mines. Since then several companies have been formed and considerable capital expended, with very poor results. The most promising of the latter appears to be the Somondoco mines, worked by a British company. The department of Boyaca, from a mining point of view, is of a totally different geological formation to the mining departments of the republic, no gold or silver being found except in the few rivers emptying into the Magdalena.

The one great mine of production is that of Muzo, famous since the year 1555 for the production of the finest emeralds of the world, a stone, in the rough, weighing 2,330 carats having been taken from one of the many veins of this mine. These mines are the property of the Colombian government, which leases them for periods of five years to the highest bidder at public auction, which takes place in the capital of the republic one year previous to the expiration of the term in force. The value of the production of these mines has always been kept a secret by the lessors.

The mode of working is similar to that generally adopted in large quarry mines. The top soil is removed by a hydraulic monitor washing until the slate rock is left bare, this being cut away by means of stout long bars handled by native labor, which is cheap, abundant and very good, and with the aid of blasting with black powder manufactured at the mines and employed where no danger can be done to existing veins. The precious stones are then extracted from the veins, which run in no given direction or angle in this slate rock formation. The stones are found chiefly in pockets, but occasionally some are found isolated from the veins, necessitating constant care and vigilance. The immense amount of debris which necessarily falls from the quarry, is carried away by means of discharges of water from reservoirs at an elevation above the workings. The flow of water is regulated automatically, great care being taken conveniently to direct this great discharge of water so that no damage may be done to existing productive veins. The short term of the lease does not admit of any very extensive system being adopted, (as for example, at the Kimberley diamond mines in South Africa,) to prevent stealing of the stones, but special care is taken in the selection of the workpeople, who, in turn, watch most carefully all operations on the banks. The stones, after extraction, are arranged in their respective classes, ranging from first to sixth quality, by the superintendent in charge, who forwards them insured to the markets.

The major portion of the stones are sent to British India to be cut, and afterward the better qualities to the markets of Europe for sale.

The theory of the genesis of the emerald is that the silicate of glucina and alumina ran in the fissures of the veins and their cooling off formed this particular hexagonal crystal, and according to its abundance produced greater or less quantity, as also the quality, according to the favorable or unfavorable conditions existing. The Coscuez group is said by tradition to be very rich and the quality of the stones said to be of the particular "canutillo" form and of superb quality. Many attempts have been made to find the actual "locus in quo" of the productive formation, but up to the present without success.

Recently, however, an emerald producing formation of great importance has been discovered by the aid of old Spanish parchments in the Somondoco district, locally known by the name of Chivor, but as yet has not been worked by the discoverers; at present only the old Spanish tunnels and workings, indicating that in past centuries great mining operations had been carried on there, have been overhauled, giving proof of the existence of emeralds of considerable crystallization. It is intended to open up these extensive workings, so long lost to the world since the suspension of the works by order of the King of Spain in the year 1792, owing to the fact that all the emerald properties, Muzo and Coscuez included, produced a loss and not a profit to the kingdom of Spain. This was due to the dishonesty of the captains of the mines, who, by law, were obliged to deliver the fifth part of the production to the King of Spain in return for the assistance afforded to them by the Royal House in the form of troops and ammunition to protect them from hostile tribes. It was during this suspension that so many mines were lost sight of and completely overgrown with tropical vegetation, as were also the bridle-paths which led to them through the forests and mountains. Even towns with 2,000 inhabitants dependent on the mines were abandoned; some have been rediscovered by accident, a hunter coming upon a paved street, or some stone foundations of a house. The Spaniards always built their houses with stone foundations. Among these lost towns Muzo may also be counted. At one time it boasted of seventeen churches and a large population. To-day there is one church and only about 300 people. It is interesting to note that, with one or two exceptions only, all the mines of any worth now being worked were known to the Spaniards, and in the majority of cases considerable workings are evident.

THE HEAVENS IN SEPTEMBER, 1902.

BY HENRY NORRIS RUSSELL, PH.D.

As the sun moves southward, and the shortening days bring the coolness of autumn, it seems appropriate to inquire: What is the nature of this immense supply of heat? By actual measurement (allowing for the heat absorbed by our atmosphere) it is found that the heat received by the earth under a vertical sun is enough, if all of it could be utilized, to run a one horse power engine for every four square feet of exposed surface. On account, however, of the absorption of heat by the air and the great mechanical losses in any form of heat engine, not 10 per cent of this power can be put to practical use. Nevertheless the energy is there, though we cannot harness it.

Now the cross-section of the earth, as seen from the sun, is about 1,200 million million square feet. So the rate at which the sun expends energy in warming the earth amounts to about 300 million million horse power.

But this is not all. If there were a number more planets each as large as the earth and at the same distance from the sun, they would form a close-packed spherical shell inclosing the sun completely, and intercepting all its radiation. This sphere would be 186,000,000 miles in diameter and would contain over 2,000,000,000 planets. The total radiation of the sun must then be 2,000,000,000 times what the earth receives. The corresponding number of horse power is about 600,000,000,000,000,000,000,000—a number quite beyond our power to grasp. It amounts to over 10,000 horse power for every square foot of the sun's whole surface.

What can supply the sun with this enormous amount of energy?

If the sun's heat was not kept up in some way, calculation shows that it would cool off entirely in a very few thousand years. Even if it were all composed of the best of fuel, its combustion would only keep it radiant for five or six thousand years more.

A satisfactory explanation has been given by Helmholtz, who assumes that the whole mass of the sun is slowly contracting. The mass of the descending layers and the force of solar gravity that acts on them are so great that a very large amount of heat is evolved by the process. His calculations show that the whole amount of the sun's radiation in a year would be accounted for by a decrease of 250 feet in the sun's diameter. The whole shrinkage of the sun in the 300 years since the invention of the telescope would be about fifteen miles. Twenty times as great a change could hardly be detected by the best modern observations. So we shall have to wait a few thousand years before any evidence of this shrinkage can be obtained by observation.

THE HEAVENS.

At 9 P. M. on the 15th Cygnus is overhead. Lyra lies to the west of it, then Hercules, Corona and Boötes, the last near setting. Ophiuchus and Serpeus are in the southwest, and Scorpio is setting there. Sagittarius is west of south. Jupiter is just due south, and Saturn is an hour west of him. Between them, and a little distance above, are the two double stars of Capricornus—both worth looking at with a fieldglass.

Aquila is above them, marked by the brilliant Altair, east of which is the little group of Delphinus. The southeastern sky is very dull, the only bright star being the lonely Fomalhaut, in the constellation of the Southern Fish, low down near the horizon.

Pegasus and Andromeda lie east of the zenith, with Aries and Perseus below and to the left. Capella is just rising in the northeast. Cepheus is above the Pole, Cassiopeia to the right, and Ursa Minor and Draco to the left of it, while Ursa Major is well down toward the northern horizon.

THE PLANETS.

Mercury is evening star throughout the month. On the 24th he is at his greatest elongation, but being south of the sun, sets less than an hour after sunset, and is, therefore, hard to see. On the 20th he passes close to the bright star Spica, their apparent distance being less than ¼ of a degree. This will be an interesting sight, though one must look sharp to see it in the twilight.

Venus is morning star, rising rather less than two hours before the sun. Although 150,000,000 miles distant, she is still the brightest of the planets. Mars is morning star in Cancer, rising about 2 A. M. in the middle of the month and gradually increasing in brightness.

Jupiter is in Capricornus, and is by far the brightest object in the evening skies. Saturn, which is in Sagittarius, comes next to him in this respect.

Uranus is in Ophiuchus. On the 10th he is in quadrature with the sun, and comes to the meridian at 6 P. M.

Neptune is in Gemini, and is also in quadrature with the sun on the 27th, being due south at 6 A. M.

THE MOON.

New moon occurs at noon on the 1st, first quarter at noon on the 9th, full moon at 1 A. M. on the 17th, and last quarter at 6 P. M. on the 23d. The moon is nearest us on the 19th and farthest away on the 7th. She is in conjunction with Mercury on the 3d, Uranus on the 9th, Saturn on the 12th, Jupiter on the 14th, Neptune on the 24th, Mars on the 27th and Venus on the 30th.

At 7 P. M. on the 23d the sun crosses the celestial equator, entering upon the sign of Libra, and, according to the almanacs, autumn commences.

THE SUPPLANTING OF AGRICULTURE BY CHEMISTRY.

Senator Berthelot, the well-known French chemist, has published an interesting paper anent the chemical synthesis of aliments, in which he foresees in the difficulties it still presents the economical emancipation of the human race, and the transformation of this planet into a vast pleasure ground. The more the conquest of electrical energy advances the nearer it appears to M. Berthelot that mankind approaches toward the substitution of chemistry for agriculture.

Just as agriculture was evolved from the hunting, fishing and pastoral stages of primitive mankind, so chemistry now sets up to displace with its products agricultural industries based on the production of living organisms, animal and vegetable, by the creation of nutritive matters. The farm is already being edged out by the factory, and engineers and mechanics will soon take the place of peasants and field laborers. It is not long since the possibility of creating by synthesis all the organic matters was held to be chimerical; now the possibility has been demonstrated so often as to render it undeniable. Alimentary stuffs may be broadly divided into three fundamental classes —fats, sugars and albumenoids. As early as 1854 M. Berthelot by chemical synthesis created bodies exactly similar to natural fats by means of substances related to them, namely, glycerine and acid. He also generated these two substances with hydrocarbons. Sugar can now be produced in the chemist's laboratory by similar combinations. Chemical synthesis has not yet created the albumenoids, which are more complex and more liable to spoil. There is no doubt, however, but this feat will shortly be accomplished. Chemical discoveries have already given rise to changes in agriculture. Madder has gone out of cultivation in the south of France, indigo in the West Indies and vanilla in other tropical places, owing to the chemical substitutes, and chemical foodstuffs are no more an impossibility than chemical dyestuffs. M. Berthelot, however, utters a note of warning against the illusion of thinking that food can be condensed into lozenges and pills, and that one's meals can be carried in a small chocolate box in one's waistcoat pocket. The human organism has its habits which are tantamount to necessities, and among its habits is that of burning from 250 to 300 grammes of carbon daily, and of eliminating from 15 to 20 grammes of nitrogen. Allowance must also be made for the waste in the body of about one-seventh of the food it consumes. A certain bulk or weight of food will, therefore, continue to be indispensable, and though this may be chemical food it is not likely ever to become so condensed that a man can carry a week's rations on the march without inconvenience as is sometimes suggested.

ANOTHER GREAT HYDRAULIC ELECTRIC POWER PLANT.

A company has organized in Los Angeles to build a large power plant on the banks of Feather River. This plant will be the largest electrical power development scheme yet undertaken or proposed in western America, and will rival that of the Niagara power plant. It will be located in Plumas county, Cal., from which point current will be transmitted to San Francisco, a distance of 180 miles. The water supply is to be obtained from the North Fork of Feather River, and impounded in two reservoirs of unusual size, one of which will cover 8,000 acres, and the other, in Butte Valley, a few miles distant and some 250 feet lower, will cover about 2,000 acres. The watershed area tributary to these reservoirs is about 600 square miles, on which the most prominent elevation is Lawson's Peak, a region of perpetual snow. The average rainfall of that region for the last twenty years has been about 67 inches, and for the twenty years previous to that about 70 inches, with a range of from 33 inches as a minimum to 103 inches as a maximum.

It is well known that Feather River is the largest tributary of the Sacramento, and only second to the Sacramento in discharge of any of the streams of the State, while the greater portion of the flow of the Feather comes from the watersheds tributary to the reservoir sites purchased by the new company. These reservoirs, when constructed, will be without parallel in the western half of the United States, and will be so designed as to equalize the flow of the stream available for power to about 1,500 cubic feet per second. From the main reservoir in Big Meadows it is proposed to construct a canal about 10 miles in length to the Butte Valley reservoir, the water being delivered into this reservoir, whence it will be carried along the edge of the canyon of Feather River by a series of tunnels for a distance of 5 miles to Mosquito Creek, where it will be given a vertical fall of 1,600 feet, producing a total of about 270,000 horse power.

The favorable character of the dam sites for these reservoirs and the absence of serious engineering obstacles on the conduits will render this enormous undertaking comparatively inexpensive and vastly cheaper per unit of power than any other power plant yet constructed in the West. It will enable the company to deliver the power even at the long distance of transmission contemplated, in successful competition with other plants. When it is remembered that the total development of power at Niagara thus far has not exceeded 100,000 horse power, a better conception of the magnitude of this new enterprise and its possibilities may be had. A corporation has been organized, to be known as the Western Power Company, with an authorized capital of $5,000,000, whose headquarters will be Los Angeles.

The feasibility of transmitting electricity over 180 miles has been fully demonstrated. Only a short time ago the Bay Counties Power Company completed connections with San Francisco over lines of the Standard Electric Company, and is now transmitting power to that city via Oakland around the head of San Francisco Bay with a pressure of 40,000 volts over a distance of 223 miles.

WHERE WOOD ENGRAVING ORIGINATED.

Much controversy was at one time excited about the country that could claim to have originated wood engraving. A very simple process was known to the Egyptians for the production of stamps, and it has been asserted that the Chinese printed from blocks of pear tree as early as the tenth century. The independent origination of the art has been generally credited to Germany among modern nations. In the Cologne district a St. Christopher, which has often been reproduced, was cut in 1423, a St. Sebastian in 1437, and a Madonna has been dated 1418. Playing cards were, however, in use in France in the middle of the fourteenth century, and the figures were impressions from wood blocks. It is allowable for France to dispute the priority of Germany, and many attempts have been made to claim the art as due to French enterprise. M. Henri Bouchot, of the Bibliothèque-Nationale, now declares that a part of a block with a representation of a Crucifixion has been discovered in a country town of France. The costumes are evidently those worn in the middle of the fourteenth century, and it is assumed that the wood block belongs to some time between 1340 and 1350.

NEW TEN-WHEELED PASSENGER ENGINE.

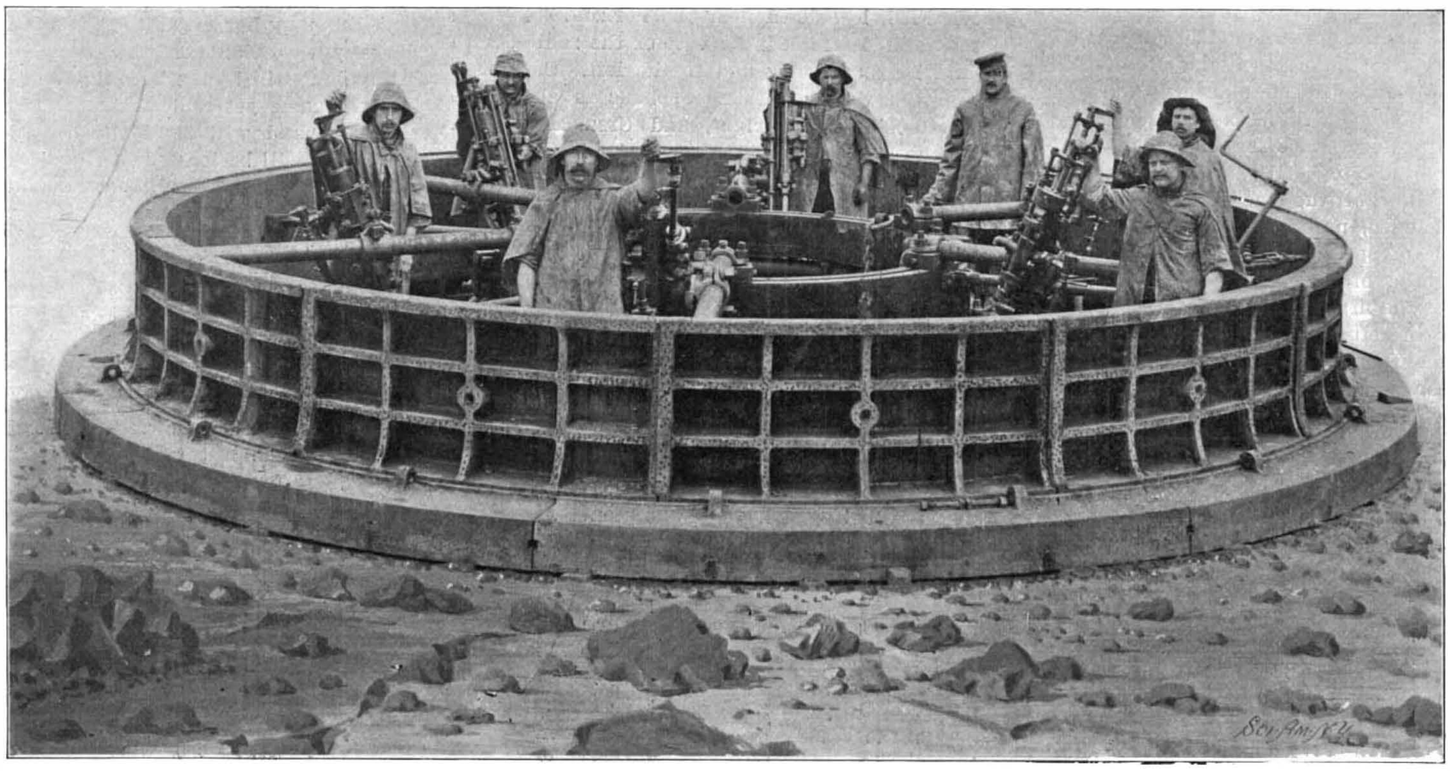
There have lately been built for passenger service of the Central Railroad of New Jersey twenty-five powerful and handsome locomotives. It will be seen from our illustration that No. 624 (one of the consignment) is of the six-coupled, ten-wheeled type, with wagon top, wide-firebox boiler, and a standard two-truck tender. There are a great many points of excellence in the design of this engine for the service in which it is to be engaged. The peculiarity of its contour, with two separate cabs, one for the engineer forward of the firebox, and another for the fireman in the customary position at the back of the boiler, is due to the fact that the boiler carries the wide firegrate designed to burn fine anthracite coal, and the great bulk of the firebox renders it advisable to place the engineer forward over the barrel of the boiler, where he has an unobstructed view. The unusual area of the grate, 67.7 square feet, is obtained by carrying the firebox out laterally over the rear pair of drivers. Its dimensions are: Length, 109 inches; width, 91 inches; depth at the front, 59½ inches, and at the back, 46 inches. It is provided with both rocking and water-tube grates, and the box is radially stayed to the outer shell.

