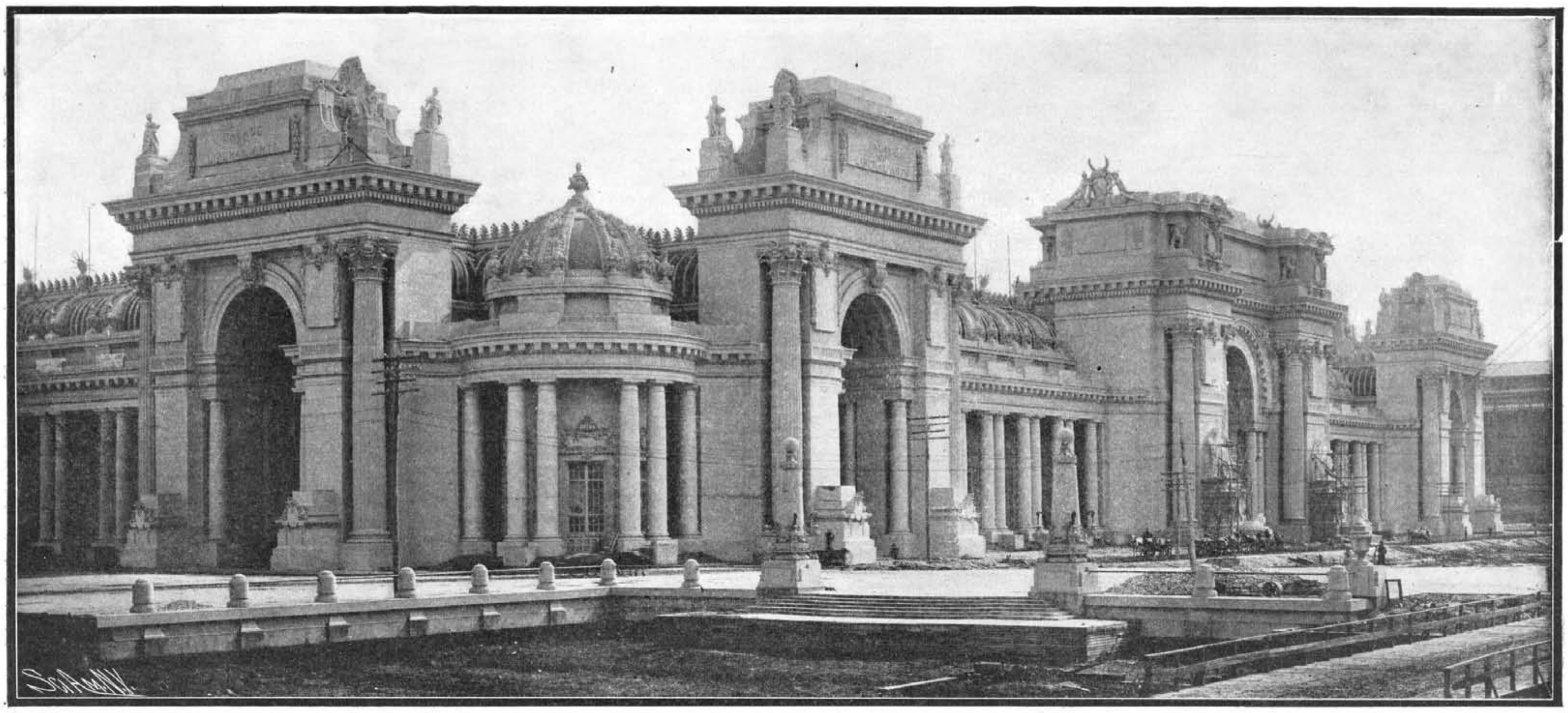
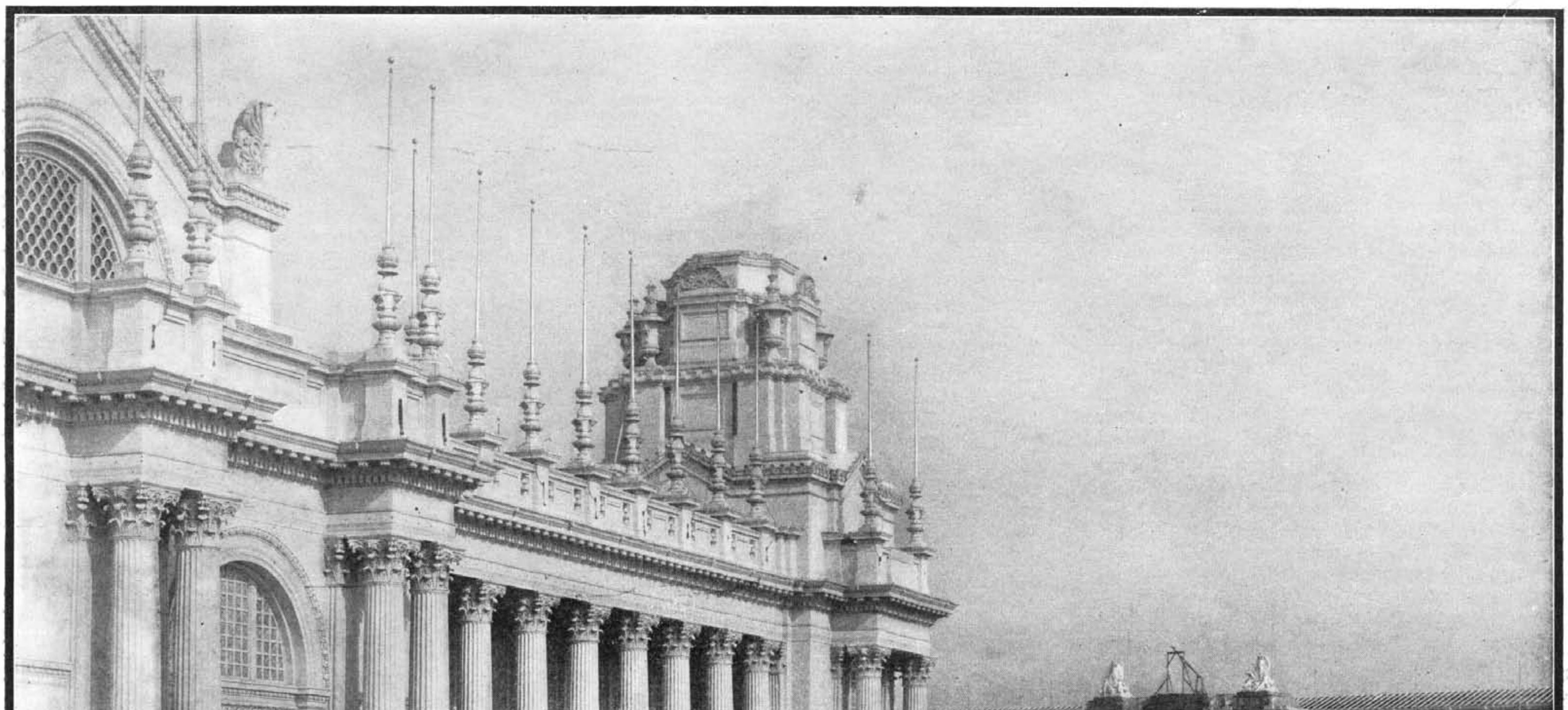
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1904, by Munn & Co.]

Vol. XC.—No. 19. ESTABLISHED 1845. | NEW YORK, MAY 7, 1904 | 5 CENTS A COPY $3.00 A YEAR.



The Palace of Liberal Arts.



The Palaces of Electricity and Education, Showing One of the Many Ornamental Bridges.

THE OPENING OF THE LOUISIANA PURCHASE EXPOSITION.—[See page 364.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) .... $3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885) .... 2.50 "
Scientific American Export Edition (Established 1878) .... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MAY 7, 1904.

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

COMMEMORATION OF THE LOUISIANA PURCHASE.

The huge industrial exposition on the banks of the Mississippi, which has now opened its gates to the world, is a worthy commemoration of one of the most important steps in the development of the United States. In view of the vast extent of the country—over one million square miles—which was acquired from the French government; the splendid field which it opened for the restless energy of the young republic; and the unparalleled growth in prestige, population, and wealth that has followed, it was necessary that any national commemoration of the anniversary of the Louisiana purchase should be carried out upon a scale that was commensurate with its intrinsic importance, and with the splendid results to which we, the posterity of a hundred years later, are the fortunate heirs.

That the St. Louis Exposition will be worthy of the event which it commemorates is shown by the vast scale upon which it is laid out, the architectural magnificence of the individual buildings, and the well-considered and harmonious plan upon which they are grouped. If mere size is to be taken as a standard of merit, the St. Louis Exposition will surely justify its existence. In point of area it covers no less than 1,240 acres, which invites comparison with the 733 acres of the Chicago Exposition, the 336 acres required for the Paris Exposition, and the 300 acres of the Pan-American Exposition at Buffalo, all three of which do not much more than equal the area of the present Exposition grounds at St. Louis. So again, if we compare the total area that is actually roofed over by the various buildings, great and small, we find that while Chicago had 82 acres, Buffalo 15, and Omaha 9 acres under roof, the main exhibit buildings at St. Louis cover 128 acres. The total cost will reach the huge sum of $50,000,000, of which $15,000,000 has been contributed in equal parts by the United States government, by the city of St. Louis, and by private stockholders. This sum has been swelled by the appropriations of States and Territories, and of the various foreign governments, and by the expenditures by the various exhibitors and concessionaires. The response of foreign governments has been most liberal, Germany and France spending over $1,000,000 each, Brazil $600,000, while Great Britain, Mexico, China, and Japan each are spending over half a million dollars. The individual buildings themselves are on a scale commensurate with the exhibition itself. The Liberal Arts and the Mining and Metallurgy buildings each cover a space of 750 by 525 feet. The Government Building, conspicuous by its splendid burnished dome, covers 800 by 260 feet. The Palace of Manufactures and the Palace of Varied Industries each extend 525 feet in breadth by 1,200 feet in length. The Transportation Building, 559 feet in width, is over 1,300 feet in length; while to crown all in point of size, as is fitting, considering that the agricultural interests are the greatest of all interests in the United States, is the building devoted to agriculture, 500 feet in width and 1,600 feet in length.

The men who negotiated for the United States the purchase of the Louisiana territory have left abundant evidence of their farsightedness. They believed in the future growth of the young republic; though whether, in their most sanguine moments, they dreamed of such a growth in population and wealth as we witness to-day, is much to be doubted. In 1803, when the transfer was made, the population of the United States was about 5,500,000 souls, our western boundary was marked by the Mississippi River, and the center of population was about thirty miles northwest of Washington, D. C. In 1820 the population had grown to 9,638,453, and its center was at a point about 16 miles north of Woodstock, Va. The westward migration was so greatly stimulated by the opening of the Louisiana territory, that the center of population moved steadily westward, and by 1840 the 17,000,000 souls in the United States found their center at a point 16 miles south of Clarksburg in the present State of West Virginia. Twenty years later, in 1860, the population had almost doubled, having reached a total of 31,443,321, and its center was to be found at a point 20 miles south of Chillicothe, Ohio, at about the center of the southern boundary of that State. By 1880, the center had moved westward along the southern boundary of Ohio until it lay at the point where the States of Ohio, Indiana, and Kentucky meet, and the total population had grown to a little over 50,000,000 people. Twenty years later the Census of 1900 showed that our population had reached 75,568,686, with its center in the southern suburbs of the city of Columbus, Ohio, or about 240 miles from the city of St. Louis. Judging from the fact that in the last ten years, from 1890 to 1900, the westward progression of the center of population was only about half as much as in the ten years 1880-90, it is questionable whether the center will have moved to St. Louis or to any point on the Mississippi River, before the second centennial of the Louisiana purchase has been celebrated.

BATTLESHIP OR TORPEDO BOAT.

It was inevitable that the unbroken series of disasters to the Russian battleships should stimulate into renewed activity those people who believe that the battleship is a cumbersome and costly type of war vessel, that has outlived its usefulness. This was proved in a recent discussion in Congress, when several prominent members, one of whom at least is closely connected with naval affairs, seriously advocated the abandonment of all battleship construction. The argument adduced was the familiar fallacy that because a ship costing six or seven million dollars can be destroyed in a few minutes by the attack of an insignificant torpedo boat, or sunk by a mine, it would be better to build smaller ships and more of them. "Let us have done with 12-inch guns and foot-thick armor," said one; "give me the fast cruiser and the 8-inch gun, which is big enough to sink any ship afloat."

We are not going to reiterate the well-known arguments in favor of the big battleship. They are as well known to our readers, doubtless, as they are to the gentlemen in Congress, who just now seem to be seized with something of a panic because of the Russian disasters. What we do wish to state, is that while the torpedo boat and the submarine mine have given fresh demonstration of their deadly powers, nothing whatever has occurred to prove that the battleship has outlived its usefulness. The loss of these vessels must be viewed carefully in the full light of the circumstances under which it happened. On the night of the attack at Port Arthur, there is no question that the Russians were totally unprepared. An article published recently in one of our leading dailies, by a correspondent who was on board a passenger steamer that lay with the Russian fleet in the outer roadstead, makes it perfectly clear that an attack by the Japanese on that particular night was not even dreamed of.

The task of sinking these ships, judging from the description, was almost as simple as if the torpedo boats had steamed in among a fleet of anchored merchant vessels in time of peace. In saying this we do not detract one iota from the praise due to the Japanese for their alertness, dash, and skill. We simply wish to emphasize the fact that the torpedoing of the battleships "Czarevitch" and "Retvizan" and the cruiser "Pallada" proves nothing more, as regards the vulnerability of battleships, than that an 18-inch Whitehead torpedo with 200 pounds of guncotton in its nose will, if fired from close ranges of a few hundred yards, most surely disable, if not send to the bottom, any battleship afloat. This has been known for years, and the practical demonstration of the fact on that eventful night in Port Arthur has introduced into the problem of battleship construction not a single factor that was not well known before.

As to the sinking of the "Petropavlovsk," it is not denied that she was sunk by a submarine mine of some kind, and the probabilities are that it was one of several that were laid by the Japanese on the night previous to the disaster. A submarine mine may contain anywhere from 250 to 500 pounds of the most powerful high explosive. It was perfectly well known that contact with such a mine by anything that floats, battleship or what-not, meant almost certain destruction. The "Petropavlovsk" did not turn turtle because of any faults in her design, or any want of a proper margin of stability; she turned turtle because when a huge section of her bottom was blown in, the work of cutting her in two was completed by the blowing up of the magazines. It is little wonder that she went down; and it matters little whether she went down on an even keel, by the head, by the stern, or keel uppermost. It was not that the battleship was weak; but that the mine was strong. The true lesson of the loss of the Russian battleships is that these costly and most formidable engines of war are to be handled with a becoming sense of their inestimable value, and of the terrible gap that is left in the naval fighting strength of a nation if so much as one of them be lost. They are not designed for running in and out of harbors over fields that are mined both by friend and foe. They were never built as floating fortresses for harbor defense. Their place is in the open; they are preeminently deep-sea craft; they are designed to fight where sea room can be had, the perils of the mine do not exist, and the deadly torpedo boat can be fought under conditions that limit its powers. Had the splendid Russian fleet on the night of February 9 been concentrated, as it should have been, in the inner harbor of Port Arthur, it would not have had its wings clipped at the very opening of the war. It would have probably met and fought the Japanese fleet on the open sea, on thoroughly even terms, if not with a slight advantage in weight and numbers, and we have not a doubt that after the hard hammering of a bitterly-fought engagement in the open, the survivors would have proved to be the ships that carried the heaviest guns and the heaviest armor.