The barrel of the boiler is 60⅞ inches in diameter at the front and 69⅜ inches at the throat. It is built of steel varying from ½ inch to 11-16 inch in thickness. There are 282 charcoal-iron tubes, 2 inches in outside diameter, the length over tube sheets being 13 feet 10⅛ inches. The heating surface in the firebox is 156 square feet and in the tubes 2,031 square feet, making a total of 2,187 square feet. The weight on the leading wheels is 41,000 pounds and on the driving wheels 120,000 pounds, making a total weight of 161,000 pounds. The weight of the tender loaded is 106,000 pounds. The cylinders are 19 inches diameter by 26 inches stroke and the drivers are 69 inches in diameter. The steam ports are 24.2 inches in length by 2 inches in width, and the least area of the exhaust is 65 square inches. Piston valves are used. They have a greatest travel of 5⅜ inches; a steam lap (inside) of 1⅛ inches, and a lead in full gear of 1-32 of an inch. The working pressure is 210 pounds to the square inch. The engine is of a decidedly handsome and imposing appearance, which is due partly to the great height of the boiler, whose center is 9 feet 5½ inches above the rail. We are indebted for our information to the American Locomotive Company, at whose Brooks Works this handsome engine was constructed.

A NEW SYSTEM OF SINKING SHAFTS.

FROM OUR ENGLISH CORRESPONDENT.

A short while ago we described in the Scientific American the ingenious freezing process for boring shafts through sandy soil. We illustrate herewith another method applicable to all kinds of soil from sand to rock, which has been devised by the Hardy Patent Pick Company, of Sheffield, England, and which has already been submitted to practical tests with highly satisfactory results.

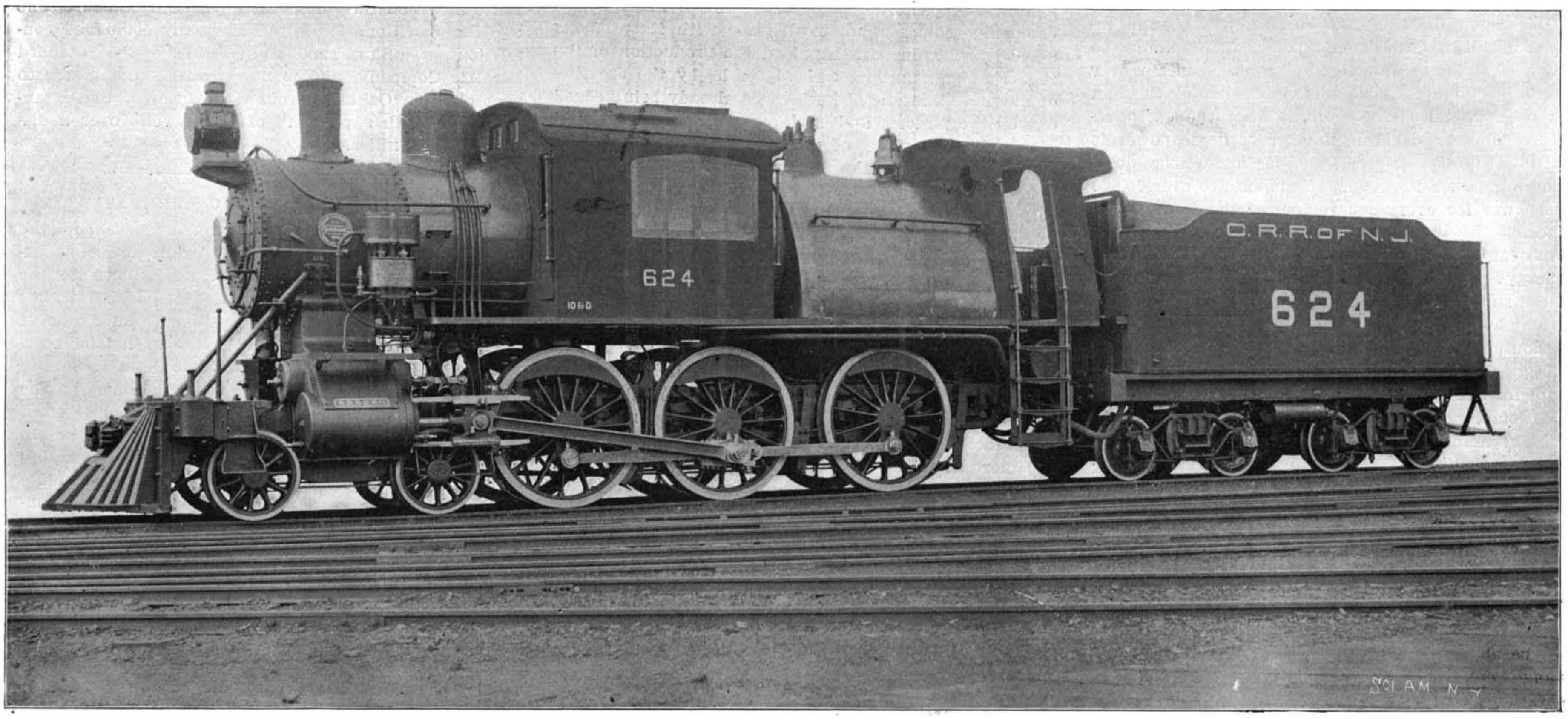


A NEW SYSTEM OF SINKING SHAFTS.

It is a curious fact that there have been comparatively few developments in the process of shaft sinking, either to minimize the cost of the undertaking or to expedite its progress. Yet the sinking of shafts must always necessarily be accompanied by enormous initial expenditure, such as the installation of surface plant. The process of sinking almost universally adopted, however, is either by the hammer and pick system, or by boring machines, and as a matter of fact under certain circumstances even now the latter process, although slow, cannot be equalled; but where rock or hard ground is encountered even the machine boring process becomes a very expensive and protracted operation. The appliance illustrated herewith is a decided improvement, in the way of utilizing a mechanical plant for shaft sinking, and in the north of England where it has been employed it promises to supersede all other methods of shaft sinking. The three most noteworthy characteristics of this invention are the speed of boring, the comfort and absolute immunity of the men working within the shaft from accident, and a decided minimizing of the risks generally incurred in such work.

Our illustration will supply a very comprehensive idea of the general appearance of the appliance. Two shafts each 25 feet 6 inches in diameter are at present being bored by this machine at a colliery at Mansfield, Yorkshire, and a description of the plant being used will supply a very good idea of its operation.

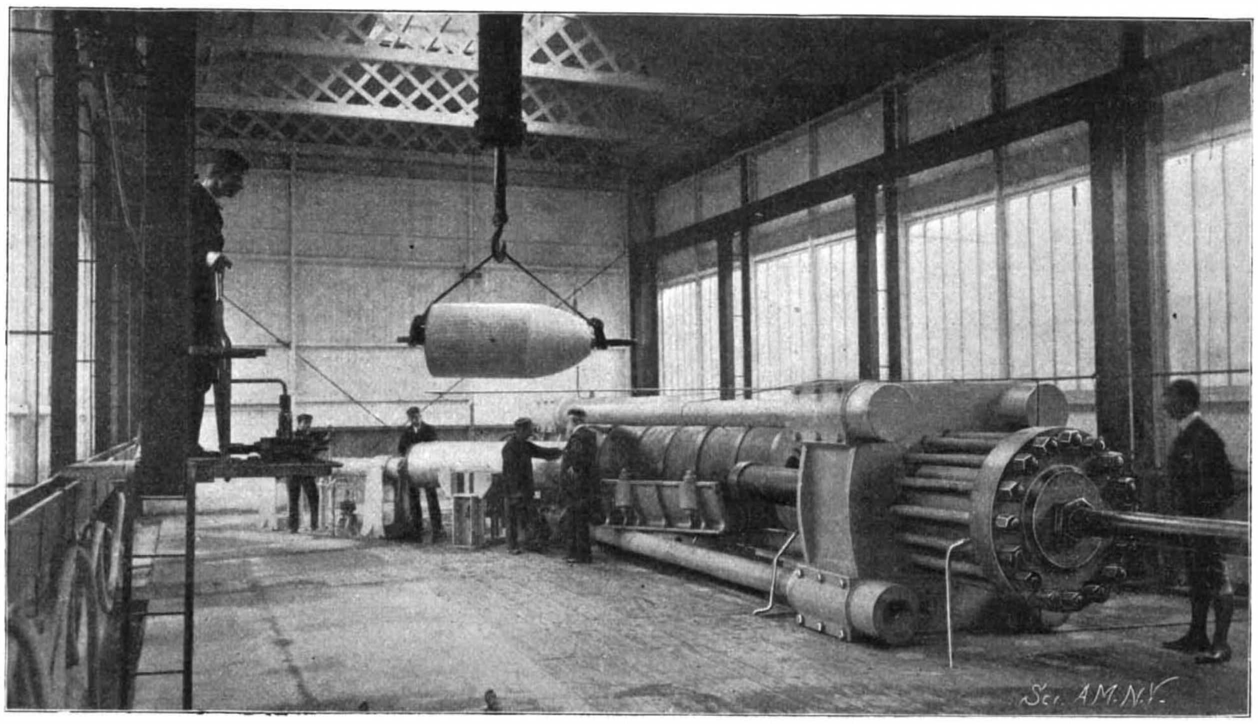
A circular steel frame, 8 feet in diameter, has cast in its entire circumference an annular tee-slot. Fitted in this slot are suitable clamps, each carrying telescopic arms, projecting so that the diameter over such arms corresponds approximately with the diameter of the shaft to be sunk. Upon these arms are mounted an improved form of compressed air drill, preferably two on each arm. This plant is put together complete on the bank and lowered by means of winch and guide ropes to the bottom. It will, therefore, be seen that the whole of the drilling plant can be lowered at once, and raised again after the completion of the boring, thus abolishing the slow and tedious methods of clearing the pit bottom. In fact, from the time of rapping to the lowering and starting of eight drills in the bottom, less than ten minutes have elapsed. This, however, is not the only feature in connection with the frame. Its circumference is so indexed that any number of holes may be drilled mathematically correct without the trouble of marking out, an item which has hitherto been of very serious moment, involving loss of time. Reducing this to actual figures, it may be taken that a round of 60 holes, 6 feet deep, can be drilled through hard limestone (25 feet 6 inches diameter) and the gear raised to the bank in two hours and a half, a result which we venture to think has never before been approached. In combination with the sinking frame a new form of scaffold has been introduced, by means of which bricking, or tubbing, can be carried on at the same time as the sinking. After a suitable spot has been found for the first



Cylinders, 19x26 inches. **Drivers,** 69 inches. **Heating Surface,** 2,187 square feet. **Weight,** 161,000 pounds.

NEW TEN-WHEELED PASSENGER ENGINE FOR THE CENTRAL RAILROAD OF NEW JERSEY.

crib, and the cribbing ring laid in, the circular scaffold is so lowered that it is slung immediately inside the crib, and between it and the crib a stout rubber tube is provided which, being connected with the compressed air main, may be inflated, thus making an absolutely water-tight joint, compelling all the dropping water to flow to the crib channel, and thence to the pump sump. The circular opening to allow the free passing of the hoppet, is fitted with automatically closing doors, so that when the hoppet is above the scaffold, there is not only a complete floor for the bricklayers, but a dry and protecting roof for the sinkers.



PRESSING AND MOLDING GUNCOTTON IN SOLID BLOCKS OF HIGH DENSITY BY THE HYDRAULIC PRESS.

Another important point is the advantage obtained by the guide ropes for the sinking frame. These serve as a steady for the hoppet when being lowered, thus abolishing all risk of a swaying rope when the banksman has improperly signalled for lowering. The motive power for driving the apparatus is compressed air. Experiments have been tried with electricity, but this motive power has not given very great success, while steam of course is out of the question. But the utilization of air serves a dual purpose; for since approximately 100 cubic feet of free air may be discharged from each drill in the bottom, it will be seen that the atmospheric conditions for the workmen are always highly satisfactory; a very important factor in shaft sinking

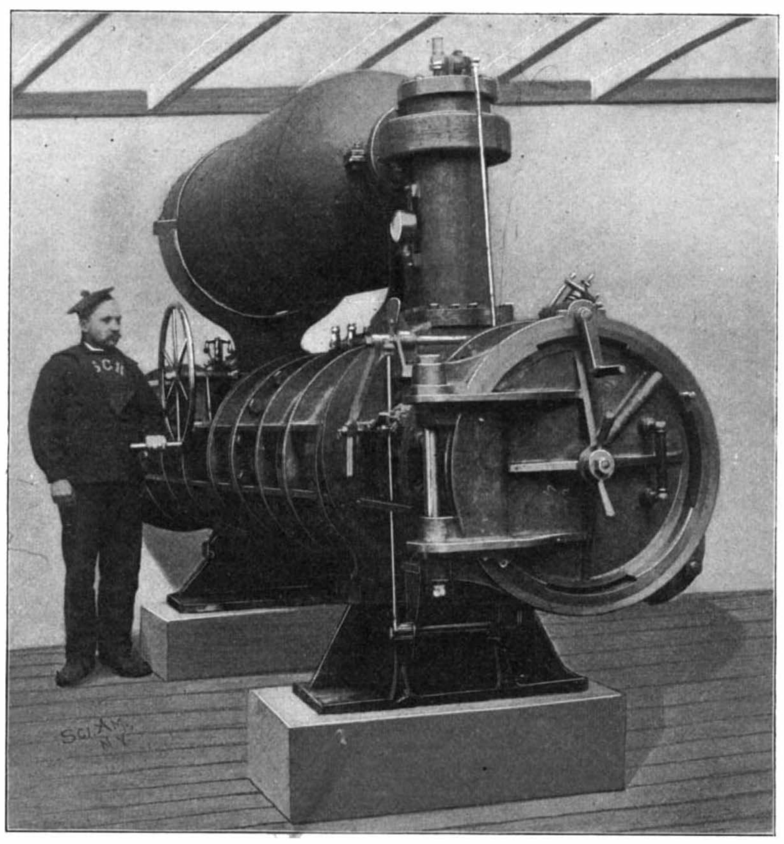
The rapidity of boring naturally fluctuates with the nature of the soil to be penetrated; but through hard limestone a speed of 30 feet per week 25 feet 6 inches diameter has been attained, with an average (including all stoppages) of 22 feet. In the softer and coal measures power drills are unnecessary and hand drills may be applied to the frame and the proportional speed of sinking equally well maintained. Another noticeable feature of this contrivance is that when the desired depth has been reached the greater part of the plant may be efficiently used for driving and general purposes.

SCHNEIDER-CANET LAUNCHING APPARATUS FOR SUBMARINE TORPEDOES.

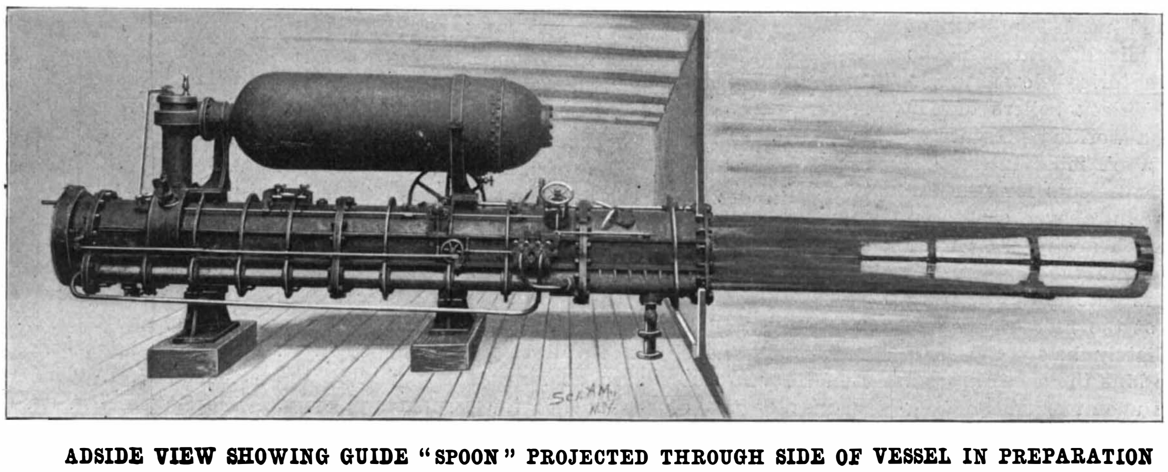
The Schneider-Canet torpedo launching apparatus consists essentially of a tube or barrel, a guiding spoon or bar, and a launching reservoir.

The tube proper is formed of a cylinder fixed to the side of the vessel and closed at one end by a gate, or valve, and at the other end by a breech-block. In this tube the spoon is arranged to slide, and is grooved to form guides for the torpedo.

This spoon is formed with a cylindrical portion and with a semi-cylindrical portion. The latter portion is formed with openings to permit the passage of the liquid, in order to regulate the pressure as much as possible on the entire surface of the torpedo at the moment of launching. The spoon is operated by means of a hydrostatic ram situated at one side of the tube. When the spoon has been run out, the launching of the torpedo is effected by means of compressed air, contained in the reservoir which is seen situated above the tube.



TORPEDO DISCHARGE TUBE; VIEW SHOWING BREECH CLOSED READY FOR FIRING.



ADSIDE VIEW SHOWING GUIDE "SPOON" PROJECTED THROUGH SIDE OF VESSEL IN PREPARATION FOR LAUNCHING A TORPEDO.

The gate being closed and the tube empty, the torpedo is launched in the following manner: The breech is opened; the torpedo introduced; the breech closed; the gate or valve opened; the spoon ejected; the torpedo launched; the spoon returned; the gate or valve closed; the tube is emptied, and the necessary precautions taken to prevent improper operation of the mechanism.

The necessary steps preceding the actual launching can be taken beforehand so that the torpedo can be ejected at any given moment or at command.

The principal merits of this system are the following: First, simplicity of construction; second, durability; third, trustworthiness and regularity of launching; and finally, exact estimation of the time of launching by reason of the operator's precise knowledge of the volume and the pressure of air.

HYDRAULIC PROCESS FOR MANUFACTURING GUNCOTTON CHARGES.

A new process of manufacturing guncotton charges for torpedoes, shells, submarine mines, etc., has been devised by the New Explosives Company, Ltd., of Stowmarket, England. Large charges are made by hydraulic pressure in a single homogeneous block, instead of being built up of a number of small segments. Hitherto it has not been possible to make a block exceeding a maximum weight of 9 pounds or over 2 inches in thickness in one piece. For instance, the number of small sections contained in the guncotton charge of an 18-inch Whitehead torpedo is about one hundred. The introduction of the hydraulic process has involved several important changes in the manufacture of the guncotton, particularly in the working up of the pulp, by which means all air is forced out of it. Several safety devices are introduced into the hydraulic machinery, by means of which all danger of detonation is absolutely obviated.

The guncotton pulp is first placed in a vertical cylinder made of finely-perforated sheet metal surrounded by a strong casing. Here all air that may be contained in the pulp is removed, which is a most important essential in the manufacture of the charge. A vertical shaft, equipped at the lower end with a small propeller-like screw and numerous agitators, fixed to a sleeve mounted to rotate independently of the propeller, descends into the vessel, and thoroughly disintegrates the pulp. The shaft not only revolves, but works up and down, so that the pulp is tightly compressed. By this means, all the water is forced out and it carries the air with it, through perforations in the cylinder. The cylinder is fixed to a table which has a perpendicular travel actuated by a screw. As the kneading proceeds and the charge is formed, the table leaves the screw, but the same pressure is excited by the agitators and propeller, and even distribution of the pulp is preserved throughout the charge, no matter what its length may be. One important point that has to be observed in the manufacture of the charge by this process, is that once the agitators have been set in motion, they must continue without cessation until the charge is finished; for should a breakdown occur, the agitators when restarted would cause a plane of cleavage in the block, which would subsequently result in a break at that point.

The accompanying photograph illustrates the machinery employed for the compression of the larger charges of guncotton. With this press blocks 2 feet 6 inches in diameter and 3 feet 6 inches in length can be produced. Moreover, the specific gravity of the guncotton is appreciably increased, being 1.523 as compared with the previous maximum gravity of 1.4. The perforated container in which the guncotton is placed is held within an outer holder, between which is a space for the admittance of water under pressure, which prevents the pulp being forced through the orifices in the container, and also acts as a lubricant when the guncotton is forced out of the container into the mold where the guncotton is forced into its desired ultimate form, by the hydraulic ram. The container, with its charge of guncotton, is attached on a cradle, fixed at an angle to the center line of the press. At the back of the container is a side hydraulic ram, which forces the guncotton from the container into the mold mounted on a swiveling carriage. The mold is constructed with an inner lining, divided longitudinally into two or three sections surrounded by a jacket, also in longitudinal sections, but more numerous than in the case of the lining. Outside this jacket is a thick casing, wire-wound to insure extra strength. Both the lining and its jacket are perforated to drain off the water, which escapes into annular channels provided between the jacket and the wire-wound casing. Provision is made, in case of an expansion of the guncotton charge, when the compression ceases, for permitting water to be absorbed by the guncotton instead of allowing the air to enter.

As soon as the guncotton is forced into the mold it is turned round, so as to come in line with the rams of the press. The lining and its jacket project slightly at one end and rests against the head of one ram, while an annular ring placed over the projecting lining and casing against the outer casing, rests against a corresponding annular ring attached to the head of the same ram. The guncotton is then compressed between the two rams. This operation completed, the rams are withdrawn, and the mold swung into alignment with the side ram, which forces it out onto a cradle.

There is one serious danger in connection with this process of hydraulic compression, which is, however, ingeniously guarded against. There is always the liability of a few fibers of the guncotton adhering to the side of the mold. The friction of the ram against the inside of the mold might ignite these particles when dry and detonate the entire charge within. To guard against such a possibility the head of the ram is grooved spirally, and at the bottom of the grooves are numerous fine perforations, through which water is forced, while similar orifices are provided in the face of the ram itself. This water acts as a lubricant and prevents particles of guncotton adhering to either the ram head or the mold, or if any fibers should so adhere they are kept in a wet condition. The great advantage of this system of manufacturing solid blocks of guncotton charges to fit any desired torpedo or shell is the saving of space within the missile. It has been proved that by this method about 15 per cent more guncotton can be contained within a specific area than with segment charges. Also, as the density is uniform throughout the block, detonation is far more perfect. According to results so far achieved, the cost of manufacturing is reduced by 25 per cent.

THE NEW YORK EDISON POWER STATION.

In few branches of steam and electrical engineering have the great advantages of concentration been so completely realized as in the mammoth power stations which are being built in the city of New York. The largest of these, at the present time, is the magnificent plant at the New York Edison power station which, when the whole of it has been installed, will have a maximum capacity of 125,000 horse power. A visit to a station of this kind teaches more in a half-hour regarding the remarkable advancement of the United States in mechanical and electrical engineering than can be gained in a whole day's study of the literature of the subject; for this vast aggregation of boilers, mechanical stokers, mammoth engines and generators, and all the thousand-and-one accessories with their endless devices for labor-saving, represents one of the very latest phases of our twentieth century development. With a view to making clear the general arrangement of the power house, we present, on our front page, a large sectional view through the engine room and boiler house, and also a diagram showing the means by which coal is taken up from barges in the river and carried to the 10,000-ton bunkers in the roof of the boiler house.

The power house, which occupies the block between 38th and 39th streets, First Avenue and the East River, extends 197½ feet north and south, and 272½ feet east and west, the western façade of the building fronting on the East River. A dividing wall extends longitudinally through the building, separating it into a boiler house 79½ feet in width and an engine house 118 feet wide. The boiler house is divided into four stories. In the roof of the building is a huge coal storage bin, capable of holding 10,000 tons of coal. The sides of the bin, which are carried on deep lattice girders, slope at an angle of 45 degrees to the floor, the weight of the structure with its load of coal being carried upon the side walls and upon two lines of columns which extend longitudinally through the building, as shown. The next two stories below are occupied by fifty-six Babcock and Wilcox boilers of 650 horse power, which are run at a working pressure of 175 pounds to the square inch. A most interesting feature of the plant is the arrangements for mechanical stoking. From the coal bin above, sheet-iron chutes lead down to hoppers which are placed on the fronts of the Roney stokers. From the hoppers the coal is fed by mechanical stokers onto the grate bars. The ashes fall from the grate at the rear of the furnace into bins located immediately below the floor of each boiler room. From the bins the ashes are led by chutes to ash cars which run upon tracks extending the full length of the basement.

One of the most spectacular features of the plant are the four great steel-plate stacks, each of which is 17 feet inside diameter, and extends to a height of 200 feet above the grate bars. These stacks are built of steel and lined internally with brick, the weight of each chimney being about 500 tons. The steel varies from ⅝ of an inch in the lowest portion of the chimney, to ½ an inch at its middle section, and ⅜ of an inch in the upper third. The lining of the lower third is of firebrick, and the rest of the chimney lining is red brick.

When every unit of this great plant is installed there will be sixteen Westinghouse-Corliss engines of 8,000 indicated horse power. Each engine will be direct-connected to its generator, and the units will be arranged down the building in two long lines of eight each. At present eight of the engines are installed and two are nearing completion. The other six will be added from time to time, as the business of the company calls for them. When running at 70 revolutions per minute, under 175 pounds steam pressure, the most economical capacity of each unit will be about 5,500 indicated horse power, but they will be capable of working up to a maximum of 8,000 horse power. The engines, which are exceedingly handsome specimens of the engine builder's art, are of the compound, vertical, three-cylinder type, with the high-pressure placed in the center and the two low-pressure cylinders on either side. The crank-shaft is built up in three forged sections with a 10-inch axial hole, which is reduced to 8 inches at the crank cheeks. The cranks are so arranged with regard to each other as to secure as even a turning moment on the shaft as possible. With a stroke of 5 feet at 75 revolutions, the piston speed is 750 feet per minute. The steam enters the 43½-inch high-pressure cylinder through a 14-inch throttle valve, thence it passes to a reheating receiver of about 4¼ times the displacement of the high-pressure and 7-10 the combined displacement of the two low-pressure cylinders. From the 75½-inch low-pressure cylinder the steam is led by 26-inch mains to the surface condensers, of which there is one to each engine. As shown in the drawing, they are located in the basement, each beneath its respective engine. Each of them contains 3,752 ¾-inch brass tubes, which give a cooling surface of 9,200 square feet. A point of interest in these engines is that they are the first engines of great size to be equipped with poppet valves, which were adopted because they lend themselves to the use of superheated steam. This form of valve lifts from its seat without any rubbing friction and, therefore, it does not involve those difficulties of lubrication which are often so troublesome when superheated steam is used. The low-pressure cylinders have double-parted Corliss valves. By means of a mechanical adjustment of the governor, which can be made while the engine is running, the speed of the latter can be varied at any time. In addition to this there is an electrically operated device for controlling the speed from the switchboard, for the purpose of synchronizing the alternators that are operated in parallel.

The fly-wheel is of cast steel in five segments, consisting of two arms and 72 degrees of the rim, which are joined by I-links, shrunk into pockets in the sides, the links being bolted to the hub. The generator armature is pressed onto the shaft beside the fly-wheel, and in addition to being keyed to the shaft, is bolted direct to the fly-wheel hub. The outer end of the generator shaft is supported by a heavy pedestal, as shown in our engraving. The total weight of the main shaft, which is 29 inches in diameter at the bearings, is 136,000 pounds.

We have spoken of the many labor-saving devices by which the operation of this vast plant is carried on expeditiously and at a minimum cost. Of these the most important is the system of bucket conveyors and elevators by which the coal is transported from the East River to the big storage bin. The coal is brought alongside the company's dock, opposite the eastern façade of the building, in barges, from which it is raised by a grab bucket operated from a cantilever conveyor derrick, and after being dumped into a screen, falls into an endless conveyor that carries it to the boiler house. Here it is unloaded into a vertical conveyor, by which it is taken to the roof of the boiler house and distributed through the length of the coal bin, which extends for 270 feet. A similar automatic disposal is made of the vast amount of ashes which is continuously being dumped from the ash pits of the boilers. The coal-handling apparatus is shown in detail in the sectional view in our front page engraving. For our information we are indebted to the engineers, Westinghouse, Church, Kerr & Co.

The University of Cincinnati has ordered from Alvin Clark & Sons, the famous telescope makers, a 16-inch refractor. The objective will be figured by C. A. R. Lundin, who has played so important a part in the success of the Clarks during the last thirty years. Ever since the death of Alvin G. Clark, Mr. Lundin has figured the large telescopes.

Correspondence.

George M. Hopkins.

To the Editor of The Scientific American:

In the death of Mr. George M. Hopkins science has suffered a great loss. By his pen and handicraft he had instructed a larger class than any professor in his lecture room and laboratory has the opportunity to teach. By his books and articles he reached many thousands and his printed words will still continue to inform and instruct multitudes to whom he will be only a name.

The leading characteristic of Mr. Hopkins' work was its genuineness. He printed nothing unless he had demonstrated its truth by actual experiment. His numerous designs of apparatus for the illustration of physical principles were all wrought out, mostly by his own hand, for he was a skillful mechanician, before they were given to the world. Many a time he came to me, saying: "I suppose you have always known this, or have always done this in this way, but I thought of it the other day, and wonder if it is new." He would proceed to show me some ingenious device which, so far as I knew, was novel. It certainly was original. It was in this way that his widely used "Experimental Science" was produced. Everything was tried before it was inserted. The book contains the results of his thinking and patient working for many years.

A controlling trait of Mr. Hopkins' character was his simplicity. In the scripture sense he was simple, a man without guile. He envied no one the most brilliant discovery. At the same time he desired to be protected in his own. The only person of whom in many years I ever heard him speak with impatience was one who had, as he thought, published without acknowledgement something he had obtained from him. His keen sense of honesty and fairness forbade such conduct.

Mr. Hopkins had numerous friends among scientific men of the vicinity in which he lived. For a number of years before the reorganization of the Brooklyn Institute upon scientific lines, there was in Brooklyn a club of men whose interests and occupations drew them together in scientific study. Of this club Mr. Hopkins was the sole officer, and the only one it ever had. The club ultimately became the Department of Microscopy of the Brooklyn Institute, he going with it into that organization. For several years he had been a sufferer from nervous disorders, and had been but little among his scientific friends. During this time he had, however, not been idle.

The suddenness of his exit from this life has terrors for some, but we are sure it had none for him.

A Personal Friend.

New Automobile Records.

On August 23 an automobile race was run on the Brighton Beach track under the auspices of the Long Island Automobile Club. The steam-carriage built by a Harvard student, George Cannon, naturally attracted the most attention. The record which it made of 1 minute 7 3-5 seconds for the mile, eclipses all records made by steam vehicles over any track or road. The best previous record for the mile on a track was held by T. E. Griffen, and was made at Chicago, the time being 1 minute 38 seconds. The best record on a straight-ahead course, was made by S. T. Davis, Jr., on May 31 of this year, on Staten Island, the time being 1 minute and 12 seconds. Cannon was barred from racing, but made his record in an exhibition mile. The other events, although interesting, did not result in the breaking of any records.

At Deauville on August 26, M. Gabriel, on a Mors car, beat the world's record for the kilometer, the time being 26 2-5 seconds, or 84 miles an hour. Not so long ago W. K. Vanderbilt, Jr., covered the same distance in 29 2-5 seconds, but his record was subsequently lowered by C. Jarrott to 28 1-5 seconds. Serpollet was the favorite for the race won by Gabriel; but the great Serpollet failed a hundred yards from the finish, when a steam joint gave away under enormous pressure.

Hezekiah Conant, who died a few weeks ago at his home in Central Falls, R. I., was an extremely useful and benevolent man. He had accumulated a great deal of money, and during his lifetime was noted for the generosity with which he made use of his wealth in order to help his fellows. In his early manhood he devised a number of minor implements which enabled him to cultivate his taste for invention, and in 1857 he designed and patented several mechanical improvements for the manufacture of thread of all grades, and ten years after he was at the head of a large business concern which bore his name at Pawtucket, R. I. This has been since consolidated with the Scotch firm of J. & P. Coats. The establishment at Pawtucket now covers about forty acres of land, and is valued at $4,000,000.

Electrical Notes.

It is proposed to establish a post office and signal station for Marconi messages about 110 miles west of the Lizard. A ship is to be moored at this point, fitted with a powerful searchlight and the Marconi apparatus. Situated, as she will be, in the very midst of the channel, distribution of orders sent from shore by owners of vessels in passing in or out, will be greatly facilitated.