The torpedo and the mine, however, have undoubtedly added in this war to their prestige, even among those naval experts who are able to estimate the dramatic incidents of the war at their full value. The most astonishing thing is the comparative immunity with which the torpedo boats seem to have run in under the fire of the forts, whether to attack with the torpedo, or to escort loaded merchant ships for blocking the harbor. What naval men are hoping for is that there may yet be a fleet engagement in which the battleship will be given an opportunity to demonstrate its powers of attack and defense.

SOME INTERESTING FACTS ABOUT THE DEVELOPMENT OF THE EDISON STORAGE BATTERY.

In a lecture delivered before the New York Electrical Society on April 27, Mr. R. A. Fliess, the superintendent of the testing department of the Edison Storage Battery Company, traced the development of the new nickel-iron storage cell from its beginnings up to its present form, in which it is being manufactured. A number of interesting lantern slides were exhibited, showing the cell and the way it was tested in the Edison laboratory, as well as numerous discharge curves taken from the different cells under widely varying conditions. Some half dozen cells on the lecture room table showed the different steps in the development of the present type.

Mr. Edison's first experiments were made with small single briquettes of active material suspended in caustic potash electrolyte in round glass jars. By surrounding a briquette of nickel with a number of briquettes of iron and discharging it, Mr. Edison found he could obtain 1-5 of an ampere hour of current per gramme of nickel, and by reversing the process, 0.23 ampere hour per gramme of iron. These results were arrived at early in 1901 after much experimenting; and the best part of a year, during which some 10,000 tests were made, was spent in refining and improving these active materials in order to increase their capacity. Finally, in the fall of 1901, ½ an ampere hour per gramme of nickel and 0.57 ampere hour per gramme of iron were obtained, whereupon Mr. Edison set to work to build a commercial cell.

The active materials were prepared in sufficient quantity to make up a set of automobile cells, but when the first one was completed and tested, it was found that mixing the active material in bulk and in commercial quantities was quite a different matter from making a little for laboratory purposes, and that consequently the capacity of the first lot of cells was somewhat reduced.

The first machine-made cell was completed in January, 1902. This cell had 9 iron and 9 nickel plates, although the first hand-made cell had twice as many iron as nickel. Twenty of these cells were made and were tested on the road in a Baker runabout, which was first sent out equipped with the new battery on April 3, 1902. These cells, which were of the "C" type, were tested thoroughly after they had driven the runabout 2,488 miles, and, on the test discharge, they gave about 18 per cent in increased capacity. This increase, however, was due to numerous overchargings which they had received when in service, and, on receiving a normal charge afterward, they resumed their normal capacity. This appears to be a good feature of the Edison cell, viz., that if extra capacity is needed, about one-third more can be got out of it if it is given an extra long charge first. Yet this heavy overcharging does not appear to hurt the plates. The "C" type cell was, however, affected by the rates of discharge to a considerable extent. It lost 37 per cent in watt-hour capacity when discharged at five times the normal rate, as against 50 per cent loss by the lead cell at the same rate. This defect Mr. Edison set out to remedy. Another difficulty which was met with at the start was that if hard rubber was used in the cell for separation and insulation purposes, it caused the caustic potash to foam. Rubber had to be abandoned, therefore, for a time, and glass used instead. Flat, enameled, iron clamps were devised for holding the plates together and against the glass rods which were placed between them, while different arrangements of glass tubes on steel plates had to be devised and tested for insulating the plates from the bottom of the jar. All this took a great deal of time, as Mr. Edison was very thorough. Later, after he had solved the problem of capacity at varying rates of discharge, he took up again the question of rubber for insulating purposes, and finally succeeded in treating it so as to overcome the difficulties and so that it can now be used without any damage to the cell.

The "D" type cell showed a considerable advance over the "C" type. There was 35 per cent more surface area of active material in this type cell, which contained 18 positive plates of nickel and 18 negative plates of iron. When discharged at a 150-ampere rate, this cell gave only 4 ampere hours, or 2 per cent, less capacity than when discharged at a 10-ampere rate, and there was no difference in ampere hour capacity between a 30- and a 120-ampere discharge rate.

The present, or "E" type, cell is perfect as regards falling off in capacity at a high rate of discharge. This cell can be discharged at five times the norma' rate without any loss whatever in ampere-hour ca· acity. This type of cell having 18 plates (6 iron and 12 nickel), weighs 47¾ and 54¼ pounds per horse-power-hour at a 30- and 120-ampere discharge rate respectively. At the former rate of discharge, the "E" cell gives 15.56 watt-hours per pound as against 14.7 watt-hours per pound—the figure given by Dr. Kennelly in his paper read in May, 1901. The comparison between the lead cell and the nickel-iron cell was neatly made by a photograph showing two of the latter cells in one pan of a balance, which was elevated by a single lead cell in the other pan. The lead cell weighed 27½ pounds against 25 pounds for the two Edison cells (which is equal to a net gain of 9 per cent in weight), and the latter had 34 per cent more energy, their watt-hour capacity being 375. The space they occupied, however, was only slightly greater than that taken up by the lead cell. The three sizes of cells that are now being manufactured are a 12½-pound, 18-plate, 110-ampere-hour cell; a 17¼-pound, 27-plate, 165-ampere-hour cell; and a 28-pound, 45-plate, 275-ampere-hour cell. These cells, by a considerable overcharging, can be made to give 140, 220, and 350 ampere-hours respectively. The first cost of an Edison battery is nearly double that of a lead battery of equal capacity, a fact mentioned not by Mr. Fliess, but by one of the audience who took part in the discussion. At a four-hour rate of charge, Mr. Fliess claimed for the Edison battery 55 to 60 per cent watt hour efficiency, while the watt hour efficiency of a good lead battery is about 75 per cent. Discharging the Edison cell at high rates for short periods decreases the energy output but slightly. Between the normal and five times the normal rate of discharge, the efficiency of an Edison cell varies between 55 and 44 per cent only, while the efficiency of a lead cell under the same conditions varies from 75 per cent to 38 per cent.

If the battery is charged in two hours at 75 amperes instead of in 3¾ hours at 40, the total loss in efficiency due to the use of this high rate is only 6.6 per cent, whereas the saving in time amounts to 46 2-3 per cent. At still higher rates of charge, such as 120 amperes for 2¼ hours instead of 30 amperes for 9 hours, the loss of efficiency in output increases in a slightly greater ratio than that of the saving in time. For instance, in the case just cited, there is a saving of 75 per cent in time, with a loss of 12 per cent in efficiency. The voltage on charge reaches 1.85 volts when the cell is about two-thirds charged. From that point on, the charge curve is a straight line, no matter how much longer the cell is charged. On this account there is no way of telling when the cell is charged, except by keeping account of the amount of current that has been put in. A recording ammeter for the discharge and charge will of course overcome this difficulty.

With regard to the durability of the cell, Mr. Fliess stated that a three month's test in a specially devised bumping apparatus, during all of which time the cell was being constantly charged and discharged, failed to show a loss of active material or capacity. Tests on the road covering over 5,000 miles under the most severe conditions failed to cause any deterioration. This would go to show that the life of the Edison cell is extremely long.

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

Though the evening skies are not very brilliant at present, there is yet much worth seeing in them. In identifying the principal constellations, let us begin with Ursa Major, which, at our usual hour of 9 P. M. on the 15th, lies just north and west of the zenith, the Dipper being most nearly overhead. The star at the bend of the handle—Mizar—is a fine naked-eye double, having a companion of the 5th magnitude, at a distance of some 12 minutes of arc.

Following the curve of the dipper-handle to the southward, we pass several fainter stars in Boötes, and reach Arcturus, the brightest star in this part of the sky. Half way down from this to the horizon, and rather to the right, is the fainter Spica, the principal star of Virgo. Below it and to the right is the little group of Corvus.

Leo lies southwest of the zenith, and Hydra occupies the dull region below him and Virgo.

A series of brighter constellations lies along the course of the Milky Way, which skirts the horizon pretty closely from west through north to east.

Canis Minor is almost due west, Procyon being still an hour high. North of it is Gemini, and then Auriga. Perseus has almost set in the northwest, but Cassiopeia is still visible, right under the Pole. Cepheus comes next on the right, and then Cygnus, which is just rising. Lyra is higher up, so that Vega is the most conspicuous star in the northeastern sky.

Ophiuchus and Serpens are rising in the east, and Scorpio in the southeast. Hercules and Corona Borealis, which lie between Vega and Arcturus, and Draco, which is between them and the Pole, are the only other prominent constellations.

Observers south of latitude 30 deg., that is, in southern Florida and Texas and farther south, can see the Southern Cross at this season, low on the horizon, and, a little later, the two bright stars of Centaurus, which lie some 15 deg. east of the Cross, and point to it.

Certain recent observations relating to some of the asteroids are of sufficient interest to deserve mention here. It will be remembered that these small planets are, for the most part, too small to be seen as disks even in the most powerful telescopes. Only the four brightest ones have measurable diameters, and Prof. Barnard has found that these are from 200 to 500 miles in diameter. Many of the fainter ones must be less than 50 miles in diameter—probably less than 20; and telescopes several times more powerful than any now existing would only show them as star-like points.

There would seem to be no hope of finding out the time of rotation of such small bodies; but in some cases this can be done, as we shall soon see. The first asteroid to lend itself to such an investigation was Eros, already remarkable enough for its singular orbit and close approach to the earth. Early in 1901 it was discovered that the planet showed rapid variations in brightness, to the extent of more than a magnitude, so that at some times it was three or four times as bright as at others. Further observation showed that the changes repeated themselves in a period of 5¼ hours, during which there were two maxima of brightness, and two minima, which some observers found to be unequal in light.

As the planet changed its direction from the earth, the amount of the variation decreased, and in a few months it had become insensible.

Early in the present year it was announced from the Harvard Observatory that Iris, one of the brighter asteroids, showed similar fluctuations in light, but of much smaller range—only 3-10 of a magnitude, or about 25 per cent of the total light. In this case the period is 6¼ hours, with two maxima and two minima, as before.

Certain other asteroids have been observed to vary in brightness, but the extent and period of their variation is not yet determined.

The only available explanation of such changes in a planet's light seems to be to assume that the planet is rotating about an axis, and either that it is not spherical in form, or that some parts of its surface are much darker than others, or that both of these things happen together.

If the planet is of irregular form, and we are looking at it from the direction of its equator, we will evidently see it "end on" twice in each revolution, and broadside on twice.

The first position will give us a minimum of light, and the second a maximum. If we accept this explanation for the cause of the light-changes, the period of rotation of the planet must be twice the interval between consecutive maxima, that is, 5¼ hours for Eros, and 6¼ for Iris.

But if we assume that the variation is due to the presence of dark and light spots on a nearly spherical planet, the phases will in general occur only once in each revolution, so that we will be led to find values for this period just half as large as those quoted above. However, it is easily possible to imagine arrangements of spots which give rise to two maxima and two minima in each revolution, so that the time period remains uncertain. If we allow ourselves to assume that the planet is irregular both in shape and in the brightness of its surface, it would be possible to represent almost any observed light curve by a variety of different assumptions. Consequently, we cannot be sure of any details about the planet's surface (at least at present), though we can be certain that it rotates rapidly, and that the period is either that mentioned above for each planet, or else one-half of it. The longer periods appear on the whole to be more probable.

The rotation hypothesis affords also an explanation of the observed change in the range of the variation of Eros. If we looked at one of our hypothetical planets from the direction of its axis of rotation, the total amount of light it sent us would be constant, no matter how it was spotted, for we would always see the same side of it.

Consequently, if we assume that the planet's axis of rotation is so situated that at first the earth was nearly in the plane of its equator, but later got nearer and nearer to its pole, we can account for the decrease and final disappearance of its variations in brightness.

The idea that the asteroids may be irregular in shape recalls, and apparently confirms, the old "explosion hypothesis," which regarded them as the fragments of a disrupted planet. This theory has however been discredited by the proof that it would have required, not one, but many successive explosions to produce the present system of asteroid orbits, so that the wisest attitude appears to be to suspend judgment on the question.

THE PLANETS.

Mercury is evening star until the 13th, when he passes between us and the sun and becomes a morning star. He is usually nearly in line between us and the sun, and if he had been in conjunction a day earlier, he would have transited across the sun's disk. We need not regret this seriously, however, as there will be a transit in 1907. He is practically invisible to the naked eye throughout the month.

Venus is morning star, but is inconspicuous, as she is getting near the sun. On the 1st she rises about an hour before him, but the interval decreases to about half an hour at the end of the month, when she will be hardly visible.

Mars is evening star until the 30th, when he is in conjunction with the sun and becomes a morning star. He is entirely invisible throughout the month.

Jupiter is morning star in Pisces, rising at about 3 P. M. on the 15th, and is fairly conspicuous.

Saturn is morning star in Capricornus. On the 11th he is in quadrature with the sun, rises at 1 A. M., and comes to the meridian at 6 A. M.

Uranus is in Sagittarius, and comes to the meridian at 2:20 A. M. on the 15th.

Neptune is in Gemini, and sets about three hours after the sun.

THE MOON.

Last quarter occurs at 7 A. M. on the 7th, new moon at 6 A. M. on the 15th, first quarter at 5 A. M. on the 22d, and full moon at 4 A. M. on the 29th. The moon is nearest us on the 22d, and farthest away on the 8th. She is in conjunction with Uranus on the 3d, Saturn on the 7th, Jupiter on the 12th, Venus on the 13th, Mercury on the 14th, Mars on the 15th, Neptune on the 18th, and Uranus again on the 30th.

Cambridge, England.

ACTION OF RADIUM ON METALS.

Mr. N. Orloff, as stated in a recent communication to the Russian Phys. Chemical Society, covered in April, 1903, an ebonite capsule containing 0.03 gramme of radium bromide with an aluminium plate, 0.01 millimeter in thickness, instead of the mica generally used. In the course of July, the author, having opened the capsule, noted on the surface of the aluminium turned toward the radium some protuberances of the same aspect as the surrounding surface of the aluminium and resembling small drops of melted metal. These protuberances proved to be radio-active, producing a photographic image on acting for some minutes through black paper, and even after six months they were found to emit invisible radiations without any appreciable weakening. The author thinks that a stable alloy is formed by the accumulation of material particles given off from the atomic systems of radium, around small aluminium nuclei.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1479, opens with an illustrated article on the "Old and New Railway Bridges Over the Susquehanna River at Rockville." The English correspondent of the SCIENTIFIC AMERICAN describes at length an engineering novelty in the form of a powerful gasoline locomotive. Pictures accompany his article. Dr. Erlwein's interesting discussion of the purification of potable water by means of ozone is concluded. Prof. C. F. Burgess and Mr. Carl Hambuechen recently read a paper at the Washington meeting of the Electro-Chemical Society on electrolytic iron, to which subject much attention has been devoted of late. The paper describes original work in an investigation, the primary object of which was to produce, if possible, pure iron in such quantities and at such cost as to make it an available material for further inquiry into its properties. The work shows that it is possible to obtain electrolytic iron in large quantities and at a reasonable cost. Mr. William A. Robertson writes interestingly on Pennsylvania's first mountain railroad. "Sofka and Blue Dumplings, a National Indian Dish," is the title of an instructive article by William R. Draper. Charles H. Coe discusses the subject of ginseng, its character, history, commerce, and medicinal value, with great thoroughness. In a *résume* of recent studies of radio-activity, new information about radium is given.