The Société Nouvelle des Etablissements Decauville has devised a handy portable electric generator applicable for domestic purposes. It is convenient for lighting premises which cannot obtain the necessary current from central stations. The dynamo is driven by an oil or gas engine. The pipes delivering the liquid fuel, and those for the inlet and outlet of the cooling-down water, run under the flooring, at the foot of the engine. Adequately effective means are provided for the escape of the gases of combustion. The base-plate is cast in one piece, and is fitted with a two-cylinder engine, all the motive parts of which are cased in. Automatic lubrication is provided. The dynamo is mounted beside the engine, on the same base-plate. A compensating flywheel is placed between the engine and dynamo, forming an elastic coupling, which insures the independence of both the engine and dynamo shafts, and also regularity in the working. A noticeable feature of the apparatus is a contrivance for insuring fixity in the degree of light, whatever may be the number of lamps in service. The engine can be easily and quickly dismantled and transported, while it does not require much attention when running—two essential features of the invention. The cylinders are 3⅛ inches diameter. The oil to lubricate the mechanical parts is supplied from a hand pump, and the cooling water is delivered under pressure, a suitable tank fed by a pump forming part of the installation, to insure a regular supply. The generating capacity of these engines is sufficient to supply current for forty 16 candle power lamps. The switchboard contains an exciting rheostat, and is made for direct lighting. Machines of similar design are also manufactured for the lighting of building yards. For this purpose the engine is mounted on a four-wheel trolley to facilitate transportation from one point to another. The installation in this instance comprises engine, dynamo, water tank, pump and gearing, ribbed tubes forming a radiator for cooling, a tank for liquid fuel, another for the lubricating oil, a switchboard and a roll of cable for connecting the dynamo with the lamps.

M. Eginitis, in a paper read before the Académie des Sciences, describes a series of novel effects which he observed in the case of the spectra obtained by an electric spark passing between different metals. He finds that by introducing self-induction into the circuit the spectra are modified in a striking manner. In one case he used two poles of aluminium wire of 0.04-inch diameter, covered to within 0.1 inch of the ends with a small quantity of metallic sodium. The wires are connected to an induction coil and a spark is passed for a few seconds. By introducing into the circuit a series of solenoids, the self-induction may be given any desired value; the resistance of the circuit is kept constant at 3 ohms. Ordinarily the spectra of the spark contain the aluminium and sodium rays, but when the self-induction is increased the aluminium rays diminish in intensity very rapidly, while the yellow sodium rays become stronger. A small coil 2 inches in diameter with a few turns of wire shortens up most of the aluminium rays, and on increasing the self-induction they almost disappear; meanwhile the sodium rays become more and more brilliant and finally reach a remarkable intensity. In this case the sparks have a bright orange color, due to the vapor of sodium, and the poles are surrounded by a halo of considerable extent. The values of the self-induction which eliminate the aluminium spectra are greater when the distance between the poles is increased, but in general diminish as the capacity of the circuit is greater. Other experiments of a like nature were made using sodium or potassium in connection with platinum, iron, tin, and other metals. In some cases the elimination of the spectra of one of the metals is difficult and not always possible; this occurs, for instance, in the case of a sodium-mercury combination. The elimination may also be obtained without the immediate presence of another metal on the same pole. In one case the experimenter used one pole of platinum and the other of mercury, contained in a glass tube; here the platinum rays were eliminated while the rays of the mercury were reinforced. Sometimes the mercury rays presented a curious appearance. Each of the rays was divided into two parts of different intensity. The most intense portion corresponded to the mercury itself, and the ray passed briskly from one part to the other as if the spark-gap had been half filled with mercury vapor. It may be remarked in general that the metals whose spectra are diminished are those which give but a small quantity of vapor, while the metals whose spectra remain or are increased in intensity are very volatile.

Engineering Notes.

In many mountainous regions a steel rope railway constitutes the only means of transportation. On this slender support and suspended 2,000 feet in the air, freight and passengers are daily carried. One of these aerial tramways was recently built by A. Leschen & Sons Co., of St. Louis, Mo., at Ouray, Colo. The line is 4,200 feet long and runs up 2,000 feet to the mouth of a gold mine. The line consists of two stationary sustaining cables, securely anchored at each end. The loaded buckets run on a rope 1½ inches in diameter, while the empty buckets return on a 1-inch rope. An endless steel wire rope ¾ of an inch in diameter propels the buckets, an 8-foot sheave being used at the terminals of the line. The buckets are attached and detached automatically to and from the traction cable. The weight of the loaded buckets traveling down is sufficient not only to operate the tramway by gravity, but also to bring up supplies to the mine.

One of the New York Central Company's new tandem compound locomotives recently hauled a train of 108 loaded cars from De Witt to Albany in eleven hours. The 108 cars were loaded with 4,500 tons of freight. This is the greatest tonnage ever moved by a single locomotive on any railroad in the world. Some idea of the size of the load can be gathered when it is realized that 9,000,000 pounds of freight were moved. The engine was in charge of Philip Eberhardt, of Albany. The same locomotive has also drawn 100 cars over the division. In the 100 cars there were 4,200 tons. The hauling capacity of the locomotive is enormous. It drew fifty loaded cars up the Schenectady hill without assistance, an unheard-of feat among Central enginemen. The increased power of the monster is gained by the use of steam four times, that is one compound cylinder placed ahead of the other, hence its name tandem compound.

During the last ten years a great many mines have replaced animal haulage with compressed air motors, which lend themselves splendidly to the work desired. There are, in general, two systems—the low-pressure system, in which air is compressed to five or six hundred pounds; and the high-pressure system, with air pressure of 2,000 pounds and over. The former system can be used in large galleries or tunnels or drifts where the width is ample and the track is reasonably straight. This permits a large receiver on the motor, 30 to 40 inches in diameter and from 8 to 16 feet long, to be handled with ease. The high-pressure system is used where the drifts are narrow or the curves on a small radius, permitting only a small wheel-base on the motor. Large receivers are, therefore, impractical, and steel tubes must be used and charged with high-pressure air to get sufficient volume. Compressed air may be used cold on either of these motors, or the air may be passed to small tanks of hot water supplied to the motor at the charging stations. The air and hot water combination does almost double the work that cold air will do. These motors can carry sufficient air for any ordinary run desired and haul tremendous loads. Two miles and return, with fifteen or twenty loaded cars, is not an extraordinary effort, and from the general results obtained, the cost of haulage is from one-half to one-third of the cost of the animal power. The air escaping from the exhaust of the motor engines adds to the ventilating effect in the mine and the whole system harmonizes thoroughly with the power outfit in the average mine.—Cassier's Magazine.

One of the most ancient industries in existence at the present time in Europe is the production of zinc in Silesia. From the sixteenth century calamine was obtained in the manors of Beuthen and Jagerndorf; it was used in the local manufacture of brass, and it was exported to the countries adjoining the Oder and Vistula. During the 30 years war, when the workmen, mostly Huguenots, had abandoned the mines, this industry disappeared, and its exploitation did not recommence until the eighteenth century, when George de Giesche, a Breslau merchant, obtained in the year 1704 from his sovereign Leopold the privilege, for 20 years, to extract calamine in Silesia. The first zinc foundry established in Silesia was that of Lydagnla, which existed from 1809 to 1900. At first prices were very high, $21.75 per quintal. As the production increased, which in 1816 reached 20,000 quintals, prices dropped to $3.75 and in 1820 to $2.35. This year proved fatal to the high furnaces, some of which were obliged to shut up. At that time the article was exported to Asia via Brody and Russia. In 1820 the English route was employed for shipment to India, where it proved a powerful competitor to the Chinese zinc. This exportation gave fresh prosperity to the Silesian mines. Since 1830 the production has continued to increase. In 1837 there were 32 works, employing 1,091 workmen, in activity, and the production reached 207,707 quintals. At present it exceeds 2,000,000 quintals, and requires nearly 8,000 workmen. The exportation in 1897 amounted 496,004 double quintals, and in 1901 to 533,129 double quintals. The nominal price at Breslau is now from $3.25.

Science Notes.

After having vanished from view for more than a year, the planet Eros has been rediscovered. The planet was first observed in 1898 by Witt, of the Urania Observatory, Berlin, and given the name which it bears. Until 1898, as far as telescopes could show, Mars came nearer to the earth than any other planet, but after Witt's discovery it was found that Eros reached a point a little more than a third of the distance from earth to Mars. The honor of the rediscovery belongs to Professor G. D. Ling, of the Chamberlin Observatory, Colorado.

In the streets of Paris there may soon be installed a noval apparatus for rendering first aid to the injured. A model of the device was recently tested. According to reports which have been received from Paris, the contrivance resembles a lamp-post letterbox and contains a small medicine chest, folding stretcher, and is equipped with a telephone apparatus for communication with the nearest ambulance station. In order to obtain access to the box, a glass panel is broken, as in some fire alarm systems.

A curious astronomical phenomenon was observed in the South of England recently, a short time after sunset. From a bank of clouds hanging over the horizon to about 35 degrees, a clear pillar of light, about 5 degrees in width and perfectly cylindriform, shot up. It was distinguishable almost to the zenith, and was deep crimson in color on the horizon, dissolving to the sky color through orange as it ascended. This appearance was nearly stationary and perpendicular to the horizon, and what slight movement could be detected was with the sun, but the column remained perfectly upright. This remarkable light faded down rapidly in about eighteen minutes from the time when it began to decrease, although it had rather the appearance of being withdrawn below the horizon than fading, for the color did not decrease in intensity in the same proportion that the column decreased in size. This phenomenon was seen on an evening following one on which there was a vivid display of zodiacal light and Eastern night glow.

The report of the Parliamentary Committee which was formed some time ago in England for the purpose of investigating acetylene generators in the interests of public safety, has been published. Various types of generators, the greater proportion of which belonged to the automatic class, were examined, but the latter type are not recommended as being the most secure. In the automatic generators the object is the gradual generation of the gas as used, thus dispensing with the necessity of the gas holder. This principle of generation is claimed to be more advantageous and convenient than the non-automatic type in which the gas is evolved in a short time from a given charge of carbide, and has to be stored in a gas holder. The committee, however, point out that the advantage of the automatic type is emphasized only where skilled supervision and favorable conditions are assured, but the varied conditions of use, especially with unskilled labor, these advantages are completely nullified, while many automatic generators were condemned as being of too complicated design and deficient in constructional strength to be of practical utility. On the whole, having regard to the conditions of use which must often prevail, the committee have advised that a generator conducive to the greatest safety should comprise the following desiderata: Simplicity of construction and design, strength of construction, high efficiency as indicated by the yield of gas per pound of carbide, low pressure in generator, and facility of removal of the residue.

In the Popular Science Monthly Prof. Woodward discusses the progressive cooling of the earth and its relation to the length of day. Whether the day was formerly shorter than now, and whether it will be longer in future, depends upon the mass of the earth, for meteorological dust constantly falls upon the surface and increases the quantity of matter. Laplace concluded that there had been no sensible change in the length of the day for nearly 2,000 years. Repeating this calculation with new data Prof. Woodward finds that the day has not changed so much as half a second during the first ten million years after the beginning of the solidification of the earth's material. When the cooling of the earth is finally determined, the change will be marked. Prof. Woodward finds that the ratio of the change by day to its initial length is two-thirds of the product of the loss of temperature multiplied by its cubical contraction. If the primitive temperature of the earth, for example, was 3,000 deg. C. and if its cubical contraction was that of iron, the day will be finally reduced about 6 per cent; that is to say, about one and a half hours. In order to bring about so pronounced a change, an enormous lapse of time is necessary. About three hundred thousand millions of years, according to Prof. Woodward, are required for a 95 per cent contraction to take place. After the expiration of one million millions of years the length of the day will not be sensibly affected.

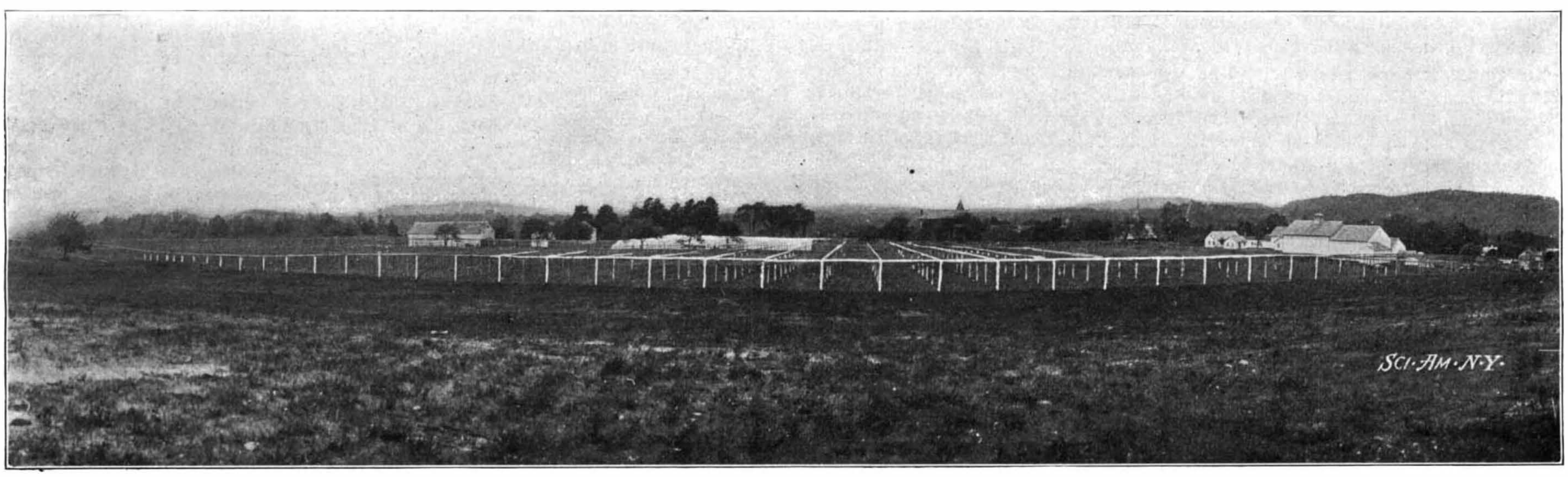
SHADE-GROWN TOBACCO.

BY WALDON FAWCETT.

One of the most interesting as well as most important of the new activities fostered by the United States Department of Agriculture is found in the growing of Sumatra tobacco under shade in the Connecticut Valley. The experiments in this field were the direct result of the investigation of the physical properties and composition of tobacco soils under-

View Inside a Patch Showing Arrangement of Posts, Stringers and Wires for Supporting Cheese-Cloth.

taken soon after the organization in 1891 of the Division of Soils of the Department of Agriculture. The similarity of the tobacco grown upon the light sandy soil bordering on the Connecticut River to that produced in Sumatra was at once noted, but the American leaf was lacking in some respects, notably in uniformity of color, and it was to remedy this as well as to improve the quality of the tobacco in other



Framework for 8-Acre Plot.

respects that the government officials undertook the experimental work which has resulted so successfully.

The plan followed has been, in a sense, a co-operative one. The farmers pay the entire cost of the erection of the shade, cultivation of the crop, and the fermentation, grading and sorting of the leaf. The government furnishes the seed and controls in every way the cultivation, preparation and selling of the product, the understanding being that the government derives no financial benefits from the transaction, but simply has the right to offer the crop for sale in order to determine the value placed upon it by the tobacco dealers and manufacturers.

The very light sand or sandy loam of the Connecticut Valley is admirably adapted to the cultivation of the Sumatra tobacco. In this connection it may be noted that with the exception of a small area in Florida and southern Georgia and a narrow area in Pennsylvania there are no other tracts, so far as at present known, where this type of tobacco can be successfully grown unless it be, perhaps, in some of the tobacco districts of New York and Wisconsin, where a thorough investigation has not yet been carried out.

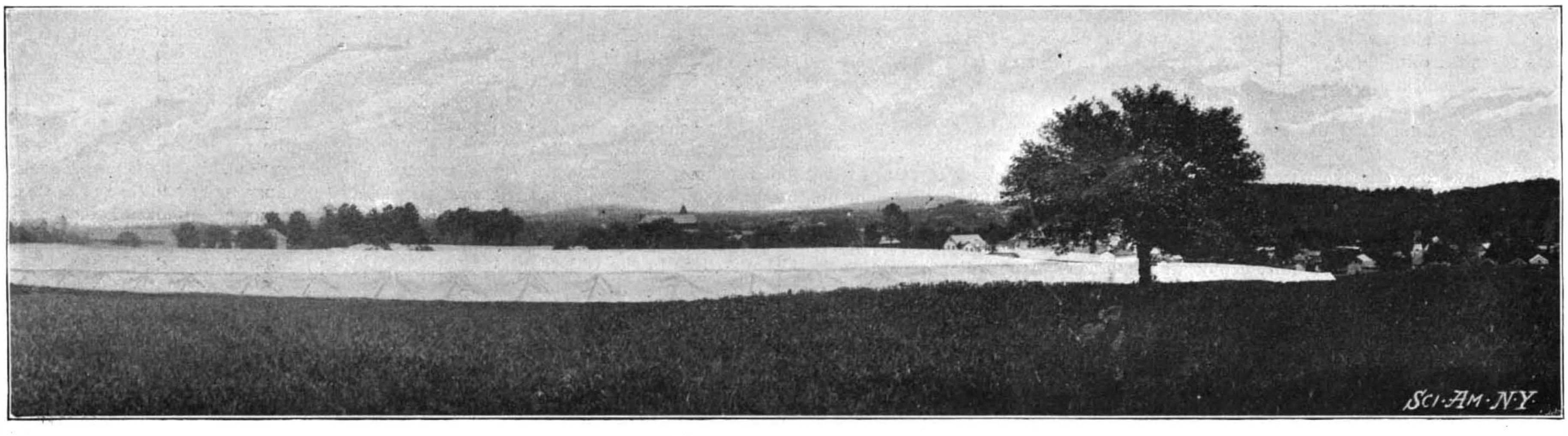
The provision of the cheese-cloth shade constitutes one of the most distinctive features of the industry in the Connecticut Valley. The vast canopies are supported on frames of substantial construction. Chestnut posts, four inches in diameter and twelve feet in length, are set three feet in the ground, leaving nine feet for the height of the frame. The posts are placed sixteen and one-half feet apart and are connected one way by stringers, while across the other are run heavy cable wires stapled to each post and made secure at each end of the field by stakes driven well into the ground. Parallel with and between these cable wires are run wires of lighter weight to support the cloth. The entire structure is covered with a heavy tent cloth which comes to the ground on all sides. A gate is provided, covered with cloth, and in the case of a field of exceptional size a road is left lengthwise through the field.