EXPERIMENTS WITH THREE-PHASE ELECTRIC ARCS.

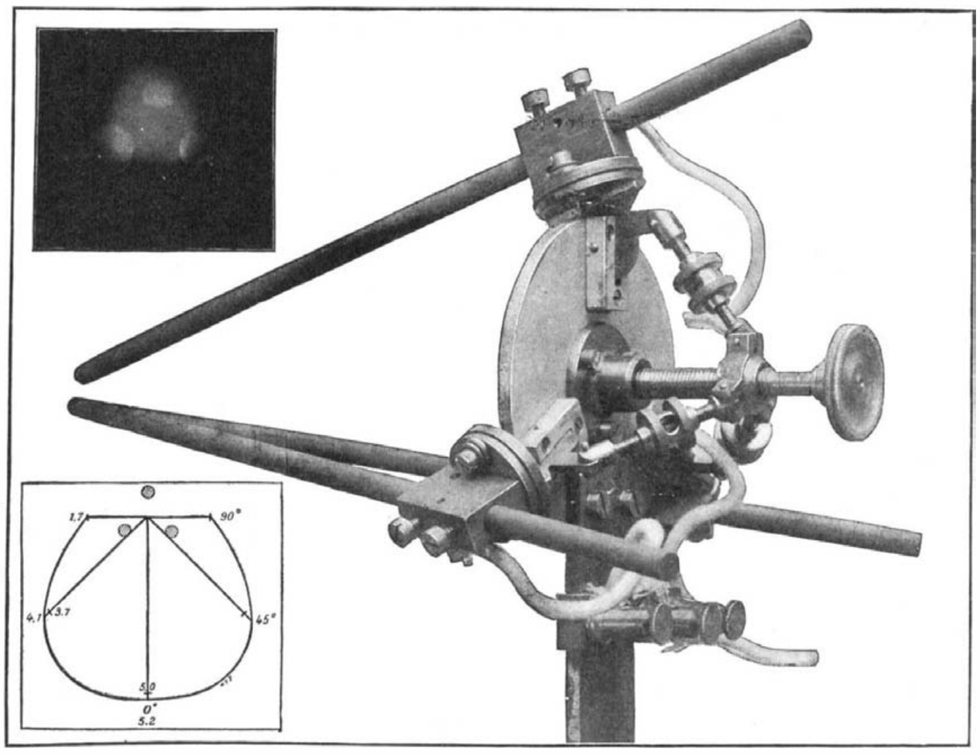
Three-phase electric arcs have recently been produced and investigated by the Italian General Electric Edison Company, at Milan, on the one hand, and by an American, Mr. Richard Fleming, on the other. Quite independently of these researches (of which he was not aware until after his work was completed), Dr. P. L. Mercanton, of Lausanne, Switzerland, undertook a number of investigations in the same direction with a view of producing powerful illuminants in a rather condensed form, and of materially lowering the frequency necessary for maintaining the arc. The principal object of this work was, however, a possible increase in the luminous output of the electric lamp.

Three-phase arcs are constituted by three single-phase arcs burning successively between each pair of carbons, each being extinguished and lit again twice per period. As these are therefore at any time at least two arcs burning, the cooling effects are likely to be considerably reduced, and the consumption of energy required per candle materially lowered. These previsions were in fact fully borne out by experimenting with the lamp represented.

The lamp contains three carbons connected each to a phase of the current, and constituting a regular triangular pyramid, on the top of which the arc is produced by virtue of electrodynamic forces. Regulation is effected by hand, and consists in inclining the carbons with respect to the axis of the pyramids. For this purpose they are supported by three carbon holders which are pivoted at three points placed at angular distances of 120 deg. on the circumference of a circular metallic disk that serves as a base plate. To the middle of this disk, on the side opposite the arc, there is fixed a strong screw, the box of which is connected to a lever system controlling the mutual distance of the carbons. By a special arrangement, the levers may be lengthened or shortened.

The aspect of the luminous focus of this lamp depends to some degree on the kind of carbon used; the latter should be rich in volatile substances. As regards the length of the arc, on which its behavior will depend to a high degree, this is always upward of some millimeters, and in most cases superior to 10 millimeters. Under these conditions, the ends of the carbon appear to the eye placed on the axis of the lamp, like three luminous points of a high brilliancy (as represented); the common angle between the carbons varies between 30 deg. and 50 deg. The lowering in the frequency necessary to maintain the three-phase arc may be readily shown by adjusting the arc for the maximum of frequency and eventually withdrawing violently one of the carbons, when the arc ceases to pass between the two remaining points. The jumping of the single-phase arc from one pair of carbons to the other is visible by the flicker in the light given off from the edges of the crater in front of each other. For a number of periods ranging between 38.5 and 51, the light is quite steady.

In order to determine the candle power of three-phase arcs, Dr. Mercanton undertook photometric measurements for various carbons and different directions of the light rays, by means of a Lummer and Brodhun photometer.



A THREE-PHASE ELECTRIC ARC.

From the results recorded, it is shown that three-phase arcs have a much better luminous output than monophase arcs between the same carbons.

While the previsions of the experimenter were thus borne out fully, Dr. Mercanton is however somewhat doubtful as to whether the saving afforded will warrant the difficulties inherent in the design of a regulating mechanism. On the other hand, there is the necessity of using three wires instead of two, and of replacing the single-phase lighting transformers by three-phase transformers. Wherever regulation by hand is practicable, and especially in connection with luminous projections, three-phase arcs seem however likely to render materal services, in virtue of the steadiness and brilliancy of the triple illuminant.

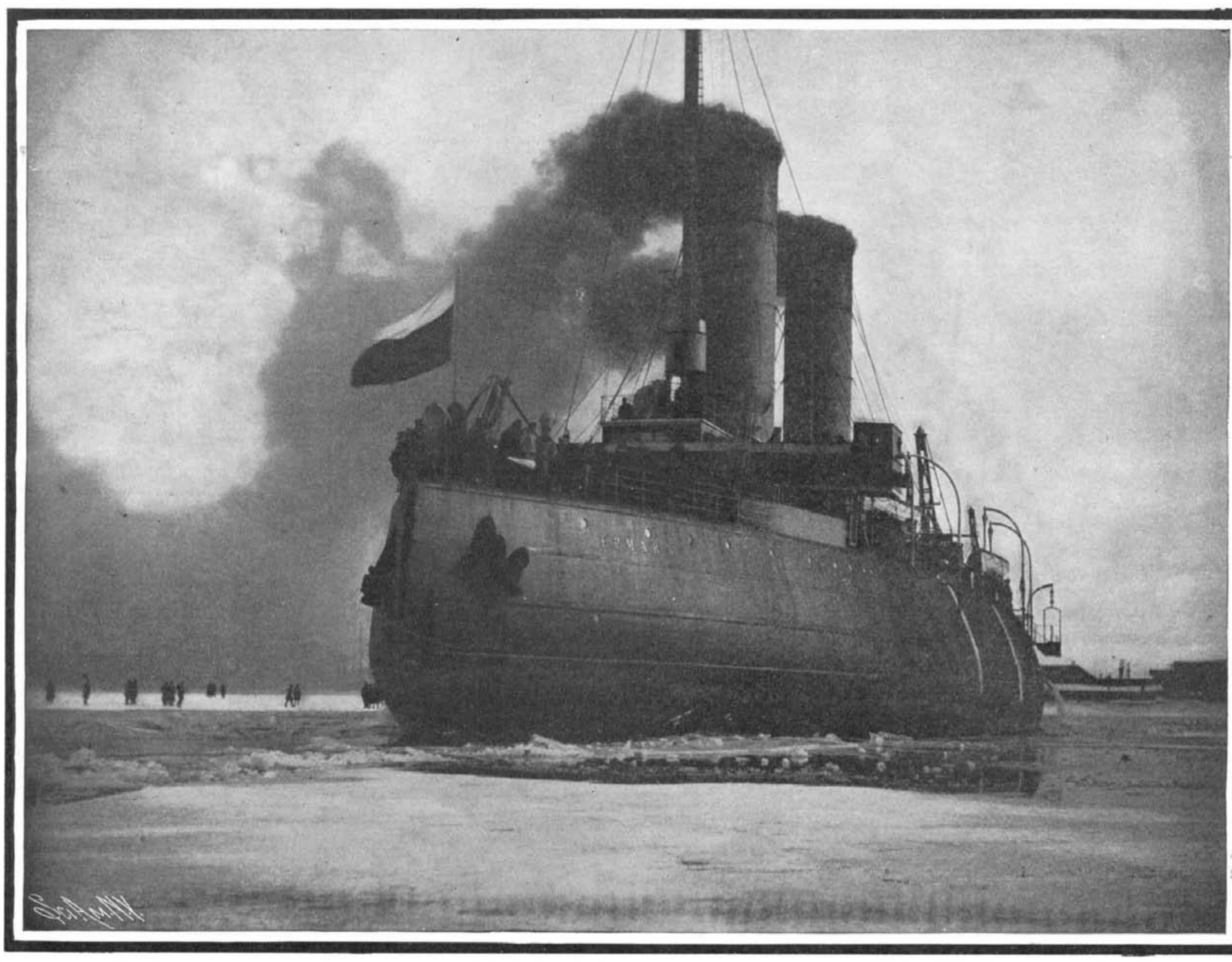
Thirty-five miles of roadway have been constructed within the World's Fair grounds.

THE RUSSIAN ICE-BREAKER "ERMACK."

To Admiral Makaroff, who went down with the ill-fated "Petropavlovsk," is due some belated tribute for his skill and enterprise in familiarizing the Russian marine with ice-breaking steamers of more pretentious size than the small craft of this type that had been used for thirty years in the harbor of Cronstadt. The "Ermack," if not actually designed by him, is at least a product of his energy and the embodiment of the best features of the American ice-breakers, which he had made the subject of an exhaustive study during a visit to America. She carries, moreover, many an appliance which Makaroff himself invented.

The problem of keeping open the ice-bound ports of the Baltic and of the Siberian Pacific coast is somewhat more difficult than the task that confronts the American engineer of the Sault Ste. Marie region. Russian ice is thicker; it lasts longer; and the longer it lasts, the more difficult it is to penetrate. For that reason Admiral Makaroff was compelled to design a vessel which, although in principle it did conform with the best American practice, still embodied features that would enable her to cope with the difficulties presented by the ice-bound harbor ice of Cronstadt and Vladivostock. What these features are will appear more fully from the following description:

The "Ermack" is 335 feet in length, 71 feet beam, and with her coal and stores on board has about 8,000 tons displacement. Her propelling machinery consists of four sets of triple-expansion engines of 2,500 horse-power each, steam being generated in six very large double-ended boilers built for 160 pounds pressure. She has three stern propellers and one bow propeller. Her speed with 8,000 horse-power is nearly 15¼ knots. The speed with the three after engines working ahead is about 15½ knots, and the speed with all the engines running ahead is about 16¼ knots, the power in each case being at the maximum. The highest indicated power developed is 12,000, corresponding with the speed of 16¼ knots.



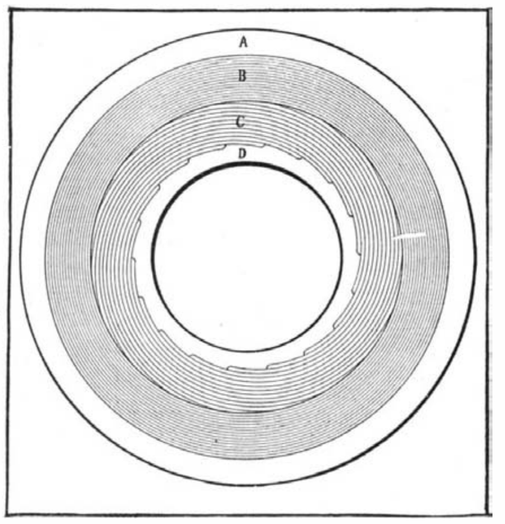
THE RUSSIAN ICE-BREAKER "ERMACK." CAPABLE OF FORCING HER WAY THROUGH ICE TWENTY-FIVE FEET THICK.

Each propeller has a set of main engines of the triple-expansion type for driving it when the full power has to be exerted. At the side of the shafting of each screw is a pair of ordinary compound engines which drive the propeller by tooth gearing. The cylinders of the main engines are 25½ inches, 39½ inches, and 64 inches in diameter by 3 feet 6 inches stroke. The boilers are are double-ended, and six in number, 15 feet in diameter, and 20 feet 6 inches long. The grate area is 800 square feet, while the heating surface is 27,600 square feet total. The propellers are made with nickel-steel blades containing 3 per cent nickel, having a tensile strength of 40 tons; the stern propellers are 14 feet in diameter, the wing propellers being 14 feet 6 inches pitch, and the center propeller 14 feet pitch. The forward propeller is 13 feet in diameter and is 13 feet 6 inches pitch. The

(*Continued on page* 362.)

HIGH-VELOCITY 6-INCH WIRE-WOUND GUN FOR THE UNITED STATES ARMY.

The Board of Ordnance and Fortifications of the United States army recently made an allotment of $41,000 for the construction of a 6-inch Brown wire-wound gun which, if it fulfills the requirements of the



A. Trunnion jacket. B. Wire. C. Segmental tube. D. Liner.

Cross-Section Through the Gun at the Powder Chamber.

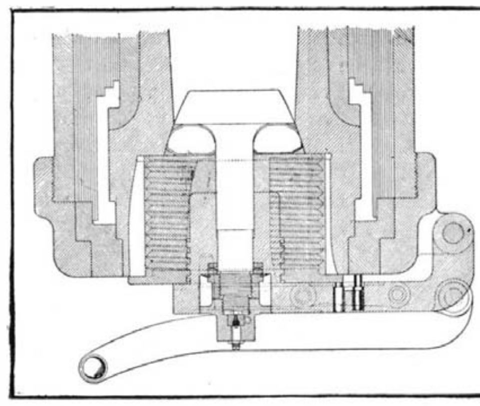
specifications on which it is built, will certainly be the most powerful piece of its weight and size in existence. The gun will shortly be tested at Sandy Hook proving ground and fired 250 rounds, with gradually increasing powder pressures, the last five rounds being fired under from 45,000 to 50,000 pounds maximum pressure in the powder chamber. The estimated service velocity of the gun is 3,541 feet per second, under a maximum powder pressure of 42,823 pounds.

The full significance of these figures will be realized if we compare them with the ballistics of the 6-inch 50-caliber navy gun which is designed for a muzzle velocity of 2,900 feet per second when firing a 100-pound projectile. On February 8 of the present year the Bureau of Ordnance, in consequence of recent failures of some navy guns, decided to reduce the service velocities, and an order was sent out that the 6-inch, 50-caliber navy gun was to have a service velocity of only 2,700 feet per second, which is 800 feet per second less than the service velocity designed for the new wire-wound gun under construction. As the striking energy of the shell varies as the square of the velocity, it will be seen at once how very much more efficient the new piece will be than the latest type of navy gun.