In July, 1901, the Connecticut Valley was visited by a cyclone of unusual severity preceded by a hailstorm, which did considerable damage to the crops in the open fields, but the cloth entirely prevented damage from the hail to the plants growing within the tents. Such was the force of the wind following this hail that buildings were overturned and trees uprooted, but the crops growing within the tents did not sustain the slightest injury. The cloth was torn in some places, but the total damage in the forty-one acres under shade was repaired at an expense of only $50 for material and labor. Thus far it has been considered advisable to purchase new cloth each season, but the framework will last from five to eight years. The approximate cost of materials and labor for the provision of one acre of shade is $360 for a very excellent grade of material, whereas some of the Connecticut growers have provided satisfactory shade for

An 8-Acre Patch After First Picking.

Note that lower leaves are gone.

as low as $260 per acre. Preparation of the seed beds begins in the fall when the ground is well plowed or spaded, and divided into beds six feet wide and of any desired length, surrounded by boards. These beds are highly fertilized and covered with leaves to protect them from frosts during the winter season. About April 1 this top dressing is removed and the bed again spaded, after which there is sown the seed which has sprouted in jars or other receptacles kept in warm rooms, a preliminary treatment made necessary by the fact that the Sumatra seed requires an unusually high temperature for germination. If the soil is at all dry the beds are kept continuously moist, but not wet, until the plants are set out. The plants are set with a planter at a distance of twelve inches apart in rows three feet three inches apart. Inasmuch as the



Same Plot Under Canvas.

A NEW INDUSTRY—GROWING TOBACCO UNDER SHADE.

machine waters the plants when they are set, the transplanting can be done at any time irrespective of weather conditions.

When the tobacco plants are not topped they grow to the full height of the shade and the blossoms often push up the cloth cover at the height of nine feet from the ground. The shade-grown tobacco must be primed or the leaves plucked off as they ripen, and this is a matter which requires great judgment on the part of the farmer, owing to the fact that it is more difficult to tell when the shade-grown leaves mature than when grown in the open field. It is advisable to harvest the leaf in the early stage of ripeness, but there is always danger of harvesting too green. Often not more than three or four leaves will be taken off each plant at a priming. As the tobacco is picked off it is transferred in baskets lined with burlap to the curing shed. It is customary to make five or six primings of a crop, which occupies a period of from one month to six weeks. In the curing shed from thirty to forty leaves are threaded on a string, each end of which is fastened to a lath and this is hung in the barn for curing.

The curing is, of course, a very delicate operation, governed by the nature of the tobacco and the conditions of the weather, and consequently varying in almost every case. The object in all cases is to have the tobacco become fairly moist and fairly dried out once every twenty-four hours, and to accomplish this latter it is sometimes found necessary to have fires started in small charcoal heaters distributed throughout the barn. The average time for curing tobacco is from fourteen to eighteen days.

The next step is fermentation, which is carried on in the sweat room where from five thousand to six thousand pounds of tobacco are placed in each bulk. When the tobacco has been thoroughly cured it is sized, assorted and baled. The bales measure thirty inches square and pressed to a thickness of one foot—the exact size of the bales imported from Sumatra. A bale of these dimensions contains from 150 to 160 pounds. The covering used is matting imported from the island of Sumatra, and over this is put another covering of burlap. The total cost of producing shade-grown tobacco in Connecticut averages about $657 per acre. The tobacco has already sold at prices ranging from $1.40 to $2.50 a pound, which is very significant in view of the fact that the Connecticut Havana tobacco, grown in the ordinary manner, but long recognized as the most desirable domestic tobacco for wrapper purposes, brings but eighteen or twenty cents a pound. The Sumatra tobacco imported exclusively for wrapper purposes pays a duty of $1.85 per pound and sells on the market for from $2.50 to $3 per pound.

REMARKABLE BLASTING OPERATIONS IN SLATE QUARRIES.

BY OUR ENGLISH CORRESPONDENT.

One of the most delicate and dangerous operations in connection with the slate quarrying industry of Wales is the removal from time to time of gigantic masses of waste rock by blasting. As a rule these blasts are carried out on a gigantic scale, from 150,000 to 300,000 tons of rock being displaced by a single explosion. The slate extends through the rock in layers, and the waste granite or "dyke rock" as it is technically called, has to be removed in order to facilitate the work of the miners. Blasting is the only means by which the rock can be removed, as the ordinary mining implements make scarcely any marks upon the hard granite.

The largest of these blasts are carried out at the extensive slate quarries, near Bangor, in North Wales, under the supervision of the Hon. W. W. Vivian, the general superintendent of the quarries, and one of the most expert blasting engineers in the country.

In the case of the 150,000-ton blast at these famous quarries, the preparation for the blast occupied no less than three months. It was a dangerous performance, since the quarrying of the slate had undermined the base of the wall which towered 140 feet into air and threatened to overbalance at any unexpected moment.

At the base of this rock three tunnels were cut, and on either side of them were hewn ten large chambers for the accommodation of the blasting charges. Each chamber measured 11 feet by 4 feet. All the preparations were carried out by the aid of the electric light, a special installation for which was laid down.

Fig. 1.—A 125,000-TON PINNACLE, 75 FEET HIGH, IN LORD PENRHYN'S SLATE QUARRY. BEFORE BLASTING.

Gelatine-dynamite was the explosive used, as it is considerably more powerful for this work than blasting gunpowder. In all 2½ tons were buried in the ten chambers, and the mouths of the tunnels were filled up with stone and rubble, securely cemented, so as to prevent the charges simply blowing out instead of exploding. The charges in the various chambers were connected with instantaneous fuses, which terminated at one point, where a twenty minutes' time fuse was attached, to enable the engineer, after firing the charge, to escape to a safe distance.

The explosion was peculiar in character. There was a dull thud as the charges detonated, and the earth for about a mile round quivered as if visited by an earthquake. Then sheets of smoke spouted from the crevices of the dyke, and huge bowlders at the summit of the wall were detached as if by their own volition and fell with deafening crashes to the bottom. The wall then split open in all directions and subsided quietly in a huge disintegrated heap, covered by a thick cloud of smoke, the after damp. Not a single bowlder was blown any distance.

In the case of the huge blast whereby 300,000 tons of rock were demolished—the largest on record—more elaborate preparations had to be made. This blast was necessitated by reason of the vast quantities of worthless rock which separated the veins of slate. As the latter was of a very rich quality, and too much time would be occupied in cutting it out by the ordinary process, the engineer resolved to raze the whole solid mass to the ground.

The rock was of enormous dimensions measuring 216 feet in height and ranging from 84 feet to 150 feet in thickness. Thirty-five men were requisitioned to bore the main tunnels into the base of the rock, for a distance of 174 feet, and ranging from 5 feet 3 inches to 3 feet 2 inches in width. From this tunnel six shafts were driven at right angles, 39 feet apart, in which the gelatine dynamite was placed, which, by the way, is specially prepared for this work. The charges were laid in bags, 512 containing 12½ pounds, and 72 bags containing 6¼ pounds, of the explosive each. In all 6,840 pounds of gelatine-dynamite were used, which is equivalent to 67,200 pounds of blasting gunpowder. In addition six dynamite primers, each of 25 pounds were used.

The charges in each chamber were connected with twelve instantaneous fuses, each 200 feet in length—the longest instantaneous fuses ever used for blasting work—and were attached to a twenty minutes' time fuse. The work of laying the charges in position, and connecting the fuses involved incessant work for three days and nights. The chambers and tunnels were sealed up with 350 tons of clay and rubble, to ensure perfect detonation.

The blast was a perfect success. The huge mass of rock broke up like a cake. Not a single stone was hurled into the air. Some of the bowlders which were disintegrated were over 2,000 tons in weight.

A huge blast was carried out at Lord Penrhyn's slate quarry, when a huge pinnacle of rock called the Talcaen Mawr, 75 feet in height and weighing 125,000 tons, standing in the center of the quarry was demolished. Our illustrations show the pinnacle before and after the explosion.

A tunnel was bored into the base of the pinnacle for a distance of 60 feet, and measuring 7 feet in height and width respectively. About the center of the tunnel, on either side, a chamber was cut out of the rock at right angles for a distance of 21 feet. At the end of each of these two smaller tunnels, a shaft was sunk to a depth of about 10 feet, and filled with the explosive which in this instance consisted of black blasting gunpowder. In all 280 casks of explosive, each containing 56 pounds, representing a total quantity of 15,680 pounds of powder were used. A wooden trough placed at an angle of 50 degrees passed through each chamber to the charge in the shaft, one of which contained a charge of 6,720 pounds and the other 8,960 pounds of powder. In this wooden trough the instantaneous fuse was firmly embedded in a mixture of sand and sawdust, a process called "tamping." The ends of the two instantaneous fuses were connected to a patent igniter, which in turn was attached to a 48-foot length of slow-burning twenty minutes' fuse, which extended for 20 feet outside the entrance to the tunnel. In this instance firing the charges was delayed owing to heavy rain having damped them. After igniting the fuse the engineers jumped on a small locomotive standing ready near by and were rapidly conveyed to the top of the quarry. The charges detonated eighteen minutes after the ignition of the fuse, and the huge pinnacle was shivered to pieces. Examples of smaller blasts could also be given; but those mentioned are perhaps the most important and interesting.

Fig. 2.—THE QUARRY AFTER THE PINNACLE WAS BLASTED AWAY.

THE NEW RUSSIAN BATTLESHIP "KNIAZ POTEMKIN TAVRITCHESKY."

The "Kniaz Potemkin Tavritchesky," built in South Russia, is out and away the most formidable fighting ship in the Black Sea, and greatly strengthens the fleet which Russia keeps—for the present—inside the Dardanelles.

She will be an imposing-looking warship, with her big military tops bristling with guns and her three tall funnels, which, curiously enough, are placed with their longest diameter athwartships, contrary to the usual custom. Her displacement is reckoned to be about 12,500 tons; she is 371 feet in length and has a beam of over 72 feet.

Her armament consists of four 12-inch guns, placed by pairs in two turrets, one of which is forward upon the forecastle and the other aft upon the quarter-deck, which is of lower freeboard than the rest of the vessel. Her secondary battery, comprising sixteen 6-inch quick-firing guns, is placed in a series of casemates, of which four are on the upper deck at the corners of the superstructure and the remainder on the main deck, six a side. These guns are all placed in circularly recessed ports, which give the ship a somewhat unusual appearance, but which, doubtless give them a considerable arc of fire. Fourteen 3-inch, 12-pounder, rapid-fire guns are also carried, four mounted above the casemates on the upper deck, eight between them, and two right forward on the main deck. In the tops and on the upper works are distributed a like number of lighter pieces. Her torpedo equipment consists of five tubes, one right forward below the ram, one on either bow below water, and one on each broadside near the after turret. The two last are above water, but are protected by armor of considerable thickness, so that they are safe from the fire of light guns, unless a shell should enter the tube itself.

The extent of armored area is considerable, as the "Tavritchesky" is provided with an almost complete belt 9 inches in maximum thickness, has 6-inch armor on her lower deck, and 5-inch on her main deck, besides a protective deck about 3 inches thick. Her turrets are very efficiently protected by Krupp steel armor 12 inches in thickness.

The "Kniaz Potemkin Tavritchesky" has engines of 10,600 horse power and is equipped with twenty-seven of the "Belleville" boilers which have been so much discussed of late. The contract speed is about 17 knots an hour.

Marking Blue Prints.

It has become the custom to use a soda solution, using it as ink, and the result is a white line not very different from the print. The soda on the surface of the paper collects dirt and the lines fade and lose their original intensity. The right way is to write your figure in ink—ordinary Carter's or any other fluid that is acid-proof—then take your ruling pen and put a blot of soda over the spot. This whitens the background and turns the ink jet black, and it is done in half the time and twice as nicely as any other way. The white spot is there to stay and the ink will never fade.—The Draftsman.

LARGEST WATCH IN THE WORLD

What is probably the largest watch ever constructed was recently completed by the Waltham Manufactur-

THE LARGEST WATCH EVER MADE.

ing Company at its plant at Waltham, Mass. While the timepiece is without the dial and hands, it contains all the parts of a modern watch, and was made for the purpose of showing the quality and formation of the more delicate parts contained in a movement, some of which in the ordinary size are so small that they are scarcely discernible without the aid of a microscope. The cog wheels, springs, pins, jewels, set screws and all other pieces are large enough in the model to examine with the naked eye. An idea of the size of the timepiece is given by contrasting it with a watch which is shown on the pedestal at the left of its mammoth companion. As a matter of fact the latter represents an ordinary watch magnified ten times. The glass case surrounding the model is 21 inches in height and the timepiece itself actually weighs 120 pounds.

A Superior Whitewash.

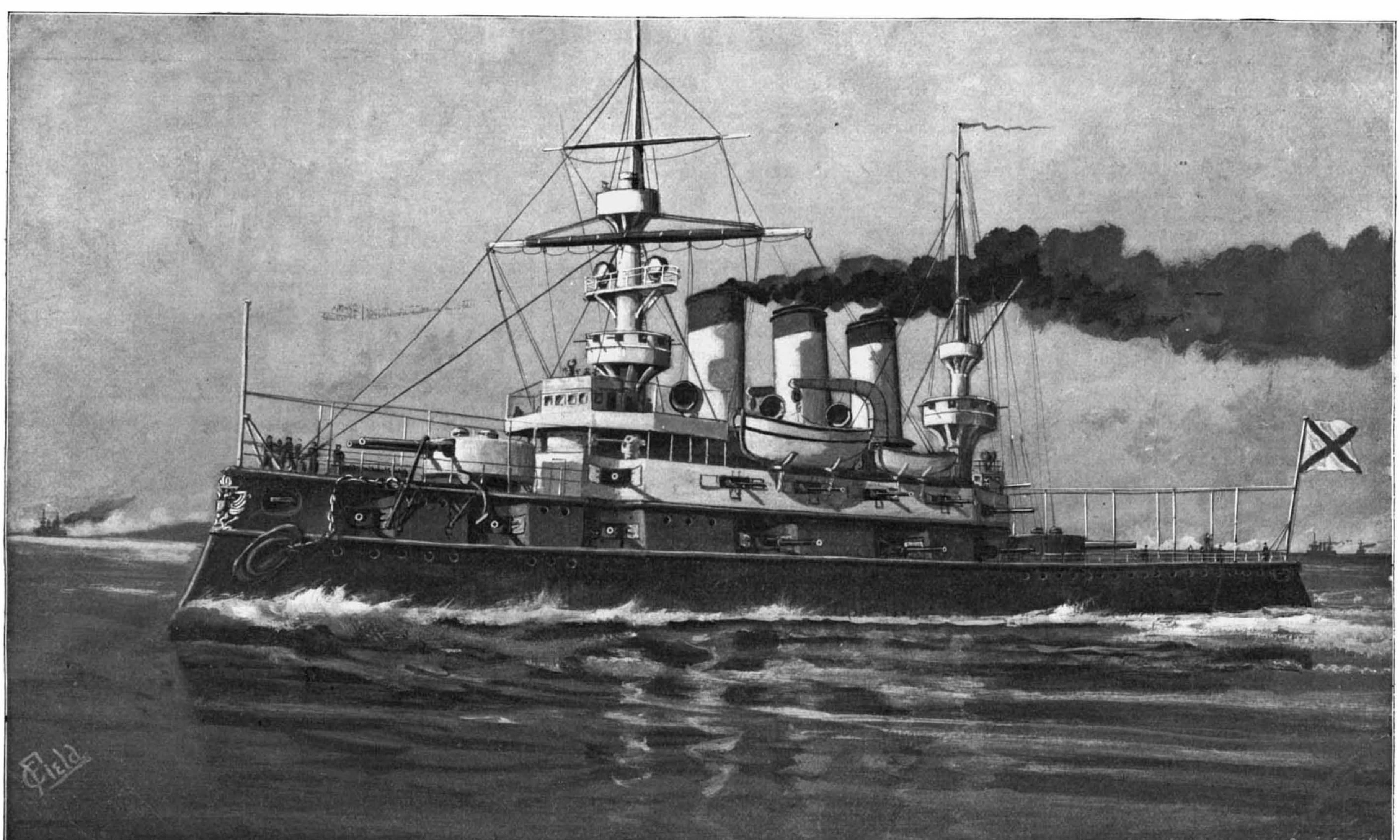
Every spring the lighthouses of the country are given a coat of whitewash of a composition which is enduring and able to withstand the attack, not only of the elements, but also the corrosive action of salt water. The east end of the White House, which bears the brunt of the strong moisture-laden winds of Washington, is annually coated with this wash.