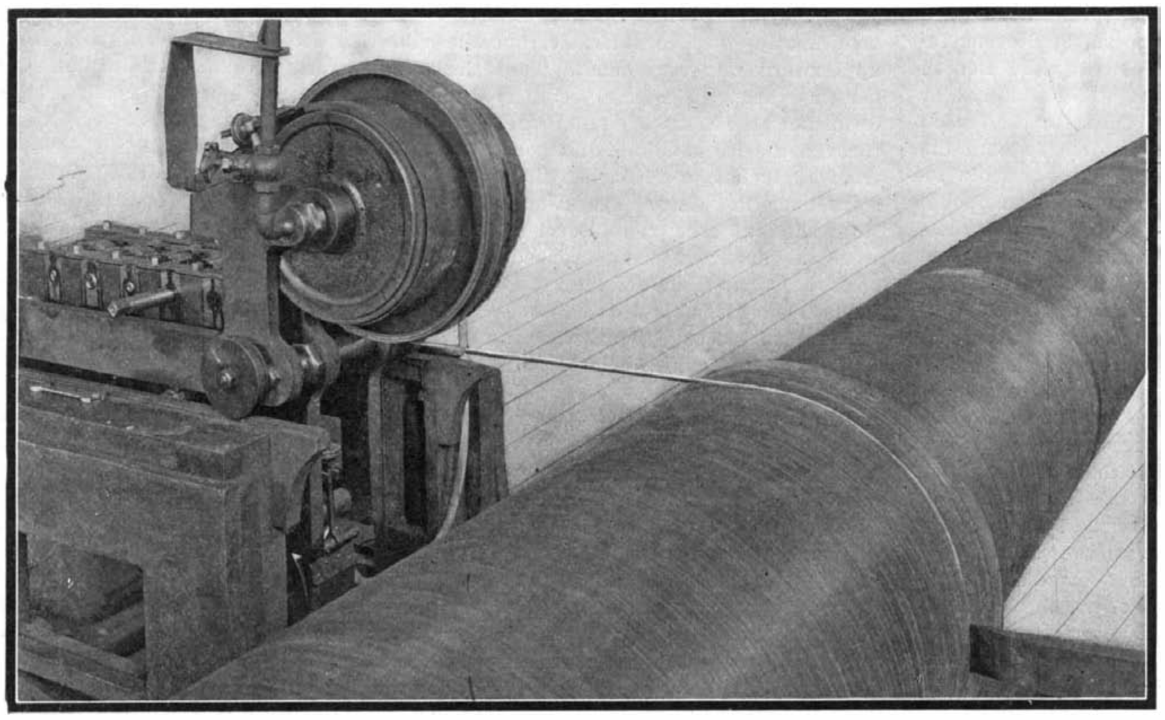
If a person who was quite unacquainted with modern gun construction were to watch the tedious and costly process of building up a modern high-power gun, he would naturally ask why it is not forged out of one solid piece. The gun-maker, in explaining to the inquiring layman why guns must be built up piecemeal would point out that, in forging masses of metal of the size that would be required, it would be impossible to detect any hidden defects, and that, steel being a highly elastic material, it is necessary that in the finished gun, if the whole mass of the gun is to be available in resisting the bursting effects of the powder, the metal be brought into a certain condition of initial strain. He would tell him that in a 12-inch gun, for instance, where there may be a foot or more of solid metal surrounding the bore, the pressure of the powder gases would stretch the metal at the bore of the gun to the rupture point, before the outer layers of metal were able to add their full resistance to that of the inner layers; that the bore of the gun would be cracked, and that the crack would eventually extend from bore to circumference. He would explain to him how Rodman, an army officer, at the time of our civil war, very cleverly met the difficulty in cast-iron guns, by running a stream of cold water through the bore of the gun when it was being cast, chilling and contracting the metal at the bore, with the result that as the body of the metal throughout the gun cooled from bore to circumference, it contracted and gripped the bore, throwing the latter into a state of compression, and placing the rest of the metal of the gun in a state of initial tension. The effect of this was that when the gun was fired the pressure of the powder gases was felt throughout the whole section of the gun from bore to circumference and every part of the metal did its share of duty.

He would then explain to him that as the manufacture of steel developed, the superiority of this metal to cast iron for gun manufacture became evident, and the Rodman principle of gun construction was applied by first making a steel tube containing the bore of the gun, and then shrinking on successive hoops of steel which, as they cooled, threw the inner tube into a state of compression, and were themselves left in a state of tension. He would explain to him further that in addition to the higher resisting qualities of steel over cast iron, the former metal, having the advantage of being built up in hoops which are forged on a mandrel, the metal of the hoops can be subjected to more thorough working and inspection, with a view to improving the quality of the steel and eliminating all defects. The gun manufacturer would then proceed to explain to our supposititious layman that the system of building up guns by winding steel wire upon an inner tube was a further step in the direction of securing thorough inspection of the steel, and of placing the finished gun under conditions of initial compression and tension which would be accurately known to the maker.

Although the wire-wound gun is but little known in the United States, the gun built by Capt. Crozier and the various Brown wire guns which have been built and tested by the army being the only guns of the wire type that have been built in this country, the wire-wound system has been adopted by the English navy and is the standard type that is built by the two great gun-making firms of Armstrong and Vickers-Maxim in England. All the large guns of the latest English warships are wire guns, as are the weapons which are doing such good service in the Japanese navy during the present war in the Far East. The system has, therefore, long ago passed beyond the experimental stage. The difference between the wire gun herewith described and the English and Japanese guns is that in the former the fundamental principles upon which wire guns are constructed have been carried further along their logical lines of development, with ballistic results that are proportionately superior.

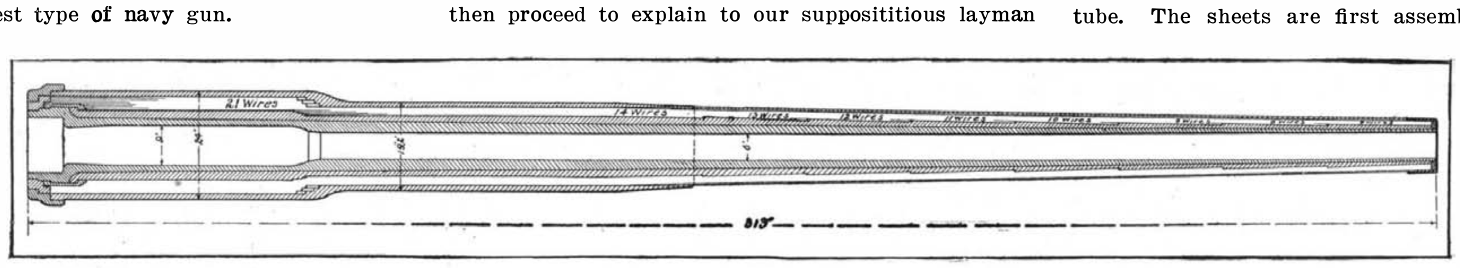


Longitudinal Section Through the Breech.

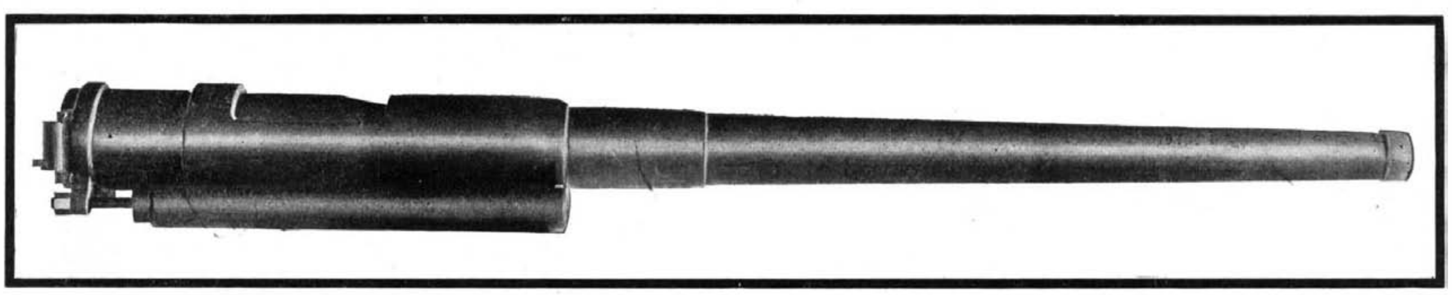


Winding the Wire Upon the Gun, Under a Tension of 2,500 Pounds per Wire, or 125,000 Pounds per Square Inch.

In the construction of the new 6-inch gun, the foundation consists of a forged steel lining tube with an elastic limit of 60,000 pounds and an ultimate breaking strength of 105,000 pounds to the square inch. This tube extends for the full length of the gun, which is 26 feet 1 inch in length, and it is enlarged from a diameter of 6 inches in the bore to a diameter of 9 inches in the powder chamber, which has a length of 49.3 inches and a cubical capacity of 3,120 cubic inches, which latter, it will be seen, is exceptionally large for a gun of this caliber. On this tube is assembled what is known as the segmental tube. It is formed of a series of sheets of rolled steel, 308 inches in length, 21½ inches wide at the breech, and 4½ inches wide at the muzzle of the gun, which are rolled into an involute shape and wrapped together to make up a solid tube. The sheets are first assembled on a stepped core, or former, and securely clamped. The core is then withdrawn and a stepped lining, of the section shown in our engraving, is forced into position within the segmental tube and the clamps are firmly screwed down, one at each 6 inches of the length of the tube, which is then centered in the lathe and turned to size. A new series of clamps is then put on, and the exterior of the segmental tube is turned down into stepped frustums of cones, each step being equal to the thickness of one wire, or one-seventh of an inch. There are seven of these steps over the bore of the gun and four steps where the powder chamber commences, one of the latter steps being the depth of one wire and three of the steps



Longitudinal Section, Showing Thickness of Wire Winding.



New 50-Caliber, 6-Inch, Wire-Wound Gun for the United States Army, Shortly to be Tested at Sandy Hook. Maximum Powder Pressure 42,823 Pounds. Muzzle Velocity, 3,541 Feet per Second.

THE MOST POWERFUL GUN FOR ITS WEIGHT IN EXISTENCE.

equal to the depth of two wires. Now comes the process of wire winding. One end of the wire is driven into a hole bored into the segmental tube at the first step from the powder chamber, and the wire, which is one-seventh of an inch square, is wound upon the gun under a tension of 2,500 pounds. The thickness of the winding varies from seven thicknesses, or one inch, at the muzzle to 21 thicknesses, or 3 inches, over the powder chamber. A trunnion jacket, extending from the breech to beyond the trunnions, a distance of about 12 feet, is then shrunk on with sufficient tension merely to prevent its rotation upon the segmental tube. A sheet-steel tube is also placed over the chase of the gun for the purpose of giving it a finish and protecting the wire wrapping. It should be noted that no reliance is placed upon the trunnion jacket or the chase covering, for the strength of the gun. By a study of the sectional view of the breech, it will be seen that the thrust of the breech-block is taken up jointly by the lining tube, the segmental tube, and the trunnion jacket, and a very even distribution of the longitudinal stress is thereby secured. The advantage of using a segmental built-up tube to carry the tension of the wiring is that the plates, being rolled down to a thickness of one-seventh of an inch, the danger of hidden flaws existing in the metal is practically eliminated; whereas when the solid tube is used, as in the built-up guns, there is sufficient thickness of metal for such flaws to exist without being detected. Moreover, in the segmental tube, should a flaw exist and a fracture occur in any one plate, it could merely extend through the thickness of one-seventh of an inch, and would not, as in the case of a solid tube, extend radially through the whole thickness of the tube.

In an investigation of the principles of the segmental tube wire gun by Prof. Denton, of Stevens Institute of Technology, Hoboken, N. J., Mr. Denton estimated that there was no loss of longitudinal or tangential strength in the built-up tube, for the reason that the tension of the wire windings throughout the whole length of the tube will bind the segments together "with sufficient pressure to cause the frictional adhesion between its curved lines of division to exceed the shearing forces which would be transmitted along these lines in a forged tube of the same thickness, when fired with powder developing the highest current pressures." He found, moreover, that "the metal of the segmental tube, by virtue of the magnitude of its frictional adhesion" (due to a tension of 125,000 pounds to the square inch in the wire winding), "is as available as a source of longitudinal strength and transverse stiffness as the same thickness of solid metal." Prof. Denton further found that "the distribution of the wire windings secured a practically uniform compressive resistance in the lining tube throughout its length, and without exceeding about 90 per cent of the elastic strength of the tightest wire. The lining of the tube was probably compressed so that under 50,000 pounds per square inch of powder pressure it was not required to exert a tensile resistance." In other words, the principles of the wire gun had by this system developed to such a high point that when this gun is fired at Sandy Hook in the last few rounds, with a maximum powder pressure of 50,000 pounds to the square inch, and a corresponding muzzle velocity of about 3,900 feet per second, the lining tube will still be under some of the initial compression which was given to it when the wire was wound on; which means that the wire with its high elastic limit of 150,000 pounds to the square inch, will be comfortably taking care of the enormous forces developed by the powder.

The unusually high velocities secured in this gun are due to the exceptionally large powder chamber. Owing to the abundant supply of gas given off by the burning powder, the pressure on the base of the shell is maintained at a high figure even to the moment that the shell leaves the muzzle, when the pressure is no less than 23,721 pounds to the square inch. In the earlier guns, the powder pressures fell rapidly toward the muzzle and it is this high muzzle pressure that has caused the blowing off or bursting of the chase of several guns of the hooped type during the past few months. It can be seen at once that by increasing the number of windings of wire over the muzzle, this part of the gun may be made relatively just as strong and reliable as any other portion.

There were recently received at the National Museum two termitariums from Jamaica, which are regarded as the greatest curiosities which have been placed in the institution for a number of years. The termitarium is the residence of a tribe of termites, or white ants. One of these specimens was at once shipped to St. Louis, where it will form a part of one of the government exhibits at the exposition. The other was placed on view in the museum. The largest of the two nests received by the museum is about four feet long and two in diameter, being shaped a great deal like an elongated double peanut, round and oval at the ends, and with a narrower portion in the center, with a decided crook between the two ends. This was built around the limb of a tree, and in order to get the nest the limb was cut, leaving about a foot extending from each end of the nest. The construction of the nest consists of leaves overlying each other, and arranged in such order that it was likened to a bill file with bills placed in regular order one over the other.

THE RUSSIAN ICE-BREAKER "ERMACK."

(*Continued from page* 360.)

blades are enormously thick, and are calculated to be brought up by ice without breaking when running at full speed. The machinery is all designed to withstand this test.

The "Ermack" is capable at half power of putting 1,300 tons of weight on the ice to crush it down, when in her ordinary ice-breaking trim, with a draft of 22 to 23 feet. The bow is enormously strong, and for a considerable distance the frames are only 12 inches apart. The ice-belt at the bow extends to the keel. At the sides of the ship it is 27 feet deep.

The "Ermack" left the Tyne on her maiden voyage to Cronstadt early in March, 1899, under the command of Capt. Vassilieff, Admiral Makaroff being also on board. In less than a fortnight after sailing, the ice-blink was seen just before dark, the first drift-ice being met with off the western end of the harbor of Revel. In the Gulf of Finland the small drift ice is first met; this gradually grows to a paste, which, in calm weather, soon solidifies into floes. These increase in size until the solid ice is met, and it is here that the packs of ice are found. The "Ermack" proceeded by night through the ice, her course illuminated by the electric searchlight. On the rocks and islands in the Gulf of Finland the ice forms to an enormous thickness, and the noise occasioned at the bow of the vessel when breaking ice was considerable, but the vibration set up forward was very small. The "Ermack" pursued her way through the ice right up to Cronstadt. Below Cronstadt the vessel could easily break her way through the ice at 8 knots an hour, the ice field being from 18 inches to 24 inches thick, with 6 inches of snow upon it. Three days after her arrival at Cronstadt she was ordered to Revel to save steamers that were in danger of being crushed by the ice, and to open the port. Upon arrival at Revel Bay it was found that an enormous ice-pack had been formed across the entrance to the bay, 15 miles from the town of Revel. The pack had formed during a northwest gale that had blown the drift-ice from the Baltic into the bay, packing it in a dense mass 3½ miles across, about one-third of a mile wide, and from 20 to 25 feet thick, completely closing the harbor. In two hours the "Ermack" succeeded in crushing a way through this ice-pack in fourteen charges. During the limited time that the "Ermack" was on that station she was instrumental in salving eighty-two vessels that were fast in the ice.