The wash is made as follows: Slake half a bushel of lime in boiling water, covering during the process to keep in the steam. After straining this through a fine sieve or trainer add to it a peck of common salt, previously dissolved in warm water. Three pounds of ground rice should then be boiled to a thin pasty mass and, while hot, stirred into the above; one-half pound of Spanish whiting should also be added and then one pound of glue, melted in a glue pot, should be put into the composition. After adding five gallons of hot water to the mixture, it should be allowed to stand for a few days, securely covered to keep out the dirt.

It is claimed that this whitewash is very efficient if heated before applying. In order to make a careful estimate of the amount of wash needed, it must be remembered that a pint properly applied will cover a square yard. Farmers will find this wash very useful, not only in the dairy, home, barn or any interior work, but also for applying to wood or stone work out of doors. If, however, white is undesirable for coating a barn or other out-buildings, an addition of paint powder such as painters use in preparing their paints may be made, and the results are very satisfactory.

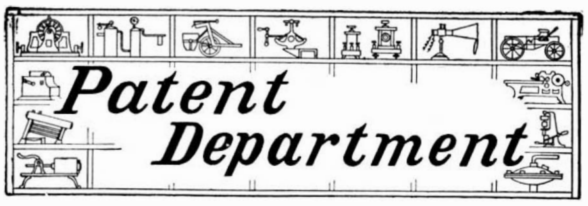
The Current Supplement.

The Duesseldorf Exhibition which is just now attracting such widespread attention in Germany is again made the subject of an article in the current Supplement. This time the Krupp exhibit of ordnance is treated. Mr. John B. C. Kershaw describes a new form of diaphragm cell for the electrolytic production of alkalies and chlorides. Of technological interest is a very exhaustive discussion of the rapid ageing and fireproofing of wood. The oil-fired locomotives used on the Great Eastern Railway of England are illustrated and described. In commemoration of the completion of the Sault Ste. Marie Canal, an article is published describing this greatest of all engineering feats. Now that the Berlin-Zossen tests have been temporarily abandoned, the critical review of the results obtained, by Robert Grimshaw, should be of particular value. Mr. Grimshaw presents as concisely as possible the conclusions to be drawn from the tests. Archæologists will doubtless read with interest Mr. Mills' entertaining account of his excavations of the Adena Mound. The Selected Formulæ and Consular Notes will be found in their accustomed places.



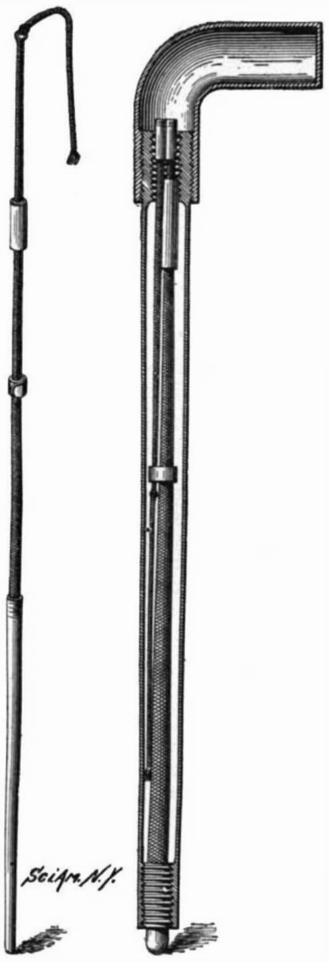
THE NEW RUSSIAN BATTLESHIP "KNIAZ POTEMKIN TAVRITCHESKY."

Displacement: 12,480 tons. **Speed:** 17 knots. **Normal Coal Supply:** 900 tons; also liquid fuel. **Armor:** Belt, 9 inches, gun position, 12 inches. **Armament:** Four 12 inch, sixteen 6-inch, fourteen 3-inch, fourteen smaller guns. **Torpedo Tubes:** five. **Complement:** 636.



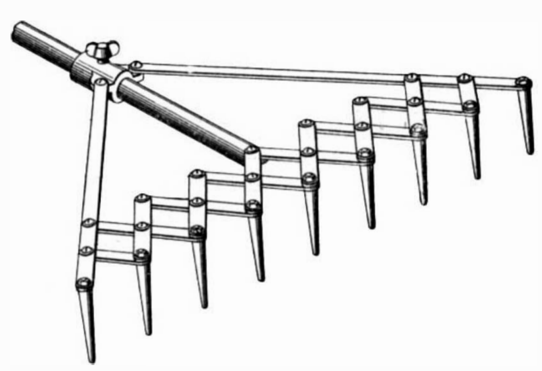
ODDITIES IN INVENTIONS.

Combination Cane and Whip.—A walking-cane which may be readily converted into a whip, or *vice versa*, has been recently invented by Mary A. Allen, of Fitzgerald, Ga. It comprises an article useful either in walking or driving, and consists essentially of a cylindrical casing adapted to contain a folded whip. An end portion covers the top of the casing, to exclude all dirt and dust and also to serve as a handle for the article when used as a cane. The whip is divided into two hinged sections, which are adapted to be folded together for insertion into the casing, a small spring catch engaging the lash. When the whip is extended for use, the sections are made rigid at the joint by a sliding sleeve, which is moved over the hinge, telescoping and securely holding the same. The butt of the whip is threaded to fit either of the two internally-threaded portions at each end of the casing. A small lug projecting from the butt end of the whip serves as a ferrule when the article is used as a cane.



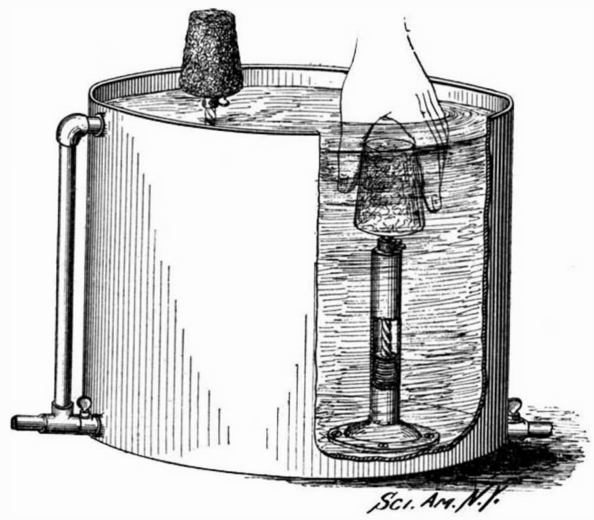
CANE AND WHIP COMBINED.

A Folding Hand-Rake.—It can hardly be denied that the ordinary rake takes up an inconvenient amount of room in a barn. A Kentuckian has sought to overcome this inconvenience in a most ingenious way. He mounts the teeth of his rake on links pivoted together after the manner of lazytongs, and connects the lazytongs thus formed with a collar sliding on the handle of the rake. By shifting this collar along the handle it is possible to adjust the width of the rake, and to bring the tines so close together that little or no room will be taken up when the rake is not in use.



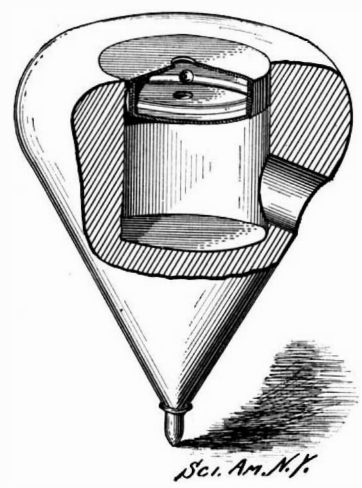
AN ADJUSTABLE AND FOLDABLE RAKE.

A Mechanical Tumbler-Cleaner.—An apparatus for cleaning tumblers which springs from the inventive brain of a Western inventor, will probably be of interest to the hotel and restaurant keeper. Brush-bearing spiral spindles are provided with piston-heads arranged to reciprocate in a cylinder. A coiled spring, contained within each cylinder, abuts against each head. The cylinders and spiral spindles are contained in a tank of water. When the devices are not in use the brushes protrude from the water. The tumbler to be cleaned is placed over the brush. By pressing on the brush the spindle is forced down, and is rotated by reason of its spiral formation. When the pressure is removed the coiled spring will lift the brush out of the water.



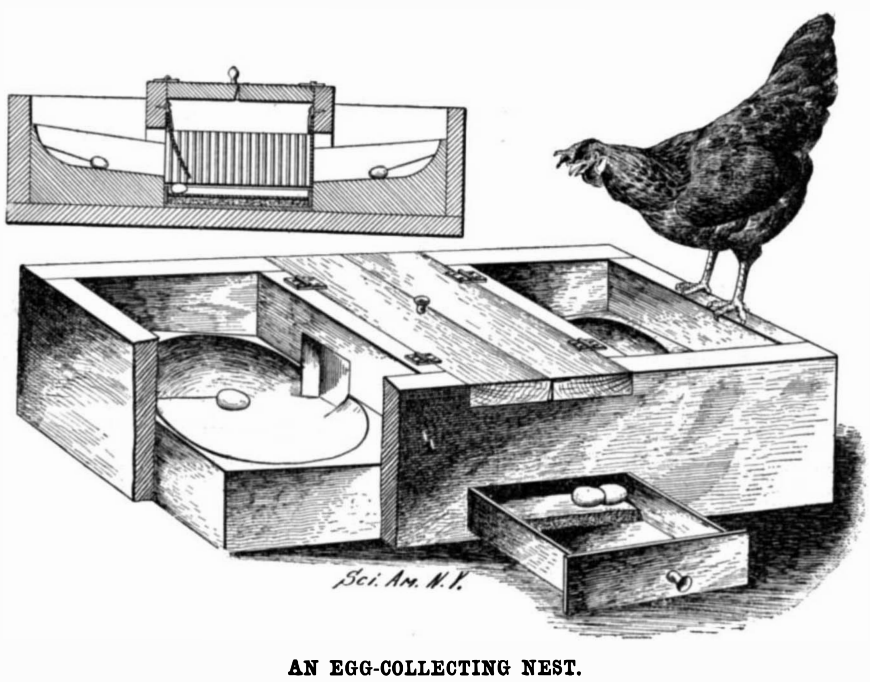
A NEW WAY OF CLEANING TUMBLERS.

Whistling and Ringing Top.—A new form of top which both whistles and rings is the invention of a resident of Waltham. The body of the top is formed with a central chamber. The side of the top has a single transverse opening communicating with the lower portion of the central chamber. In the upper end of the chamber a sound-producing device is contained, which is a combined whistle and rattle. The sound-producing device comprises two perforated disks, forming an air-chamber between them. As the top spins the air is sucked through the perforations in the disk into the central chamber and out through the transverse opening, thus producing a whistling-tone. During the rotation of the top a metallic ball or hammer strikes the disks and produces a ringing noise in addition to the whistling sound.



A WHISTLING AND RINGING TOP.

An Egg-Collecting Nest.—The nest illustrated is intended automatically to collect eggs which have been laid, in order to prevent a hen from eating them. The nest is divided into three compartments—a central storage chamber and two egg-laying compartments at the side of the storage chamber. The egg-laying compartments are inclined, and communicate with the central storage chamber by means of openings closed by flaps. An egg which has been laid will roll down the incline, push aside the flap, and drop into the cushioned storage compartment, from which it may be removed by means of a drawer. The usual nest-eggs are provided, fastened in place, however, so that they cannot follow the course of the eggs that have been laid.



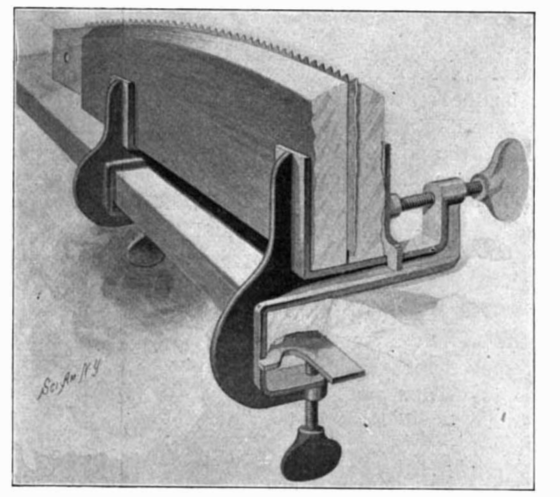
AN EGG-COLLECTING NEST.

A NEW SAW-CLAMP.

A simple form of saw-clamp which can be carried about readily and used almost anywhere, is an invention for which August J. Jaeger, of Phillips, Wis., recently received a patent.

The frame of the device is shaped like the letter S. At each end of this S eyes are formed for the reception of screws. It will be observed from our illustration that the screws move at right angles to each other. The one serves to operate a movable plate, straddling a slideway, in order to force the plate toward a fixed, flat face. The other screw serves to move a flat plate against a table, in order to clamp the entire device.

In sharpening a saw two clamps are used, as shown in our engraving. Between flat boards shaped to conform with the saw, the blade is placed. The clamps are secured upon the table, and the boards containing the saw are placed between the jaws and the plates mounted on the screws. The screws are all tightened, so that the blade is very securely held in place.



THE JAEGER SAW-CLAMP.

The simplicity of this device and the readiness with which it can be set up for use are features which deserve special mention.

Prizes for Inventions.

Several prizes have recently been awarded in connection with various contests organized by the Society for Encouraging National Industry in France for important discoveries in many ramifications of science. The prize of $400 for the invention of a cement capable of agglomerating diamond dust for mechanical purposes has been awarded, while $600 was given to the inventor of a steam superheater, which is considered to be a great advance upon any yet placed on the market. An offer of $400 for what is described as an important progress in the mechanical transmission of work is also made. A prize of $200 is offered for the practical utilization of any by-product used in chemical processes which is now wasted, and medals are now offered for the publication of papers useful to chemical industry and metallurgy. Prizes are also offered for an apparatus suitable for domestic use, and capable of sterilizing drinking water, and for an effective remedy for freeing the vine tree from an insect parasite which does great harm to it.

In 1898 an international competition for a paste for matches not containing white sulphur was announced, and a prize of 50,000 francs ($9,650) was offered by the Belgian government to the inventor. The commission appointed to judge results has now declared that, after four years of careful experiment and analysis, it has found that none of the products so far submitted fill the required conditions, being defective in inflammability, igniting on all surfaces, or, in igniting, ejecting inflammable matter containing some poisonous substance. The sum already expended in the matter amounts to 8,178 francs ($1,578.35). This covers cost of printing, correspondence with foreign countries, purchase of materials, analysis and experiment. Some American inventor ought to apply his mind to the problem.

Utilization of Cocoanut Shells.

There is a chance for some ingenious inventor to devise a means of utilizing cocoanut shells. We are informed by a cocoanut dealer of New York city that at the present time the fiber is stripped from the nut and used in the making of matting, but that the shells are used as fuel, simply because there is apparently no industrial use for them. At this late day it would seem almost a wanton waste to destroy anything at all, much less cocoanut shells. The dealer in question would be glad to place at any inventor's disposal any amount of cocoanut shells for the purpose of experiment.

Brief Notes Concerning Patents.

President E. R. Green, of the Texas Midland Railroad Company, has recently been granted a patent on a system of wireless telegraphy. As soon as it is possible to do so, his railroad will be equipped with it.

It has been announced that the American Window Glass Company intends to issue a new lot of common stock for the purpose of obtaining exclusive American rights to a window glass blowing machine. It is said that the machine dispenses with the services of skilled flatteners. The cost of production will be reduced by 50 per cent. Whether any reliance is to be placed upon the report that the owners of the patent rights value their machine at $10,000,000 cannot at present be determined. The sum certainly seems princely.

There has been a decided boom in the cultivation of rice in the past year or two and many great plantations have been taken up and are being put in shape for business through the South. A large factory for the manufacture of the rice polishing machinery is about to be started in Baltimore, Md. This company has acquired a number of patents, mainly those of Oliver R. Welch, of Baltimore, which makes use of a system of wire mesh belts and screens, and which is said to do the work of polishing the rice grains better and cheaper than by the old process of using belts of sheepskin, known as the "skin process." Rice in the hull is almost black, and when the outer skin is removed the grain is dirty yellowish in appearance. Rice is used almost over the entire world, and the custom of polishing it is general except among the Chinese, who eat it in the yellow stage.

A company has been organized in Chicago, with a capital of $250,000, known as the Du Vall Underground Railway, which will operate one of the big amusement features of the Louisiana Purchase Exposition at St. Louis. A platform capable of seating 150 persons will be erected, and the performance will begin by the descent of this platform to a point about 50 feet below the surface, although the distance will seem to be greater owing to certain optical illusions which will be introduced on the way down. When the platform comes to a rest a number of realistic representations of different phases of underground work will be shown, including divers at work, the sewers of Paris, the Catacombs of Rome, and gold and coal mines in operation. These different features will be mounted on cars which will move around the spectators, coming into view one after the other. These cars will be 50 feet long, 40 feet in depth and 35 feet wide.