In order to test the capabilities of ice-breakers of large size in polar ice, the "Ermack" was sent to Advent Bay, in Ice Fjord, Spitzenbergen. She was fully provisioned for twelve months. Advent Bay was left on August 5, 1899, and on the following day she encountered the first polar drift-ice. Then the fight began in real earnest. Collisions with enormous masses of ice occurred continually. The floes became thicker and older as the ship proceeded north. It was soon a task of ice breaking and charging continually. When stopped by ice, the vessel retired 100 yards or more, got up speed to strike the strong spot, and continued to do so until the obstruction was broken down. In some of the water lanes it was strange to note how the ice had separated in a vertical cleavage, leaving the walls of solid ice on each side of the canal from 12 feet to 20 feet thick. With half boiler power the "Ermack" could force her way through polar ice 12 feet to 14 feet thick at 2½ to 3 knots an hour.

Reference should be made to the arrangement for coupling up the "Ermack" with other vessels in order to make a train of ships for more effectually dealing with thick ice. Although the "Ermack" is big and strong, there is, of course, a limit to her capacity of breaking up ice and to the speed with which she can perform the operation. A vessel pushing astern of her, therefore, would supply additional power for the work. Forward, the stem is set at an angle of 70 deg. from the vertical. In going through ice she slides up, raising her bow, and this causes the ice to break down. She might, of course, mount the ice until her forward propeller came in contact with it; but this is made of sufficient strength to withstand the shock. That, however, is not what is expected generally to occur, as the form of the bow is designed to insure a constant breaking down of the ice. This would absorb an enormous amount of power; but if another vessel, either an ice breaker or an ordinary steamer, were pushing astern, naturally the speed could be increased. Moreover, a steamer not so strongly built as the "Ermack" would be protected by following close behind her. For this reason a recess has been built into the counter. This recess is designed to take the stem of the following vessel, arrangements being made for lashing the latter in firm contact with the leading craft.

The Geographical Society of Philadelphia.

The annual reunion of the Geographical Society of Philadelphia was held Tuesday evening, April 26, at the Hotel Roosevelt, Philadelphia. President Angelo Heilprin, the noted Arctic explorer and student of Mont Pelé and other volcanoes, in his opening remarks sketched the history of the society from its organization twelve years ago to the present, mentioning the great geographical discoveries made in the period in the Far North, Asia, Africa, and the Antarctic regions, in some of which members of the society have participated. The society began in a modest way with fifty-one members and has grown so that a hall seating several hundred is now needed for the open meetings. Excursions to points within reach from Philadelphia are a feature of the summer work of the society.

Prof. Heilprin announced that the Elisha Kent Kane gold medal for noteworthy geographical achievement had been awarded to Capt. R. F. Scott, R. N., of the "Discovery," who has been in charge of the British Antarctic expedition which has recently returned in safety to New Zealand after two years of arduous work. The principal features of Captain Scott's geographical work have been the tracing of the eastern edge of the Antarctic continent for 350 miles south of Mount Erebus; the journey of the "Discovery" eastward from Mount Erebus for 640 miles along the edge of the great ice-barrier to new land, named by this expedition King Edward VII. Land, which is probably a portion of the Antarctic continent. Capt. Scott has attained a point further south than any other explorer, and the geographical results of the expedition under his care are among the most important which have been achieved in recent years.

The chief speaker of the evening was Commander R. E. Peary, U. S. N., president of the Eighth International Geographic Congress, which is to meet in this country in the fall. Commander Peary said that when he was attached to the League Island navy yard, fifteen years ago, he completed the plans for his first expedition into the Antarctic regions, and presented them to Prof. Heilprin, then the president of the Academy of Natural Sciences, who took a hearty interest in the matter and, in connection with Capt. Amos Bonsall, Mr. H. G. Bryant, and others, began the agitation which made possible the Peary South Polar expedition of 1891.

To-day Arctic exploration is not to be considered a foolish matter, but it is a broad national undertaking participated in by the President, Congress, the press, and the people. The object, of course, is the North Pole, which is the mathematical center of the northern hemisphere, where there is but one day and one night in the year; where there is no west and no north, and every wind is a south wind. It is the last great geographical prize which the earth has to offer, and in view of the work which has been carried on under the auspices of the United States, its winning belongs by right to this nation.

The undertaking divides itself naturally into two parts. The first section is the journey by ship to the north shore of Grant Land; the second section is the 420 nautical miles from Grant Land to the Pole. The journey from New York to Cape Sabine or Cape York can be made every summer in about two weeks time. Here Commander Peary would get Esquimaux and dogs, and proceed to Grant Land in from two days to two weeks, according to the season. This journey is the uncertain part of the preparatory work, but it has been made by four ships. The ship would be frozen in off Grant Land by the middle of September, and the preparatory work for the next season's dash to the Pole would occupy the time until the long Arctic night set in. About the middle of February returning light would enable the sledges to start north, and they would have three months or more in which to cover the 840-mile journey to the Pole and back before there was any chance of the ice breaking up. Commander Peary himself has made several dog journeys longer than this.

The features which promise success for a new expedition are that the explorer would take an especially constructed ship which would depend primarily upon steam power for propulsion and would have auxiliary sail, rather than a sailing ship with auxiliary steam, as has been done heretofore. The second feature would be the extensive utilization of the native Esquimaux, which would be possible through the personal influence which Commander Peary has obtained with the tribe during his previous expeditions. The third feature would be Commander Peary's intimate personal knowledge of the coast. The nervous strain due to the long winter night, is the great drawback to work in the polar regions. The cold, which is easily provided against, is only relative in any case and is therefore a negligible factor. The value of the attainment of the Pole lies in getting many geographical data which need not be enumerated, farther than that they lie in pendulum observations which would be invaluable for determination of the exact shape of the globe, and in observations bearing upon terrestrial magnetism and the meteorology and the economics of 300,000 square miles of unknown land. For this great enterprise, Commander Peary needs $200,000. If the expedition were accomplished in one year without the loss of the ship, the cost would be only $100,000, but a larger guarantee is necessary, because two years' time or more might be consumed and the ship might not be brought back. This great geographical prize therefore can be obtained for much less than the sum expended in defense of a single challenge for the America's cup.

Other speakers of the evening were Capt. T. C. McLean, U. S. N., commander of the cruiser "Cincinnati," who rendered great services to the stricken island of Martinique directly after the eruptions of 1902, and who was in command at Colon at the time of the last revolution at the Isthmus of Panama; Major W. R. Abercrombie, U. S. A., who had charge of the surveys along the Copper and Tanana rivers, Alaska, in the search for an all-American route from the coast to the Yukon; Dr. A. Donaldson Smith, who has carried on important investigations in Abyssinia; Capt. Amos Bonsall; Dr. E. O. Hovey, who studied the eruptions of Mont Pelé and the Soufrière for the American Museum of Natural History; Mr. George C. Mercer, who is one of the very few men who have stood upon the summit of the South Dome in Yosemite Valley; Mr. Gilbert H. Grosvenor, editor of the National Geographic Magazine; Miss Dora Keen, who has traveled extensively in Asia and has been almost the only white person to witness (in Teheran) the religious ceremony of the Mohammedans which corresponds to the Passion Play of Oberammergau; and Mr. Henry G. Bryant, who has recently returned from the wilder portions of Mexico, and who is the president-elect of the Geographical Society of Philadelphia.

GROWTH OF OUR NAVY.

In response to several requests from correspondents that we would publish another general view of the new ships that have been authorized, or are under construction, for our navy, thereby supplementing the double-page engraving published in our last Naval Supplement of December 14, 1901, we present the accompanying double-page inset. The engraving in the special number referred to represented all the ships that were authorized or under construction at the close of the year 1901. The double-page inset in the present number includes every warship contracted for and under construction since that date. In looking through the official records, we were much interested to note that the whole of this very formidable fleet was authorized by Congress in the brief period of eight months, from July, 1902, to March, 1903. It includes five of the largest and most formidable battleships ever designed, vessels only slightly smaller than the British "King Edward" class, and more powerfully armed than they; two smaller battleships of about the size of the Russian "Czarevitch" or the new "Borodino" of the Russian Baltic fleet; two armored cruisers which will be the largest vessels of that type ever built, and two gunboats. This is a most remarkable addition to be made in so short a space of time, and if it were not that the contractors for our warships are so slow in completing their contracts, the vessels being at times from one to three years behind their contract date of completion, it would indicate we were rapidly moving forward to the second position in strength among the great naval powers of the world.

Battleships.—The most important vessels of the fleet are five large battleships of the "Connecticut" class, the first two of which, the "Connecticut" and "Louisiana," authorized by Congress July 1, 1902, are sister ships. The other three ships, "Kansas," "Minnesota," and "Vermont," were authorized on March 3 of the following year. They are practically identical with the "Connecticut" and "Louisiana," the chief points of difference being that the thickness of the waterline belt has been somewhat decreased, and that of the upper main belt somewhat increased over that on the earlier ships. The "Louisiana" is being built by a private firm, the Newport News Shipbuilding Company, and the "Connecticut" is being constructed at the New York navy yard, Brooklyn, where a rate of progress has been maintained that has already gone far to prove the truth of the naval constructors' assertion, that work can be done as expeditiously and satisfactorily at the government yards as it can at private establishments.

The detailed description which we now give of the "Connecticut" and "Louisiana," both of which, by the way, will probably be launched toward the close of the present year, will also serve for the three later vessels of this class in all particulars except that the main belt amidships will be 9 inches instead of 11 inches thick, and that the upper main belt will be 7 inches thick instead of 6 inches as in the "Connecticut." The particulars of these five battleships then are as follows: Length, 450 feet; extreme breadth, 76 feet, 10 inches; depth, 24 feet, 6 inches; and the displacement at this draft, when the ship is fully equipped ready for sea, with all her stores on board and a normal coal supply of 900 tons, is 16,000 tons. The ships will be driven at a speed of 18 knots by twin-screw, triple-expansion engines of 16,500 indicated horse-power, to which steam will be supplied by Babcock & Wilcox water-tube boilers. The protection will consist of a complete belt of Krupp steel armor at the waterline, extending from stem to stern, which will vary in thickness from 11 inches amidships to 4 inches at the ends. Associated with this armored belt is a complete protective deck 2¾ inches on the flat and 4 inches on the slopes. Above the main deck, throughout that portion of the ship amidships between the main barbettes, is a wall of 6-inch Krupp armor extending from the main belt to the upper deck, and protecting the central battery. The turrets for the main battery 12-inch guns will be protected with a maximum thickness of 12 inches of Krupp steel, and the barbettes upon which they turn will be protected with 10 inches of Krupp steel. The 8-inch turrets will have 6 inches of armor in the case of the "Connecticut" and "Louisiana," and 6½ inches of armor in the "Minnesota," "Kansas," and "Vermont."

The armament of these ships will be the most powerful of any vessels at present designed. It will consist of four 12-inch rifles, calculated for a muzzle energy of over 46,000 foot-tons, eight 8-inch guns with a designed muzzle energy of 13,600 foot-tons, and a battery of twelve 7-inch guns with a designed muzzle energy of 9,646 foot-tons. There will also be twenty of the invaluable 3-inch rapid-fire guns, which have a designed velocity of 3,000 feet a second, and an energy of 874 foot-tons. Four of the latter are mounted on the gun deck, firing through casemates, two of them forward and two aft; six are mounted on the upper deck in broadside between the 8-inch gun turrets; and ten are mounted in the open upon the superstructure deck, three on each broadside, and one at each corner of this deck. There will be also twelve 3-pounder semi-automatic guns and eight 1-pounder automatic guns, and eight machine guns scattered throughout the bridges and fighting tops. They will carry also two 3-inch field guns. Although no provision was made for submarine torpedo tubes in the original design of these vessels, the plans have been changed since the construction commenced, and the ships will be fitted with two forward submerged torpedo tubes. On such large dimensions the vessels will be able to give ample accommodation for the complement of 42 officers and 761 men.

Speaking of the ships as a whole, we think that they represent about the best combination of speed, armor, and armament to be found in any of the latest battleship designs of the various navies; although there can be no question that the increase of the armor protection above the main belt from 6 to 7 inches in the three later ships, at the expense of a reduction of the main belt amidships, is a decided improvement of the defensive qualities of these ships.

At the same time that the three later ships of the "Louisiana" class were authorized, Congress made provision for the construction of two battleships of 13,000 tons displacement, which were to have the maximum speed and offensive and defensive qualities practicable on these dimensions. Working under this restriction as to size, our naval constructors have turned out two admirable ships, the "Mississippi" and "Idaho," which may be termed smaller editions of the "Connecticut." The dimensions are as follows: Length, 375 feet; beam, 77 feet; mean draft, on a displacement of 13,000 tons, 24 feet, 8 inches. The ships will be driven at 17 knots by twin-screw, triple-expansion engines of 10,000 horse-power, steam being supplied by Babcock & Wilcox boilers. The main battery will consist of four 12-inch guns carried in turrets protected by 12 inches of Krupp steel, and barbettes of 10 inches of steel. The intermediate battery will consist of eight 8-inch guns mounted in four turrets protected by 6½ inches of steel, the barbettes being protected by 6 inches. There will be a central battery on the main deck of eight 7-inch rapid-fire guns, protected by 7 inches of Krupp armor, and there will also be twenty 3-inch rapid-fire guns, twelve 3-pounder, semi-automatic guns, eight 1-pounder automatics, and two 3-inch field guns. They will also carry two submerged torpedo tubes. The waterline belt will be 9 inches amidships, tapering to 4 inches at the ends. The conning tower will have 9 inches of armor, and the conning-tower tube 6 inches, while the ammunition tubes will be protected by 3 inches of armor. The vessels will have a full coal capacity of 750 tons, and at 10 knots cruising speed they will have a radius of 5,750 nautical miles.

Armored Cruisers.—The two armored cruisers "Tennessee" and "Washington" are, like the battleships above mentioned, among the very latest and most powerful of their class in any navy. Moreover, they are extremely handsome vessels, with a clean-cut outboard profile, and an excellence of proportioning and placing of masts and smokestacks, that renders them comparable in appearance to the modern Atlantic passenger steamship. These cruisers are nearly a thousand tons larger in displacement than the six armored cruisers of the "California" class, and although the length, 502 feet, is the same, they have about 3½ feet more beam, or 72 feet, 10 inches, and about a foot more draft, the draft on a mean displacement of 14,500 tons being 25 feet. They will be driven by twin-screw triple-expansion engines, with an indicated horse-power of 23,000, at an estimated speed of 22 knots an hour. The normal coal supply will be 900 tons and they will have a bunker capacity of 2,000 tons. They will be protected by a continuous waterline belt, which will be 5 inches in thickness amidships and 3 inches at the ends. This is an inch less than is carried by the "California" class; but what is lost at the waterline is gained in the protection of the main battery, which consists of 9 inches on the turrets, as against 6½ inches in the "California," and 7 inches on the barbettes, as against 6 inches in the earlier ship. Associated with the belt will be a protective deck, 1½ inches in thickness on the flat, and 4 inches on the slopes, with the armored citadel amidships, and 3 inches on the slopes toward the ends outside the citadel. The sides of the vessel from the main belt to the upper deck, and extending for the length of the ship between the main barbettes, will be protected by 5 inches of Krupp steel. The armament of these vessels is particularly powerful, consisting of four 10-inch breech-loading rifles in two turrets forward and aft, and sixteen 6-inch guns mounted in broadside. Twelve of these are on the main deck, and four on the upper deck. There is also a battery of twenty-two 3-inch rapid-fire guns, of which six are mounted on the gun deck within the central battery, six on the gun deck in sponsons outside of the battery, two forward and four aft, and ten on the upper deck in broadside between the 6-inch gun casemates. Twelve 3-pounder rapid-fire guns, four 1-pounders, two machine guns, and six Colt automatic guns are distributed throughout the superstructure, the bridges, and the fighting tops. There are also two 3-inch field guns to be used for landing purposes. This, it will be observed, is for a cruiser a tremendous battery, its most distinguishing feature being the four 10-inch breech-loading guns, which will be capable of piercing the heaviest armor of battleships at the nearer fighting range. There are altogether no less than sixty-eight guns. It must be confessed that the armament of these ships appears to be relatively heavier than their defensive qualities, and we wish that the side armor of the central redoubt had been 6 inches instead of 5 inches in thickness. The vessels will be provided with two broadside submerged torpedo tubes forward and probably another pair aft. Splinter bulkheads of nickel-steel, from 1½ to 2 inches in thickness, will be worked in between the 6-inch guns of the central battery, and the 3-inch battery on the main gun deck will be given also 3 inches of nickel-steel protection. The 6-inch guns in the broadside battery will be mounted in recessed ports, which will allow the guns to be swung around until their muzzles are flush with the side of the ship, thus obviating the inconvenience which arises from the great length of modern broadside guns. Altogether, we must confess to the conviction that these are about the most effective large armored cruisers to be found afloat or under construction to-day, the only vessels which compare with them, being the latest armored cruisers of the British navy, which carry a much lighter armament, and have no better system of protection.

Gunboats.—The two gunboats "Dubuque" and "Paducah" are vessels of the unarmored composite class, to which such vessels as the "Marietta" and "Vicksburg," the latter now at Chemulpo, Korea, belong. Both vessels are being built at Morris Heights, N. Y. They are constructed with steel framing and wood planking, and have an over-all length of 174 feet, an extreme breadth of 35 feet, and 1,085 tons displacement on a mean draft of 12 feet, 3 inches. They will be driven by twin-screw, triple-expansion engines, and steam will be furnished by Babcock & Wilcox boilers. On an indicated horse-power of 1,000 they are to have a speed of 12 knots per hour. They will carry an armament of six 4-inch rapid-fire guns, four 6-pounders, two 1-pounders, and two Colts. They are schooner-rigged and have a stump bowsprit, and a modified clipper bow, a combination which, it must be admitted, does not add anything to the beauty of the vessels. However, as the bow is full and lofty, no doubt they will prove to be excellent sea boats, well suited to their particular duties.

In a recent address before the Michigan Municipal League, Dr. Victor C. Vaughn estimated the annual loss in this country due to typhoid fever at $50,000,000. He said the total number of cases of this disease in the course of the year was about 500,000, of which 50,000 terminated fatally. Placing a valuation of one thousand dollars on each life, he arrived at the total given above. The doctor said that this terrible death list should have no existence, for by the exercise of proper care and precautions, all of these lives might be saved.

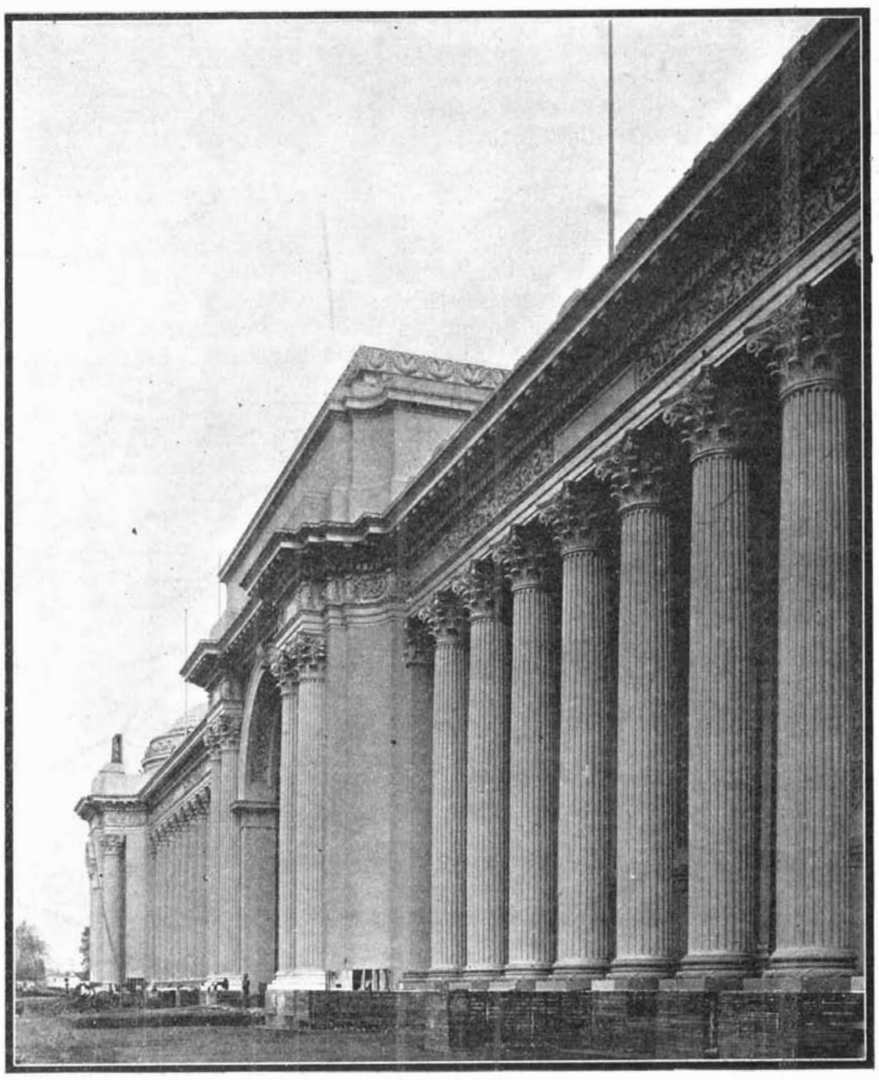
The construction of a harbor to the north of the city of Kiel is being planned.

THE LOUISIANA PURCHASE EXPOSITION—ITS SCOPE AND ITS PURPOSE.

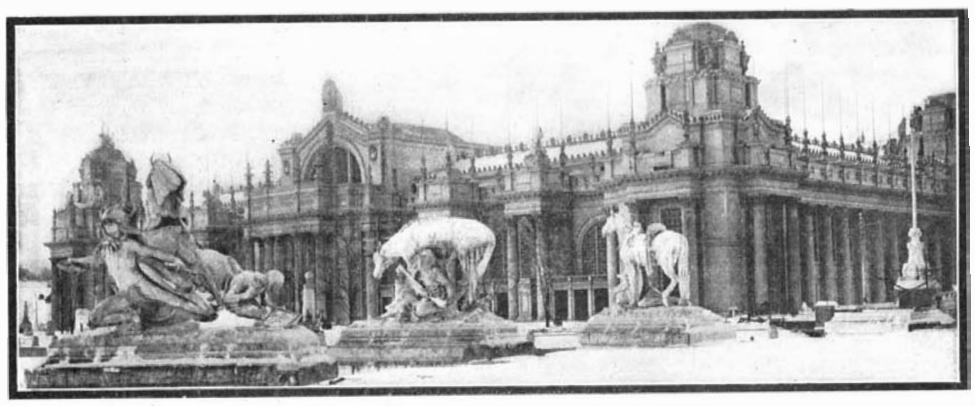
BY SAMUEL WILLIAMS.

The Louisiana Purchase Exposition, opened at St. Louis April 30, was planned to be "the greatest exposition ever held in the world." It was thought that the most fitting commemoration of one of the most important centennials in American history would be a World's Fair presenting a comprehensive and instructive illustration of the progress of all nations in arts, industries, and culture. It was an ambitious scheme, calling for the expenditure of enormous sums of money, a vast amount of skillful exploitation work, the exertion of America's influence with foreign governments, and the employment of an array of well known experts in collecting and classifying the exhibits. But there seems to have been plenty of practical ability and high intelligence as well as ambition behind the scheme, and its projectors have unquestionably succeeded in creating an exhibition far surpassing all former ones in the amplitude, magnificence, and beauty of its equipment. Ten million dollars were granted by the city of St. Louis—$5,000,000 by popular and an equal amount by municipal subscription—and an appropriation of $5,000,000 was made by the United States Treasury, to which has recently been added a treasury loan of $4,600,000, to be repaid from the exposition receipts, making $19,600,000 expended by the Exposition Company in the three years since its organization. Forty-four States of our Union are

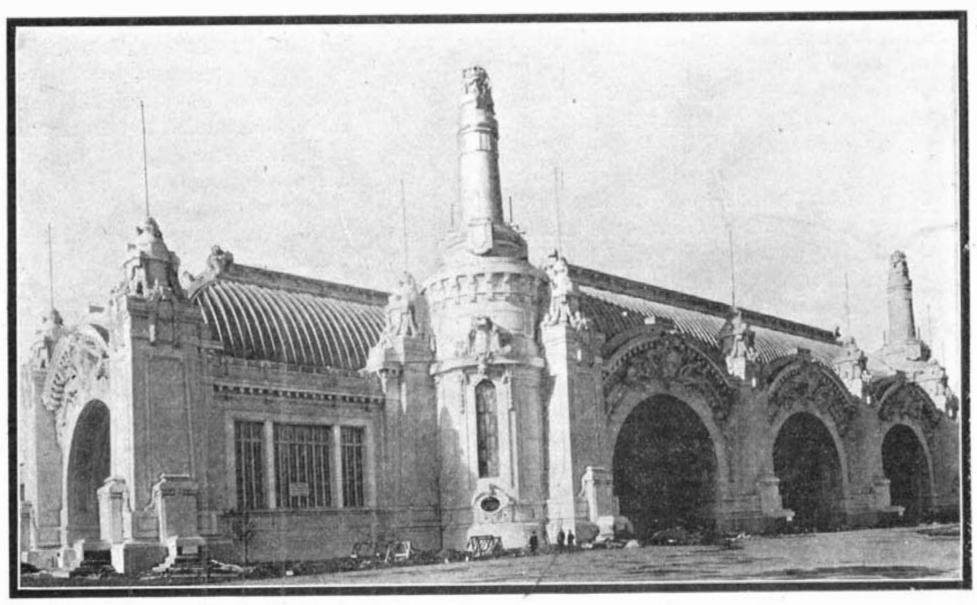
The Palace of Machinery.



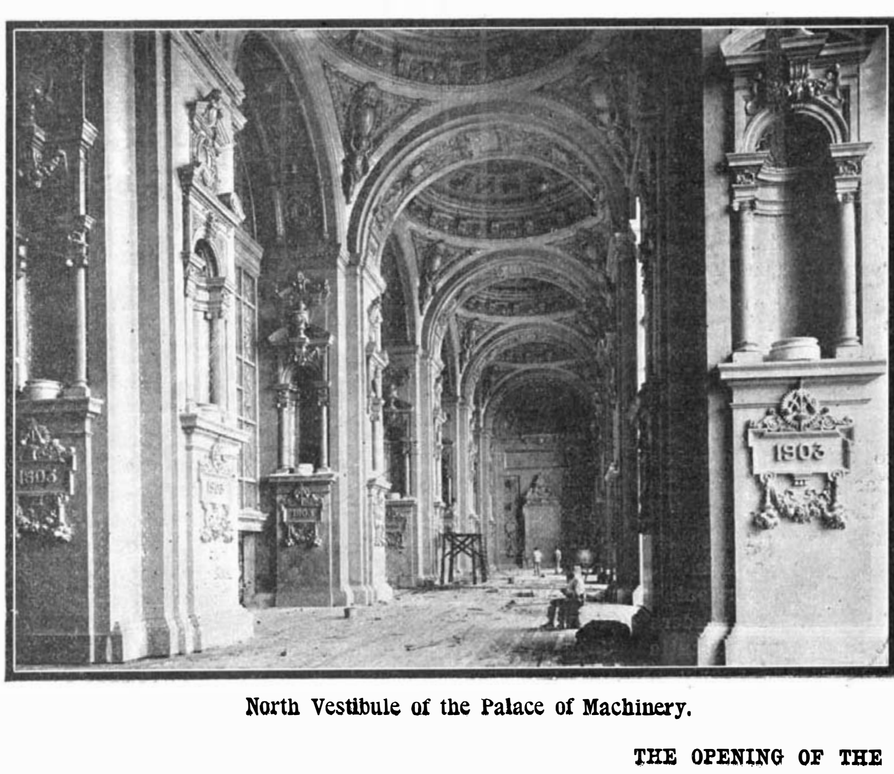
Colonnade of the Palace of Manufactures.



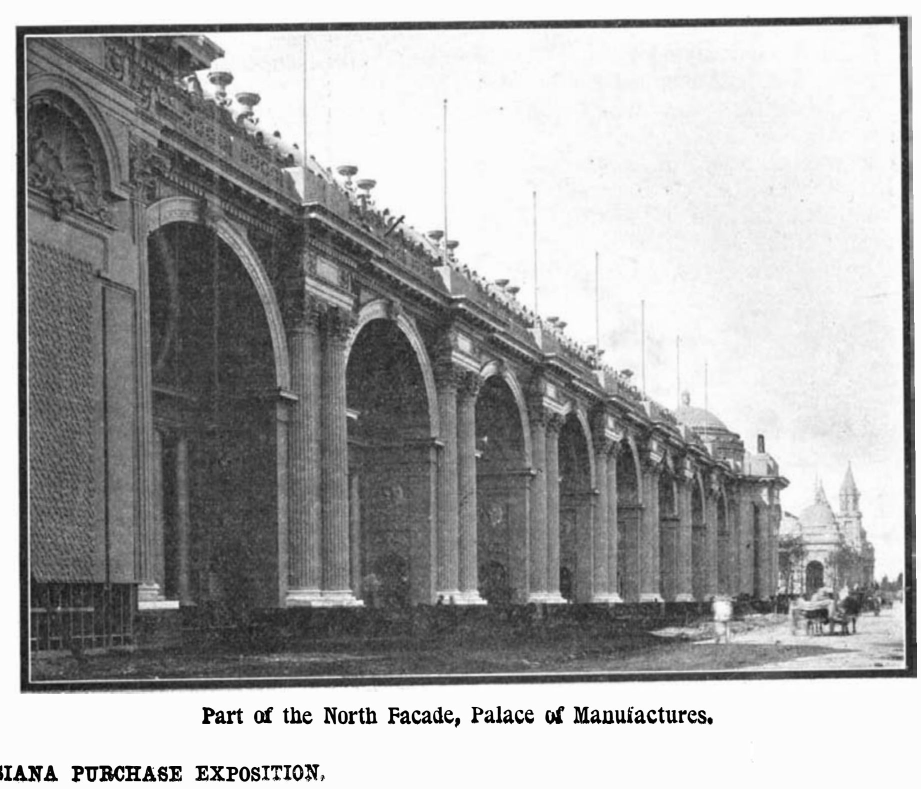
Sculptured Groups in Front of the Palace of Electricity.