A system by which it is possible to keep in constant telephonic communication with a moving train, was recently tried as an experiment on the Louisville, Henderson and St. Louis Railroad, and the trial was said to have been eminently successful by those who witnessed it. The invention is that of Dr. A. D. Jones, of Louisville, and the wire is laid either at the side of the rail or hung in the air, and the contact is made through an ingenious apparatus which constitutes the main feature of the doctor's invention, and for which a patent was recently granted by the United States. In the test made a few weeks ago, the wire was laid near the track on the ties for a distance of over a mile, and as the train passed along at the rate of ten miles an hour, a number of persons in the city of Louisville were called up on the regular local telephone system, and many of them refused to believe that they were holding a conversation with a person on a moving railroad train. It was said that the words were heard as plainly as over the ordinary wires, and there was no evidence whatever of the motion of the train in the transmission of the message.

Few persons have received patents for so wide a range of subjects as Joseph Beresford Renshaw, who died at Hartford, Conn., early in May. He was a born inventor, and in whatever walk of life he was placed, he immediately adapted himself to the surroundings and soon made some important improvement in the methods of doing the work. He was born in England, and came to this country when quite a young man and located in New York, where he made a number of improvements in loom construction and the methods of working them. He then removed to Detroit, where he connected himself with the Michigan Central Railroad. Here his inventive faculties had full play, and he was responsible for a number of inventions relating to railroading. He finally became the master mechanic at the shops in Michigan City, Ind. He later moved to Cleveland, where he had been offered a place with a firm making optical and scientific instruments, and made several improvements in the telescopes made by them. After this he devised a process by which molten metal was cleansed of all foreign matter by means of centrifugal force, and another for improving the quality of low-grade iron. All of these inventions were of great practical value.

Legal Notes.

A Long Delayed Patent Cause.—The report of the Special Master in Chancery in the suit of John E. Dubois against the mayor, aldermen and commonalty of the city of New York, has been filed in the office of the clerk of the United States Circuit Court. This is the last step in a case which has been before the courts for the last eighteen years. John Dubois was the inventor of a caisson which, it is alleged, Roebling made use of in building the Brooklyn Bridge. The patent expired in 1884. A suit was soon after commenced against the city of New York for damages. Dubois began action against other municipal corporations, his cases being classified among lawyers under the general title of "Dubois vs. the Cities."

The case of Jarndyce vs. Jarndyce, of which Dickens has written picturesquely, is no more involved than that of Dubois vs. the city of New York, or more characteristic of the law's delay. In December, 1884, the demurrers to the complaint filed by the corporation counsel were overruled. Then began the taking of testimony. Three years were then consumed by the complainant alone. Meanwhile J. Dubois died, leaving his entire estate, which consisted partly of these causes of action, to his nephew, J. E. Dubois. In 1888 the State passed a statute empowering the cities of Brooklyn and New York, and Dubois, the legatee, each to select a referee. For five years the referees sat. In 1893 they at last handed in a report adverse to Dubois. Then the referees started an independent action in the Pennsylvania federal courts for the purpose of recovering the large sums due to them for services. In 1897 the Pennsylvania federal courts decided the statutory reference illegal and unauthorized, and the referees' report therefore void. As a result, ten years' legal labor went for nothing, and the case had to be retried. For a year the cause was allowed to slumber peacefully. Then new associate counsel was engaged. When two years had elapsed, dissensions sprang up among complainant's lawyers, with the result that the courts were called upon to decide what fees were to be received by the associate counsel. The Master's report which has now been handed in is simply devoted to this question of fees, and does not in any way affect the patent litigation itself. Yet its scope is prodigious, for no less than 700 typewritten pages are needed to state what each counsel shall receive. When the patent cause itself will be decided no one can foretell.

Infringement by Officers of the United States.—An interesting question came up in the case of the International Postal Supply Company of New York vs. Bruce (114 Fed. Rep. 509) as to what is the legal status of an infringement by United States officials. Complainant's bill alleged infringement of certain patents for improvements in machines designed for use in the post offices of the United States, in cancelling stamps and postmarking mail matter. One of the defendants, who is a postmaster, was using in his office two infringing machines under leases from his co-defendants, which leases were about to expire and were to be renewed by defendants. The complainant had tendered to the individual postmaster, for use in his office on the same terms, two machines made under the patent, which tender was refused. When the case came up, the postmaster, who is the only defendant residing within the district, alone appeared, and filed a plea alleging that he never personally used or caused to be used the alleged infringing machines, but that they were constructed for, and placed in his office by the Post Office Department, where they were used by his subordinates, under orders, solely in the service and for the benefit of the United States. The rental of these machines was paid by order of the department from the government funds. The defendant never had control over the leasing of these machines nor the renewal of the leases. In view of these facts, the court held that although on principle it had no jurisdiction, and that complainant was entitled to the remedy invoked, the question of jurisdiction was so far in doubt, in view of the decision of the Supreme Court in Belknap vs. Schild, that the plea should be sustained.

Imitation of Trade-Mark.—The West Indies Trading Company adopted "El Falco" as a trade-mark designation and brand of cigars manufactured by it in Porto Rico. This was claimed by another manufacturer as an infringement of his trade-mark "El Falcon" an arbitrary or fanciful designation adopted by him twenty years ago, and he began proceedings to restrain its use, bringing out an interesting point. The defense set up that Falco was the name of its manager and they had named their brand after him with his permission. As a matter of fact the manager went by another name. The court said that while it is true that the law will protect the right of a man to use his name in his own business, even if by so doing he may injure another of the same name, in such cases it must appear that the name was honestly used, and the court will permit no artifice or deceit calculated to mislead the public.

Device Not Claimed Abandoned.—Where a patentee has made his claim, he has thereby disclaimed and abandoned to the public all other combinations and improvements that are not mere invasions of the device, combination, or improvement which he claims. But one who claims and secures a patent for a new machine or combination thereby necessarily claims and secures a patent for every mechanical equivalent of that machine or combination, because, in the light of the patent law, every mechanical equivalent of a device is the same thing as the device itself. Where form is not the essence of the invention, machines or combinations which are constructed upon the same principle, which have the same mode of operation, and which accomplish the same result by the same or by equivalent mechanical means, are mechanical equivalents within the meaning of the patent law, although they differ in form or in name.

Liability for Royalty.—The owner of patents granted a license to manufacture and sell during the term of the patent having the longest time to run, under an agreement that a certain prescribed period during the term the licensee should pay a royalty on all articles sold by him, whether manufactured under the patents or not, and reserving a right to sell on his own account on certain contingencies, and providing that the licensee might manufacture all such instruments as it was licensed to sell. The New York Court of Appeals held that such owner was not deprived of the right to royalty because the licensee transferred the license to a corporation, and ceased to do business, as such corporation, while it continued the manufacture and sale, did so by the authority of the license, rendering the licensee liable to the same extent that he would have been if he had continued the business.

Combination of Old Elements.—A new combination of old elements, whereby an old result is attained in a more facile, economical and efficient way, may be protected by a patent. Where the question of novelty is fairly open for consideration under the law, the fact that a patented device or combination has displaced others which had previously been used to perform its function, and had gone into immediate and general use, is pregnant and persuasive evidence that it involves invention. Where the advance toward the desideratum is gradual, and several inventors form different combinations which accomplish the desired result with varying degrees of operative success, each is entitled to his own combination, so long as it differs from those of his competitors and does not include theirs.

Furniture Casters.—The Berkey patent, No. 318,-533, for a caster socket provided with an interior spring made integral with one side of the socket and from the same material, the purpose of which is to press against the bulbous head of the caster shank, and prevent it from dropping out when the furniture is raised from the floor, was anticipated by the Kane & Brown patent of 1866, which showed the same spring, except that it was made of a separate piece of metal, and mechanically attached to the socket, holds the United States Circuit Court of Appeals for the Sixth Circuit, basing its decision on the principle that infringement cannot ordinarily be escaped by merely cutting in two a device made in one piece, or by making integral an article formerly made in two.

Contract to Pay Royalties.—N. S. Keith, the inventor of an improved armature for a dynamo electric machine, having secured letters patent therefor, sold the Electrical Engineering Company the right to make, use and sell the invention in California, Colorado, Nevada, Montana, Oregon, Alaska, Utah, Arizona and Idaho. The electrical company agreed to pay royalties on the sale "of all articles manufactured by it under said letters patent." This agreement, the Supreme Court of California has just held, calls for the payment by the company of a royalty on the selling price of the entire electric dynamo machine, with the armature attached, and not merely of the armature alone.

Injunction Against Infringement.—Where infringement is clearly shown, so as to entitle complainant to a preliminary injunction, and the infringing article is manufactured abroad and imported into this country, complainant has the right to the issuance of the injunction, and to use or publish it for legitimate purposes, notwithstanding the promise of defendant not to purchase or use any more of the articles.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CORN-SHOCK LOADER FOR VEHICLES.—WILLIAM A. TEA, decd., MARY J. TEA, Admrx., Bellevue, Ohio. The invention is a corn-shock loader of the type in which the shocks of corn are raised bodily from the ground and dumped into a wagon. A pair of wheels are temporarily secured to a wagon; and upon the wheels a rocking frame is pivotally mounted. The frame can be rigidly connected with the wheels so as to be rocked by their rotation. Disconnection of the frame and wheels can be automatically effected.

Engineering Improvements.

VALVE-MOTION.—GEORGE M. SCHWEND, 2516 Avenue D, Birmingham, Ala. The invention consists in providing the cylinder-heads of a steam-engine with co-acting exhaust-valves which are alternately opened and closed by the piston through the medium of connecting-rods. The exhaust-valves control the exhaust-passages. A jacket or casing communicates with the exhaust-passages and wholly or partially surrounds the steam-cylinder. An exhaust opening leads to the outer air or to a condenser. It follows from this construction that the action of the valves is more effective than usual.

Electrical Apparatus.

SHADE-SUPPORT.—ERNEST A. LIVET, 28 Bush Lane, Cannon Street, London, England. The inventor has sought to provide means for directly and detachably connecting to the bulb of an electric incandescent lamp a useful or ornamental article or one serving both an ornamental or useful purpose, such as a shade, transparency or reflector. The invention is more particularly designed to enable a light reflecting and diffusing shade or globe, constituted by a spirally-coiled rod of glass, to be secured to the lower portion of an electric incandescent lamp-bulb in such manner that the place of fastening is concealed and the light of the lamp in no way obscured.

MEDICAL ELECTRODE.—GEORGE G. MARSHALL, Wallingford, Vt. The invention is a new and improved electrode especially designed for the use of physicians in treating diseases of the stomach. The electrode is of simple and durable construction, but aims to permit convenient cleaning, and shaped to be readily swallowed by a patient.

Mechanical Devices.

VEGETABLE OR MEAT CUTTER.—FREDERICK BARR, Manhattan, New York city. The shell or body of this device is constructed in upper and lower separable sections, so that the interior mechanism can be laid bare at any time whenever it is desired to clean the working parts. A clamp of novel construction is employed, which holds the sections together in a liquid-tight manner.

WRENCH.—ROBERT J. COSSEBOOM, Leadville, Col. The wrench is of the fixed-jaw and sliding-jaw type. Novel details of construction have been devised which adapt the wrench for quick adjustment and permit its parts to have a wide gripping range. The device is particularly well adapted to grip and turn pipes and bolt bodies in small spaces.

SAFETY SUSPENDING APPARATUS FOR ELEVATORS.—ROBINSON HAINSWORTH, 21 Victoria Street, Hull, England. Mr. Hainsworth has invented an improved safety-catch gear for mine and lift cages, skips, and the like, whereby to prevent the cage from falling in case of an accident. The safety-gear is so designed that when the tension of the rope ceases to retain the gear out of action the safety catches will be caused to bind against the guides with a grip so powerful that any appreciable fall of the cage is prevented, the cage being securely supported at whatever height it may happen to be when the breakage occurs.

WASHING-MACHINE.—GEN. ODON GUITAR, Columbia, Mo. The invention is an improvement in that class of washing-machines adapted both for laundries and domestic use. A perforated rotary drum is adapted to rotate within a cylindrical casing, the clothes or other fabrics being alternately immersed in and raised out of suds-water at each rotation of the drum.

REVERSING PULLEY MECHANISM.—JOSEPH DARLING, Chicora, and CHARLES C. ELLENBERGER, JR., Peachville, Pa. The object of the invention is to provide, in connection with a shaft which may be operated continuously in one direction, a pulley operated by the movement of the shaft, and caused to turn in the same direction as the shaft or in a reverse direction. The mechanism for effecting the reversal of the pulley may operate as a clutch to permit the engine to run freely in starting.

Metallurgical Apparatus.

ORE-BREAKER.—ALBERT C. CALKINS, Los Angeles, Cal. This invention is a simple ore-breaker and crusher arranged to be turned by hand, and especially applicable to the uses of assayers. The device is of the type in which a stationary and vibratory jaw are arranged in angular relation to each other, so as to form a tapering throat between, the vibratory jaw being oscillated by a pair of toggle arms connected by a pitman with a rotating crankshaft. The present invention comprehends means for conveniently and quickly cleaning the machine, for adjusting it to the graduation of the product, and for taking up the wear.

Technological Advances.

GLASS-FINISHING MACHINE.—LANCING T. ZIMMERLY and HENRY KNIERIEM, 195 Mechanic Street, Cumberland, Md. The invention is an improvement in finishing the edges of such articles as tumblers, stem-glasses, and other ware which, when pressed or blown are rough and uneven. One of the essential features of the invention is the provision of a glory-hole by means of a retort-vaporizer, whose tube is extended along and constitutes one side of the glory-hole and receives the full heat of the retort. The tube is curved on the arc traveled by the tumblers, so that it will be heated from end to end in such manner as to secure the desired vaporization of the fuel.

PAINT-OIL AND PROCESS OF MAKING THE SAME.—JOHN F. KREBS, Colorado Springs, Col. Marine oil, acetic acid, white copperas, and litharge are mixed together. Manganese dioxid is dissolved in benzin by the aid of heat. The solution thus formed, together with sugar of lead, is added to the ingredients first mentioned. The entire mixture is stirred and allowed to stand, whereupon linseed oil, turpentine and chlorid of lime are added.

TEMPERING-BATH.—JAMES E. LAWRENCE, West Shefford, Quebec, Canada. The object of the invention is to provide a new and improved bath for hardening steel or other metallic articles, especially such as dies, tools and the like. Superimposed liquids are used, one of which is capable of buoyantly supporting the article to be hardened. By employing a bath composed of two liquids, one of which is of greater specific gravity than the article to be hardened, the article is rendered self-adjusting as to its position, relatively to the hardening liquids employed.

APPARATUS FOR CALCINING PLASTER.—AMBROSE LAWRENCE, Acme, Tex. Provision is made for keeping clean the inner surface of a revoluble drum, for ventilating the drum during the calcining operation by carrying off the vapor arising from the plaster, and for easily removing the material after completion of the cooking operation. The several parts of the apparatus are arranged to secure strength and stability to the shell of the revoluble drum. The material to be cooked can be easily introduced into the drum, and the vapor-ventilating devices are also adapted to serve as the means through which the cooked materials can be discharged from the drum.

MEANS FOR SETTING MOSAICS.—FELIX ALCAN, Manhattan, New York city. The objections which attend the usual method of setting mosaics in cement Mr. Alcan seeks to overcome by providing means which permit the workman readily to detect a wrongly placed piece of mosaic when setting the pattern in the bed, so that the mistake can be corrected before the cement has set, and also to facilitate the stripping of the backing around the set mosaic, thereby effecting a considerable saving of time and labor.

Railway Appliances.

CAR-WHEEL.—MADISON T. DAVIS, JR., Charleston, W. Va. The invention is an improvement in car-wheels, and particularly in wheels designed for use in mines, and relates especially to the means for lubricating the wheels. Combined with a hub having a chamber for the lubricant and provided at its inner end with an inwardly projecting flange notched in its inner edge, is a lubricating bushing having at its inner end a head abutting the flange and provided adjacent to the head with perforations which register at their outer ends with the notches in the flange of the hub and discharge at their inner ends adjacent to the inner end of the bushing.

EMERGENCY-GEAR FOR LOCOMOTIVES.—WILLIAM W. MURCH, Brooklyn, New York city. The invention relates to block systems for railways. A new and improved emergency gear is provided for preventing collisions by automatically shutting off steam and applying the brakes to bring the train to a standstill, without any action on the part of the engineer in case a danger-signal has been disregarded.

RETAINING-VALVE.—WALTER V. TURNER and FRANKLIN C. FARQUHARSON, Raton, New Mexico. These inventors have devised an improved Westinghouse brake retaining-valve connected with the auxiliary reservoir and the exhaust of the triple valve. The retaining-valve is so completely under the control of the engineer that he can at all times know whether the retainers are all on or off. The arrangement is such that the brakes are uniformly applied on all the cars of the train. Sliding of the wheels is largely prevented. The engineer cannot apply more than the maximum pressure to which the relief-valves are set.

Musical Instruments.

DRUM-STAND.—ALBERT B. HELLENKAMP, Cleveland, Ohio. This simple device supports a drum at any desired height from the ground. The parts of the stand can be readily adjusted so as to give the drum any desired inclination, the legs are contractible.

HARP.—KARL WEIGEL, Hanover, Germany. The harp is provided with a support for the hand of the player to obtain certainty of action for the fingers. A support is provided for the base of the harp and so arranged that the strings will be disposed of obliquely to the hand of the player, thus greatly facilitating the manipulation.

Miscellaneous Inventions.

PENDANT SOAP-HOLDER.—ROBERT H. NEAMANN, Manhattan, New York city. A longitudinal member provided with an anchor for holding a free bar of soap and composed of a number of separate cords each capable of use independently of the other, is the essential feature of this device. In washing the hands the bar of soap is drawn down. In order to clean the dirt from under the nails the ends of the fingers are scraped upon the cord.

CURETTE.—CHARLES W. SPAULDING, Carroll, Iowa. The curette comprises a handle, a member of spring metal secured by one of its ends thereto and terminating at its other end in an endless loop for the purpose of avoiding free ends. A portion of the loop is spirally wound into a general olive shape and is provided with a scraping edge.

FOLDING TABLE.—EDWARD P. VAN ALSTYNE, JR., Kinderhook, N. Y. The invention provides a folding table especially adapted to rest upon trunks, chairs, and like supports, for convenience in writing, reading, studying, displaying samples and the like. The table is light, simple, effective, and adjustable to various sizes of supports.

PUNCHING-BAG PLATFORM.—SAMUEL TREINIS, Manhattan, New York city. The punching-bag platform is rigid and strong, when supported from a wall or the like, and so arranged that it can be readily adjusted to take up possible wear in the joints or connections. The device is adapted to fold compactly for storage or transportation.

GAME APPARATUS.—JOHN S. AKERMAN, San Diego, Cal. This game apparatus is more especially designed for use as parlor clock-golf, and is arranged to afford amusement to players. Considerable skill is required to play the game successfully.

GAS-BURNER.—GEORGE LUND, Victoria, British Columbia, Canada. This gas-burner is designed for use in boilers to heat water and generate steam, but is also adapted for heating various other devices and articles, the arrangement being such that the gas is utilized to the fullest advantage and very economically.

BLANK-CARTRIDGE HOLDER.—MILTON J. SHIMER, Freemansburg, Pa. The holder may constitute a portion of a cane, pistol, cannon or other support, being adapted to retain a blank-cartridge in position to be exploded by contact with any suitable, nearby object.

GARMENT FASTENER AND SUPPORTER.—WINFIELD L. DINSMOOR, Portland, Ore. This improved fastener, besides supporting and fastening together the waist and skirt of a dress, will hold the detached waist of a dress, such as a shirt-waist, smoothly down in the back, and permit the easy removal of an outer garment without releasing the underwear. Hooks and eyes are dispensed with.

BALLOT-BOX.—HENRY DROUTLEDGE, Auckland, New Zealand. The invention relates to improvements in ballot-boxes wherein a revoluble drum is employed to contain suitable objects, such as marbles and the like. One object which the inventor has in view is the provision of a simple, compact structure, arranged to permit voting to be accomplished without any possibility of tampering with the contents of the drum or box.

EYEGLASSES.—JOHN CARTER, Malden, Mass. The invention relates to a means for fastening the spring and guard to the stud of eyeglasses, and particularly to a device to prevent the accidental loosening of the screw which is employed to effect the connection.

NON-REFILLABLE BOTTLE.—SAMUEL D. BLOCKER, Columbus, Ohio. In the bottle-neck is a holder and a tube having a closed upper end and an opening intermediate its ends. The tube is adjustably fitted in the holder and the holder is capable of closing the opening. Within the tube is a spring-actuated valve. A weight is arranged beneath the valve and capable of entering the tube to open the valve.

ROLLER-BEARING.—JOHN D. TWIGGS, JR., Manhattan, New York city. The invention relates to axle journals and bearings for rolling stock, and other devices and machines. The bearing is arranged to reduce the friction of the parts to a minimum, to hold the rollers in position when opening the bearing for examination or repairs, to insure a proper lubrication of the parts at all times, and to render the bearing dust-proof.

Designs.

COFFEE OR TEA POT.—HENRY NUTRIZIO, Manhattan, New York city. The pot is of cylindrical shape and has an ornamental enlarged base. From the base to a point near the upper end of the body the body is straight; and from this upper point the body is gradually, outwardly and upwardly inclined, forming a beveled upper section, which is defined from the main and uniformly straight intermediate section of the body by a beaded panel. The cover is of ogee pattern; the spout is of polygonal type; and the handle is of bar formation.

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

Business and Personal Wants.

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

MUNN & CO.

Inquiry No. 3090.—For manufacturers of clay smoking pipes.

Inquiry No. 3091.—For manufacturers of extension bit holders.

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Whiffletree hook, C. V. Hoover 707,779
Windmill and pump coupling mechanism, W. F. Pflueger 707,718
Winding machine, R. C. & F. L. Fay 707,684
Window, H. Vettel 707,808
Wire stretcher, E. E. Swarm 707,732
Woven fabric, W. T. Smith 707,871
Wrench, C. J. Barnes 707,895
Writing or copying pad, F. G. J. Post 707,942

DESIGNS.

Album stand, photograph, R. Aizenman.... 36,028
Blotting pads, etc., corner for, S. A. Keller. 36,027
Brushes, etc., back for, S. A. Keller. 36,023, 36,026
36,023, 36,026
Button hooks, etc., handle for, S. A. Keller. 36,024
Lamp body, C. A. Haas 36,029
Lid for puff boxes, etc., S. A. Keller 36,025
Plate, G. R. West 36,030
Rug, A. Petzold 36,033
Sewing machine table, F. G. Hogland 36,032
Toilet articles, handle for, R. R. Debacher. 36,022
Vending machine casing, G. W. Gates.... 36,031

TRADE MARKS.

Almonds, Bevan & Co 38,849
Beer, lager, Dick and Brothers Quincy Brewery Co 38,846
Boots and shoes, certain named, Dorothy Dodd Shoe Co 38,838
Boots and shoes, men's, Lamkin & Foster.. 38,837
Cleaning and polishing prepartion, certain named, E. T. Hanks 38,843
Cleaning compounds, wood stain, ship cement and antifouling bottom compound, certain named, National Architectural Improvement and Supply Co... 38,842
Clothing, certain named, Reid Brothers.... 38,832
Cotton threads, New England Cotton Yarn Co. 38,836
Flour, G. T. Evans 38,847
Food derived from albuminoids, artificial, Actien Gesellschaft fur Anilin Fabrikation 38,848
Furniture, office and library, Fred Macey Co. 38,845
Insoles, J. Aspinwall 38,839
Lamps, hydrocarbon vapor, Sun Vapor Street Light Co 38,857
Leather for making boots and shoes, Wilder & Company 38,840
Linings, Burton Bros. & Co 38,834. 38,835
Malt, peptonized extract of, Siegel-Cooper Co 38,853
Medicaments to wounds or orifices, devices for applying, G. Schirmer 38,853
Overalls, coats and pants, J. H. Wedemeyer. 38,833
Paints and painters' supplies, certain named, Colonial Works 38,841
Paper, certain named, G. A. Jaeger 38,831
Pneumatic tools, E. E. Hanna 38,850
Poison for the extermination of insects and animals, R. C. Tarr 38,854
Remedy for certain named disease of cattle, T. D. Young 38,855
Soap, laundry, N. K. Fairbank Co 38,851
Table sauce, J. C. Warvel 38,850
Thermometers, clinical, H. Hirschberg Optical Co 38,856
Toilet articles, certain named, D. P. Watson 38,852
Whisky and whisky preparations, Rothenberg Co 38,844

LABELS.

"Banner Band," for condensed milk, Northern Condensed Milk Co 9,405
"Bass Brook," for whisky, S. Bass 9,402
"Brooks Co. Makers," for hats, C. E. Sackett 9,397
"Franklin Union Number Four Cigars," for cigars, M. A. Pacella 9,401
"Good Fellow Cigars," for cigars, A. Jacobsen 9,400
"Grain Fruit. The Hygienic Breakfast Cereal," for breakfast food., Grain Fruit Cereal Co 9,407
"Joe Turner," for cigars, A. C. Henschel & Co 9,399
"Nichol's Hat Co., Hat Makers," for hats, C. E. Sackett 9,396
"Nouveau Furniture Polish," for furniture Polish, Nouveau Manufacturing Co 9,408
"Pine Tree State Taffy," for taffy, G. E. Lufkin 9,404
"Static." for packages containing carbonated beverages, Static Carbonating Co 9,403
"Sure Pop Baking Powder," for baking powder, E. C. Newman 9,406
"United Powder and High Explosive Workers of America, for explosives, W. Feenie.. 9,409
"World's Hair Restorer," for hair restorer, S. F. Lash 9,398

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS ETC.

Variable Stars of Long Period. By Edward C. Pickering. Extrait des Archives Néerlandaises des Sciences Exactes et Naturelles.

The Art of Dyeing Wool, Silk and Cotton. Translated from the French of M. Hellot, M. Macquer and M. Le Pileur D'Apligny. London: Scott, Greenwood & Co. 1901. New York: D. Van Nostrand Company. 8vo. Pp. xx-446. Price $2.

Hellot, Macquer and Le Pileur D'Apligny, were the forerunners of a long line of French savants who did much to develop the art of dyeing. In their day they were the greatest authorities on their particular subject. Since the appearance of the first English edition in 1789, practice has altered considerably. The discovery of coal tar colors, for example, has exerted a powerful influence on modern methods. But many of the principles and methods formulated by these three Nestors of dyeing are just as valuable now as when they were first published. The book is reprinted exactly as it appeared in 1789. The language although not as terse as that of technical writings of to-day will be quite intelligible to those familiar with textile industries.

The Balancing of Engines. By W. E. Dalby, M.A., B.Sc. New York: Longmans, Green & Co. 1902. London: Edward Arnold. Demi-8vo. Pp. xi-283.

Within recent years the subject of engine-balancing has become of increasing importance, for the reason that the unbalanced periodic forces of the engine, and the natural periods of vibration of the hull have approached the sensitive region of synchronism. The balancing of a marine engine and the peculiar problems to which it gave rise have been made the subject of investigation by many engineers. It is the purpose of this work to develop a semi-graphical method that may be used to attack problems connected with the balancing of the inertia forces arising from the relative motion of the parts of an engine or machine. A knowledge of the principles explained and illustrated through the book would enable an engineer to apply the method to the many problems of balancing which he will find on every hand, not only with regard to engines, but in connection with machinery of all kinds.

Annual Report of the United States Life-Saving Service for the Fiscal Year Ending June 30, 1901. Washington: Government Printing Office. 1902. Pp. 480.

The Science of Mechanics. A Critical and Historical Account of Its Development. By Dr. Ernst Mach. Translated from the German by Thomas J. McCormack. Chicago: The Open Court Publishing Co. 1902. London: Kegan Paul, Trench, Trübner & Co., Ltd. Pp. xx-605. Price $2.

Dr. Mach's "Mechanics" is presented for a second time in English in an enlarged and revised edition. The work is not a treatise upon the application of the principles of mechanics. It aims chiefly to clear up ideas, expose the real significance of matter, to throw light upon metaphysical obscurities. The little mathematics which it contains is merely necessary for the attainment of this purpose. The science of mechanics is treated not as a branch of mathematics, but as one of the physical sciences. Too much cannot be said in praise of Mr. McCormack's admirable translation, which is at once faithful in its rendering and idiomatic in its English form.

Bricklaying and Brickcutting. By H. W. Richards. London, New York and Bombay: Longmans, Green & Co. 1902. 12mo. Pp. xii-139.

The book before us is a practical treatise upon brick laying, brick cutting and setting, sufficiently elementary in its treatment for ready comprehension by the average bricklayer. Although the book is intended to cover the City and Guilds of London Institute's examination in brickwork, and to meet the requirements of that portion of the Board of Education's examination in building construction relating to brickwork, the book will, nevertheless, assist bricklayers in general in the principles of their craft.

Poudres et Explosifs. Dictionnaire des matières explosives, par le Dr. J. Daniel, Ingénieur des Arts et Manufactures. Préface de M. Berthelot, secrétaire perpetuel de l'Académie des sciences. Pp. 825. Price $6.

The monographs included in this dictionary are practical treatises. Among them may be mentioned admirable studies of cellulose and gunpowder; the manufacture of Vieille smokeless powder and of cordite. Dynamite, gelatine explosives, employment of electricity in mines, and the general employment of explosives for all purposes, are the subjects of interesting articles. A discussion of submarine explosives is worthy of attention. A rather curious chapter is devoted to infernal machines and anarchistic appliances of different epochs. Glycerine is made the subject of an entire chapter. In a word, M. Daniel's book constitutes a veritable encyclopedia of the many explosives which have been invented during the last quarter of a century.

THE STEAM TURBINE; THE STEAM Engine of Maximum Simplicity and of Highest Thermal Efficiency. By Prof. R. H. Thurston. A valuable series of articles having cuts of some of the more efficient engines of this type—the Parsons', De Laval, Dow, etc.; with exhaustive tables giving the result of tests and much general data on the subject. Contained in SUPPLEMENT Nos. **1306, 1307** and **1308.** Price 10 cents each. For sale by Munn & Co. and all newsdealers

SHOE BLACKING.—FORMULAS FOR liquid and solid blacking are given in SUPPLEMENT Nos. **1213** and **1239.** Price 10 cents each. For sale by Munn & Co. and all newsdealers

FLY PAPERS.—FORMULAS FOR Sticky Fly Papers are contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. **1057** and **1324.** Each issue contains several recipes. Price 10 cents each, from this office, and from all newsdealers.

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled

(8672) M. P. C. asks: 1. Please give the formula of a solution for a carbon-zinc battery that is suitable for running a small motor. One in which the zincs may remain in when not in use. A. There is no cell using zinc and carbon in which the zinc ought to remain when not in action, excepting the sal-ammoniac cells, and these are not adapted for running motors. The best battery for the purpose is the plunging bichromate battery described in Supplement No. 792, price ten cents by mail. 2. How many inches of zinc should there be to one of carbon? A. The best mode of arranging the zinc and carbon is to place two carbon plates with a zinc plate between them, all to be of the same size. Both surfaces of the zinc are then active. There is no rule to determine the number of inches of zinc to one of carbon. In the Le Clanche cell a rod of zinc, ⅜ inch in diameter, is used for a large surface of carbon.

(8673) G. R. R. asks: 1. How to preserve eggs, so as to keep them good, a length of time. A. A good method of storing eggs is the following: Having selected perfectly fresh eggs, put them, a dozen or more at a time, into a small willow basket, and immerse this for five seconds in boiling water containing about 5 pounds of common brown sugar per gallon of water. Place the eggs immediately after on trays to dry. The scalding water causes the formation of a thin skin of hard albumen next the inner surface of the shell, the sugar effectually closing all the pores of the latter. The cool eggs are then packed, small end down, in an intimate mixture of one measure of good charcoal, finely powdered, and two measures of dry bran. Eggs thus stored have been found perfectly fresh and unaltered after six months. 2. Can you give a recipe for a cheap and modern stove polish? A. Stove Polish.—Mix 2 parts copperas, 1 part powdered bone black, and 1 part black lead with enough water to give proper consistency, like thick cream. Two applications are to be recommended.

(8674) L. C. R. asks: 1. What is the composition of the enamel used to insulate the wires in electric heating apparatus and rheostats and how can I prepare and apply it? A. Clean and brighten the iron before applying. The enamel consists of two coats—the body and the glaze. The body is made by fusing 100 pounds ground flint, 75 pounds borax and grinding 40 pounds of this frit, with 5 pounds of potter's clay in water, until it is brought to the consistence of a pap. A coat of this being applied and dried, but not hard, the glaze powder is sifted over it. This consists of 100 pounds Cornish stone in fine powder, 117 pounds borax, 35 pounds soda ash, 35 pounds niter, 35 pounds sifted slaked lime, 13 pounds white sand, 50 pounds of pounded white glass. These are all fused together, the frit obtained is pulverized. Of this powder 45 pounds are mixed with 1 pound of soda ash in hot water, and the mixture dried in a stove is the glaze powder. After sifting this over the body coat the cast iron article is put into a stove, kept at a temperature of 212 deg. to dry it hard, after which it is set in a muffle kiln to fuse it into a glaze. The inside of pipes may be enameled (after being cleaned) by pouring the above body composition through them while the pipe is being turned around to insure an equal coating. After the body has become set the glaze pap is poured in in the same manner. The pipe is then fired in the kiln. 2. What kind of cells should I use when necessary to add an extra battery to a Queen acme bridge and how should they be connected? A. We cannot tell. We advise you to consult the makers of the bridge.

(8675) J. D. S. asks for a stove blacking or varnish that will give a black gloss and not burn off. Brunswick black gives the gloss but burns off when applied to top of stove. A. Take plumbago, make into a thin paste with sodium silicate or water glass. This makes an excellent stove polish and should be brushed thoroughly.

(8676) J. B. asks: What is the composition on back of postal cards to reprint upon? A. It is a special composition of clay. The government will not now accept these postal cards.