Palace of Transportation.



North Vestibule of the Palace of Machinery.



Part of the North Facade, Palace of Manufactures.

THE OPENING OF THE LOUISIANA PURCHASE EXPOSITION.

spending nearly $7,000,000 on their exhibits, and thirty of them have beautiful State buildings erected on the grounds. The United States government has a special building and exhibits installed at an expense of $1,600,000, and about sixty foreign governments are participating at an expense of over $7,500,000. Mexico, France, England, Belgium, Brazil, Germany, Austria, Italy, Sweden, Holland, China, Cuba, Japan, Ceylon, Canada, Siam, India, and other countries have erected fine pavilions, some of which are noble replicas of famous old buildings, such as the Grand Trianon of France, the Orangery of Kensington Palace in England, Germany's Castle of Charlottenburg, Prince Pu' Lun's Peking residence, and Siamese and Japanese temples.

The site comprises 1,240 acres of lovely undulating park land, much of it covered with forest. The landscape gardener's art has heightened its scenic beauty. A commission of famous architects laid out the building scheme. About 1,000 structures are posed on the site. Many of these are exhibit buildings of enormous dimensions and grand and imposing in architectural design. Of the twelve largest exhibition palaces, that of Agriculture measures 1,600 by 500 feet; the Transportation Palace, 1,300 by 525; Manufactures, 1,200 by 525; Varied Industries, 1,200 by 525; Machinery, 1,000 by 525; Liberal Arts and Mines and Metallurgy, each 750 by 525; Electricity and Education, each 600 by 525. The exhibit palaces cover 128 acres of ground. Eight of these buildings, grouped on broad avenues and lagoons that focus on Art Hill with its cascades crowned by Festival Hall and the Terrace of States, compose what is called the "Main Picture." This picture is intended to be an exhibit of American architecture and sculpture at the beginning of the twentieth century, and over $500,000 was set apart for the artists designing the sculptural decorations herein displayed.

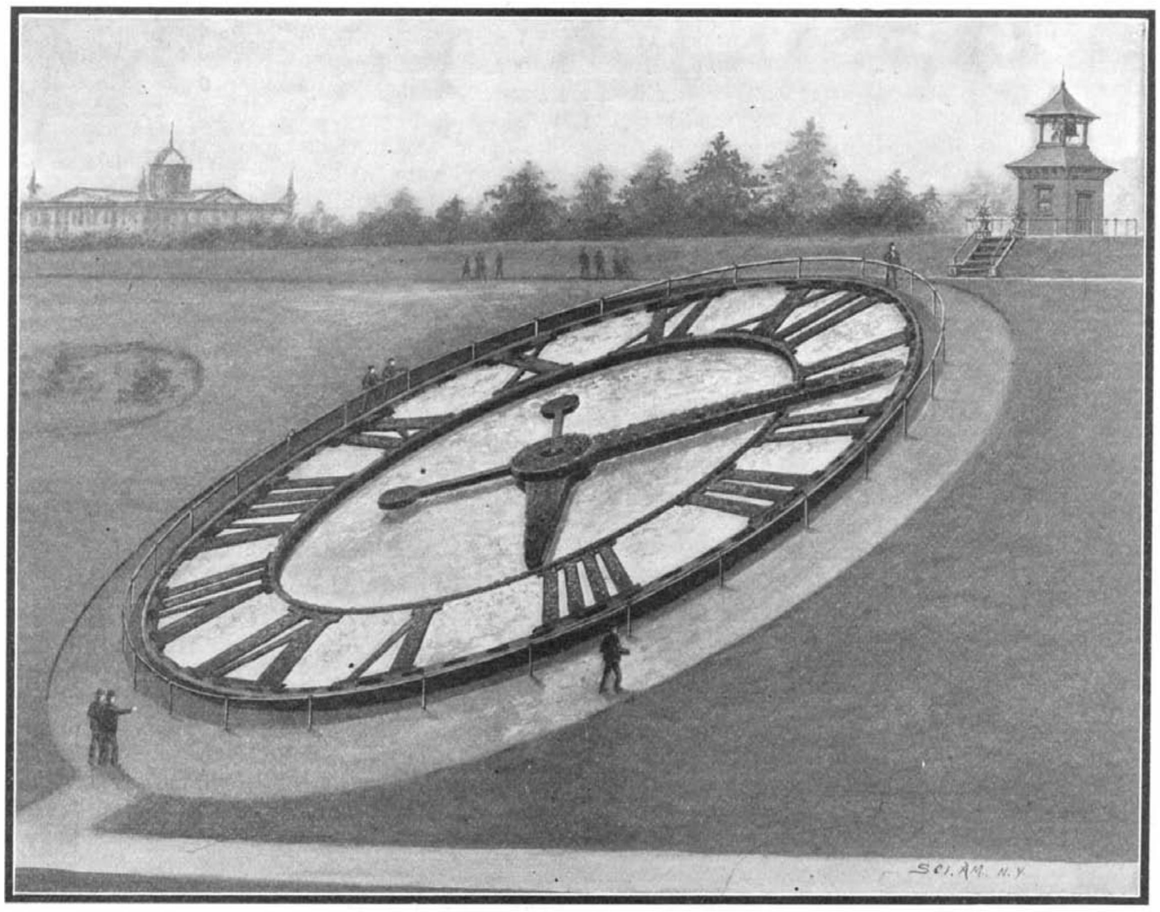
The exhibits of all nations are the results of competitive selection. All exhibits have been subjected to an admirable scientific classification and are installed in their respective buildings in 144 groups and 807 classes, so that everything can be studied in comparison with all that belongs to its own class or group. Whenever practicable the "live exhibit," the process as well as the product, is demonstrated, and this has led to a great many "outdoor exhibits." Some fifteen acres in the "Mining Gulch" are devoted to mining and metallurgical demonstrations not admissible in the Mines and Metallurgy Palace. Although the Transportation Palace covers about fifteen acres and contains four miles of railway track, Germany's elaborate display of her terminals is on outside tracks, and the airship exhibits and contests are at the Stadium, half a mile west. All the space in the Electricity Palace had been reserved for preferred exhibits, more than a year ago, and yet many interesting exhibits competing for awards in this department are "live exhibits" at work as part of the immense lighting and power plant of the Exposition in the Machinery Palace. The British, French, German, Japanese, and other foreign pavilions are treasure houses of famous old paintings, sculptures, tapestries, pottery, and other decorative art work not entered in the competitive exhibits of the Palaces of Liberal Arts, Manufactures, and Fine Arts. The school, university, manual training, and technical institutions of Germany, France, England, and America are luminously illustrated here, both in organization and method, and the teaching of defectives will be shown in actual operation.

Scientists and members of all the technical professions will find that great entertainment has been prepared for them—laboratory demonstrations of all sorts; laboratory tests of locomotives, of power generators, and other machinery; elaborate models of harbor improvements and great engineering works in all parts of the world, including the great Assouan dam; tests of kites, aeroplanes, dirigible balloons, and other airship experiments. In addition there are such great attractions for them as the World Congress of Art and Science and a long series of technical and professional congresses, with distinguished participants from many foreign countries. For musicians there are great musical events extending throughout the Exposition period, with recitals by the most distinguished organists on the most powerful and wonderful organ that was ever built.

For breeders of live stock there will be a live-stock show distributing $250,000 in premiums, besides the prizes added by the breeding associations, which are all taking a profound interest in the contests.

For the physical culture advocate and the sportsman, the International Olympian Games for 1904 will be held in the noble Stadium and Athletic Field provided for them on the Exposition site, where will also be held a long series of inter-state, inter-collegiate, and inter-scholastic games and sports, for the expenses of which the Exposition has appropriated $150,000.

The dominant idea to which the projectors of this Exposition have steadily adhered, was to make it an epochal event in the progress of mankind, a great world-university course, as it were; throwing worldwide light on all the paths of progress; aiding and stimulating invention; arousing that competitive instinct in man which impels him to improve the highest achievements of others, to produce something better than the best. The influence of former Expositions on subsequent progress has been distinctly manifest, and why should not the influence of an Exposition of far greater scope and resources be still more marked and memorable, as an inspiration to inventive genius and as a guide to popular taste and to social, civil, and industrial betterment? As the completest display ever made of the resources of our own country and of the wonders wrought by our own people, it will not only be a beneficial revelation to themselves, but greatly enhance the prestige of our republic abroad. In such a representation of the races of men and of the products of nations, each is a teacher, each a learner, and must derive from it a clearer sense of the dignity of manhood and of the kinship of the human family.



THE GREAT FLORAL CLOCK AT THE ST. LOUIS EXPOSITION.

THE LARGEST CLOCK IN THE WORLD.

BY CLAUDE H. WETMORE.

Sixteen times larger than any timepiece in the world will be the floral clock on the Exposition grounds at St. Louis, which is located in front of the north entrance to the Palace of Agriculture, and separated from that building by a driveway. Although it is what is known as a floral clock, it will keep accurate time, for beneath the vines and other plants, skilled artisans have constructed machinery similar to the works of a watch, but which in size bears the same comparison as does the dinotherium, which once inhabited the Miocene beds of Europe and Asia, to the titmouse of today.

The disk consists of a circle of flower beds one hundred and twelve feet in diameter; and the hands are long, green pointers, the largest of which moves five feet a minute. At the place where these hands join in the center, a tall man could lie down and the surface beneath would extend four feet beyond his head.

Between the dial and the Palace of Agriculture are three small ornate buildings. The central one, which is fourteen feet square at the base and fourteen feet to the cornice line, is of Grecian architecture, except the roof, which is a hemisphere twelve feet in diameter. The ground color of this roof is azure; it is dotted with stars and marked with meridians, to represent the heavens. In this building is the mechanism that connects with the underground machinery and moves the hands, also the mechanism that strikes the great bell. The south wall is of plate glass, and the glass in turn is hidden from view by a swinging door, except for a few minutes during every hour, when the door is thrown back automatically, revealing the works within. Above the dome is a figure of Time.

On the right of this central building is a similar structure, though smaller; the roof, also a hemisphere, represents half the earth, showing the western continents. Within hangs the 7,000-pound bell, which sounds the hours in deep tones that can be heard all over the Exposition grounds. And it is at the first stroke of the bell that the door swings open, revealing the clockwork.

A companion structure stands on the left of the central building, and within is an immense hour-glass that turns automatically every hour.

At night these three buildings will be brilliantly illuminated, and so will be the dial, to do which electric bulbs will nestle under the plants that form the numerals and cover the hands. To cause the necessary effect, two thousand lights will be used.

This clock, in so far as the machinery goes, is an exhibit of a western manufactory; the floral arrangement has been planned by the Chief of Agriculture of the Exposition and his assistants. Following the latest plans, the inner surface of the dial—the smaller circle, which is bordered by a wide rim containing the numerals—will be of white, low-growing flowers bordered by a thin hedge of foliage plants. Within the rim the numerals of the hours will be dark tall foliage plants, thrown into relief by intervening white blossoms, the same as those growing in the inner circle. The border of the rim will be a circle of low-growing flowers, and beyond this again will be spears of foliage plants, red alternating with yellow, which will indicate the seconds, 1,800 of the one color and the same number of the other, making 3,600 in all.

Surrounding the complete circumference of the dial on the outside will be six feet of lawn, and surrounding this again will be a broad path of red-colored earth.

The minute and the hour hands are long steel troughs, in which fertilized earth has been placed to supply nourishment to the vines that will cover the metal and completely hide it from view. The minute hand weighs 2,500 pounds, and the vines that will cover it would hide from view the front of a large house.

The effect in the daytime will be that of a mass of green moving slowly over a field of white, and pointing at brilliant-colored hours and minutes; at night, a glowing indicator will move above glowing numerals.

PARTICULARS OF THE GREAT CLOCK.

Diameter of dial	112 feet.
Length of minute hand	70 feet.
Diameter of the hands across the center	10 feet.
Minute hand moves each minute	5 feet.
Weight of minute hand	2,500 pounds.
Weight of bell	7,000 pounds.
Diameter of bell at mouth	70 inches.
Height of bell	60 inches.

The total cost of the eleven Washington University buildings, used by the Louisiana Purchase Exposition, is $1,480,000. These buildings are all permanent structures.

Idaho was one of the first States at the World's Fair to complete its agricultural exhibit. The showing is a revelation as to that State's resources, and the taste displayed in the arrangement is much admired by all who see it.

President Roosevelt, from his desk in the White House at Washington, pressed the electric button which set in motion the wheels of the World's Fair machinery. This was done at exactly 1 o'clock, eastern time, or 12 o'clock, noon, St. Louis time.

The National Academy of Sciences.

The annual or stated meeting of the National Academy of Sciences was held in Washington, D. C., from April 19 to 21, 1904, in the United States National Museum, under the presidency of Dr. Alexander Agassiz. Public sessions were held in the lecture room of the Museum during the afternoons, and were devoted to the reading of papers, of which some nineteen were presented.

Prof. John Trowbridge, of the Lawrence Scientific School of Harvard University, opened these public sessions with a series of three papers, all of which consisted of lantern-slide illustrations devoted to the exposition of the topics which they served to elucidate. The first of these was on "Spectra of Gas at High Temperatures," and was followed by one by Theodore Lyman on "Short Wave-Lengths of Light," while a third was by H. W. Morse on "Spectra Produced by the Wehnelt Interrupter." Messrs. Lyman and Morse have carried on their investigations under the direction of Prof. Trowbridge, who, as they were not members of the Academy, presented their papers.

"On Fluorescence Spectra" was the title of a short joint paper by Profs. E. L. Nichols and Ernest Merritt of the Physical Department of Cornell University, after which Prof. Robert S. Woodward of Columbia University described "A Double Suspension Apparatus for Determining the Acceleration of Gravity" and "The Compressibility of the Earth's Mass Required by the Laplacean Law of Density Distribution," both highly technical expositions of the subjects treated.

Of more popular interest was Prof. George F. Barker's "Note on Radio-activity and Autoluminescence." This able physicist discussed the phenomena which have been discovered in connection with uranium, radium, and other elements, presenting a full series of minerals showing radio-activity. Baskerville's recent announcement of his discovery of carolinium and berzelium was referred to and the work of the brilliant young chemist from the University of North Carolina favorably commented on. Prof. Barker showed a number of photographs which had been developed by the autoluminescence of the minerals which he exhibited before the Academy.

Of considerable interest was the paper entitled "Physiological Economy in Nutrition, with Special Reference to the Minimal Proteid Requirement of Healthy Man," presented by Prof. Russell H. Chittenden, director of the Sheffield Scientific School of Yale University. He described in detail the experiments carried on by him on a number of students and a squad of United States soldiers and found at the end of six to twelve months—varying with the different subjects—that he had been able to effect a gradual reduction of meat and other proteid foods with little if any increase in starch and other foods and that the weight of the subjects was almost exactly the same as when the experiments began. Their bodily vigor was greater and their strength much greater, the latter due, however, to the regular physical exercises which they practised. His conclusions were therefore that the average healthy man eats from two to three times as much as he needs to keep him in perfect physical and mental health and vigor. Prof. Chittenden said that so far as he himself was concerned he found his health greatly improved by eating only two meals a day, eliminating entirely his breakfast. Considerable discussion followed the reading of this paper, which was participated in by Prof. Horatio C. Wood, of Philadelphia, Pa.; Dr. John S. Billings, of New York, and Prof. E. S. Morse, of Salem; and while the value of Prof. Chittenden's experiments was conceded, it was contended that a series of experiments with persons eating the normal amount of food would be highly desirable in order to show what ill effects if any follow the ordinary practice. In other words, no evidence was presented to show that the satisfying of a man's appetite in the usual method was deleterious to health. The paper was illustrated by a number of lantern slides, showing the physical development of the subjects.

"A Brief Preliminary Report upon Apocynum cannabinum," showing the properties of this plant, was presented by Prof. Horatio C. Wood, of Philadelphia, Pa.; and Prof. Henry F. Osborn, on behalf of Prof. W. D. Matthew, of New York, described briefly the "Position of the Limbs in the Sauropoda."

The public session on Thursday began with Gen. Henry L. Abbot's paper on "The Disposition of Rainfall in the Basin of the Chagres," and was followed by Prof. Henry F. Osborn, who, under the title of "Recent Paleontological Discoveries by the American Museum Exploring Parties," referred to the explorations which have been carried on during the past three years with a fund of $15,000 given by the late William C. Whitney for the purpose of learning more perfectly the history of the prehistoric horse on the American continent. A number of discoveries of great interest and value to zoologists and paleontologists was reported. One of the finds made was of the skeletons of a small herd, consisting of a mare and colts, of the Neohipparion. The type was named Neohipparion Whitneyi, in honor of the donor of the gift which made the expedition possible. The Neohipparion is especially interesting as being a perfect American type of the old European Hipparion, or forest-living horse. The find was made in 1902 in the upper Miocene period formation of Nebraska. Other finds were a specimen of the *Equus Scotti*, or true Lower Pleistocene period horse, discovered in 1900 in Texas.

Prof. Osborn also read a paper advocating a reclassification of the reptilia, chiefly interesting because of the positive announcement that man as a mammal, with a single arch on the side of his skull, is unmistakably descended from that class of reptiles known as lynapida, which has only one arch. The descendants of the lynapida are all mammals, including man.

Dr. Alexander Graham Bell then introduced Prof. A. F. Zahm, of the Catholic University of America, who read an important paper on "Surface Friction of the Air at Speeds Below Forty Feet a Second," after which Prof. Bell himself presented a brief paper on "The Multi-nippled Sheep of Beinn Bhreagh," in the course of which he announced that in the continuation of his efforts to produce a variety of sheep that would yield twins, he obtained sheep that showed evidence of as many as eight nipples, thus leading to the inference that a variety of sheep could be developed that would yield larger families than at present.

Biographical Memoirs of James Hadley by Arthur T. Hadley and of Henry Barker Hill by Charles L. Jackson were read by the Home Secretary. The meeting was brought to a close by a "Note on the Simplest Possible Branch of Mathematics," by Charles S. Pierce.

In addition to the papers presented, the business of the Academy included the presentation of the Henry Draper medal to George E. Hale, director of the Yerkes Observatory, for his brilliant astrophysical researches. The constitution limits the membership of the Academy to one hundred persons, and not more than five new members can be elected each year. At this meeting only four men were found worthy of admission into this select body. They were William Morris Dean, who fills the chair of geology in Harvard University; William Fogg Osgood, assistant professor of mathematics in Harvard University; John Ulric Nef, head professor of chemistry in the University of Chicago; and William Thomas Councilman, professor of pathology in the Harvard Medical School. By the election of these members the active list has been increased to nearly ninety-three.

Also the following eight foreign associates were chosen: Dr. Paul Ehrlich, of Frankfort on the Main; Dr. H. Rosenbusch, of Heidelberg; Prof. Emil Fischer, of Berlin; Sir William Ramsay, of London; Sir William Huggins, of London; Prof. George H. Darwin, of Cambridge; Prof. Hugo de Vries, of Amsterdam; and Prof. Ludwig Boltzmann, of Vienna.

The Melancholy Cypress

In a recent issue of the St. Louis Globe-Democrat Ferdinand Tonney declares that the axman is fast destroying the melancholy cypress, and that the enormous consumption of the imperishable wood will soon clear the Southern swamps of their noblest product. Mr. Tonney says the best specimens are found in Arkansas and Louisiana. The lumbermen class the timber as red, yellow and white, according to the tint of the wood. In Southern Illinois, some years ago, there were brakes of a white variety, but the trees were pygmies when compared with the yellow cypress giants of the Cache River country in Arkansas, and the mammoth red cypress tree along the Ouachita River. The slow growth and the uncertain method of reproduction lead to the belief, says Mr. Tonney, that before many years the tree will become extinct. The great brakes are rapidly disappearing before the modern methods of lumbering, and regions which heretofore were regarded as inaccessible because of the swamp conditions are being cut over, and the lumber going into the markets at a rate surprising even to those who are intimately acquainted with the industry. The antiquated methods of logging, so slow and cumbersome, have been replaced by the up-to-date ideas, and the new facilities and improvements have worked wonders in the business. Mr. Tonney says, further, that just now cypress is the one kind of timber which has obtained a prominent place on the lumberman's list, and the increasing demand and the advancing price are attracting the attention of every one who has in any way to deal with building materials. The commercial value of a good cypress brake is almost beyond the belief of those who are not familiar with the lumbering industry. The merits of the timber as adapted to a multiplicity of uses are without question, and it has taken rank along with white pine and poplar. A house may be built, these days, wholly of cypress. The framework, siding, flooring, lath, shingles, and even the interior, when finished in this remarkable product of the Southern swamps, give satisfaction, which is shared alike by the builder and owner. Strength, durability and beauty of finish combine to make it popular with the woodworker. An instance may be cited where cypress was substituted for yellow pine in the construction of the World's Fair buildings. While it is true that the cypress brakes in Arkansas are being drawn upon heavily, there is no danger of immediate depletion. And every cypress tree felled means that in return additional wealth comes to swell the means whereby in other ways Arkansas is undergoing splendid development.

The New Warships for Japan.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A further advance in warship design and construction is to be exemplified in the two new powerful armorclads to be built in England, for the Japanese navy, by Vickers Sons & Maxim, Ltd., of Barrow-in-Furness, and Sir W. G. Armstrong Whitworth & Co., of Elswick, respectively.

In general design these ships will somewhat resemble the "King Edward VII." class, now in course of erection for the British navy, with some important modifications and improvements. They will each measure 455 feet in length. This is 30 feet in excess of the recent battleships for the British navy, but although an increase is made in the length there is no corresponding augmentation of the beam and draft, which are 78 feet 2 inches and 26 feet 7½ inches respectively. This increase of the length with the preservation of the other two dimensions marks a new feature in battleship design. That there are limitations to these dimensions is incontestable, for the progress and development of large battleships has outpaced the corresponding provisions of docks sufficiently large to accommodate them. There are few docks in existence capable of accommodating battleships exceeding 78 feet beam. Yet it is imperative in the case of hostilities when a vessel is injured that it should be able to be docked at the nearest port, and the repairs effected with all possible celerity.

This fact has been borne forcibly in mind in the design of these two new vessels for the Japanese navy. There are no graving docks in that country at present which could accommodate a vessel exceeding 78 feet beam. Consequently the beam measurement has been minimized to the most advantageous extent.

The displacement of these vessels is approximately the same as the "King Edward" class—16,400 tons. The contracted speed is to be 18½ knots generated by twin-screw four-cylinder triple-expansion engines.

Steam is to be supplied from a battery of twenty Niclausse water-tube boilers. The coal capacity of each vessel is to be 2,000 tons.

The armament will be particularly formidable, comprising four 12-inch guns mounted in pairs within barbettes. The latter are to be built of 9-inch hardened steel, and provided with armored hoods. In addition there will be one 10-inch gun placed in each of the four quarters in 6-inch armor, and also covered with protective hoods. In the "King Edward VII." class 9.2-inch guns are employed, but the substitution of the 10-inch guns instead of the 9.2-inch weapons accentuates the formidable character of the armament to a very considerable degree. The 9.2-inch gun fires a 380-pound shot with an energy of 20,000 foot-tons, while the 10-inch weapon discharges a 500-pound projectile with an energy of 28,000 foot-tons. A total of 2,000 pounds of shot with an aggregate energy of 112,000 foot-tons will thus be obtained, from the four 10-inch weapons, as compared with 1,520 pounds of shot, and 80,000 foot-tons energy from the four 9.2-inch guns, an increase of 480 pounds and 32,000 foot-tons in shot and energy respectively.

This main armament will be supplemented by twelve 6-inch guns placed as follows: Five weapons on each broadside within the main battery and one on either side of the upper deck centrally situated.

For the repulsion of torpedo and submarine attack there will be twelve 12-pounder, three 3-pounder, and six Maxim guns conveniently placed. Six submerged torpedo tubes are to be provided.

The guns placed behind the broadside armor will be separated by armor bulkheads. The 12-inch guns will be arranged 26 feet, the 10-inch guns 22 feet, and the main deck guns 14 feet above the load waterline.

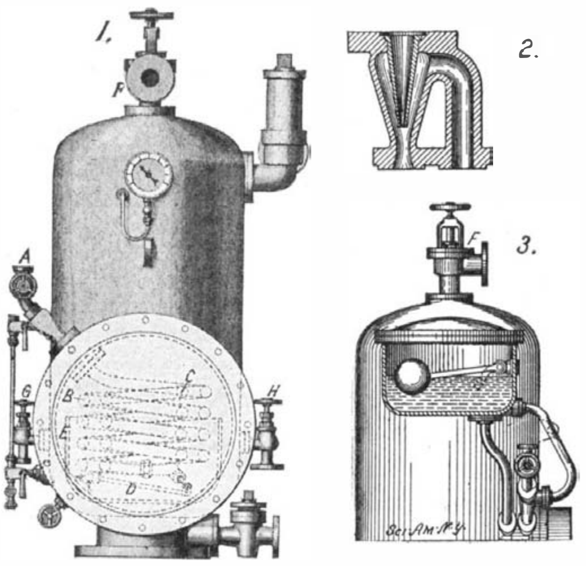
The scheme of protective belting first introduced upon the battleship "Mikasa" will be followed, but with some extension. For instance, the water-line belt will be 9 inches in thickness and 6 inches thick up to the level of the upper deck. In addition to this, however, a 4-inch continuous belting above the lower or berth deck will be introduced for the first time. This addition will be continued to within 80 feet of the bow, and 88 feet of the stern. By this arrangement, with the exception of right fore and aft, no part of the upper works of the ship will be left unprotected.

Both offensively and defensively these two vessels when completed will be the most powerful warships afloat. The gun power is the most formidable yet designed for a battleship, the guns being both heavier, and in the case of the 6-inch weapons more numerous than those decided upon for the vessels of other navies, and records a decisive advance in battleship construction and armament.

Patent Department

AN IMPROVED VAPOR GENERATOR.

Mr. James Andrews, of 180 W. Regent Street, Glasgow, Scotland, has invented a novel apparatus by which the temperature of one fluid may be transmitted to another without bringing the fluids into actual contact. The prime object of the invention is to effect



A SEA-WATER EVAPORATOR.

a thoroughly rapid circulation of the fluid, the temperature of which is to be transmitted, so that a greater amount of heat may be transmitted in a given time.

The apparatus, as it is shown in Fig. 1, is adapted as an evaporator of sea-water. It consists of the usual shell or receptacle in which the water to be evaporated is contained; a manhole to permit access into the interior; a safety valve; a pressure gage; and a valve-controlled passage *F* for carrying off the vapor generated. The water-inlet valve is indicated by *G* in the figure mentioned, and the valve for drawing off the brine by *H*. A blow-off cock is provided, which appears in the illustration immediately below the valve *H*. A water-tube and connections for indicating the level of water within the shell are provided. Outer and inner coils of pipe, *B* and *C*, are arranged vertically in the lower part of the shell and connected at their lower ends by a bend, from which a drain-pipe passes. The coils *B* and *C* are also connected at their upper ends with the two passages of an injector, which is shown in detail in Fig. 2. One of the passages of the injector is the injecting passage, the other the suction-passage. A steam-nozzle is introduced into the injector and passes into one of the passages, as shown. The other passage discharges into the former outwardly from the mouth of the nozzle. A steam-supply pipe *A* is connected with the nozzle. When steam is introduced into the injector a fluid movement is created through the one passage of the injector into the outer coil of pipe *C*, and simultaneously a suction effect will be obtained in the other passage of the injector. These movements jointly produce a circulation in the pipe *B*. Consequently the pipes *B* and *C* with their appurtenances form a continuous fluid passage, and the injector will enforce a continuous fluid movement through this passage. The excess fluid from the water of condensation may be drawn off from the drain-cock. A cylindrical partition *E* is placed at the lower part of the shell and incloses the coils *B* and *C*. This partition enforces a circulation of the sea water upwardly through the pipes and outwardly and downwardly between the sides of the shell and the partition.

In Fig. 3, a tank and ball-cock arrangement is illustrated which automatically draws off the excess fluid in the circulating coils. The fluid moving through the coils *B* and *C* is forced to pass through the tank. As the liquid in the coils increases by reason of the condensation of the steam, the level of the water in the tank rises. The ball-cock is adjusted to discharge all water rising above a certain level. In this manner the discharge of the water of condensation is automatically effected.

A NEW ELECTRIC CLOCK.

While electricity has so largely been adapted as a motor in modern machinery, large and small, and is so rapidly superseding old-time appliances, is it not a little strange that the old-fashioned weights and spring, with the attending winding apparatus, still constitute the moving power in most clocks turned out at the present time? In other words, in this branch of industry are we not still following in the footsteps of a century ago?

To be in keeping with the times, the modern clock should be an electric clock—a clock which requires no winding and no attention for periods of a year or more.

The electric clock shown, and invented by Mr. George S. Tiffany, of 30 Rose Street, New York city, possesses several unique features. It is extremely simple in construction, the working parts consisting mainly of an electro-magnet, a pivoted armature, a pawl mounted on the armature and engaging a single ratchet wheel, to the arbor of which is attached the minute hand. The ordinary train of wheels is dispensed with.

A slow-beat torsional pendulum carrying a contact arm momentarily closes the circuit of the electro-magnet and a battery, at regular intervals determined by the beat of the pendulum. The armature, moving in response to the influence of the magnet, propels the ratchet wheel and hands. As the pendulum has no mechanical work to perform in operating the clock, and consequently no frictional loads, it is obvious that it can perform its functions as a periodic time interval device in a most perfect manner.

Varying frictional loads, which in the movement of a clock of the ordinary type would seriously affect its operation, are of comparatively small importance in this clock. It is evident therefore that a clock upon this principle may be crudely constructed, yet be capable of keeping good time.

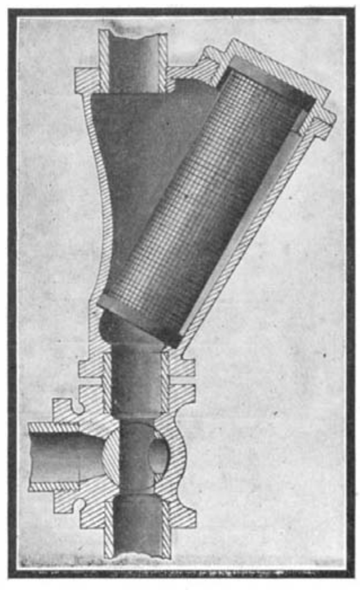
The action of the clock is very similar to that of a secondary clock controlled by an independent pendulum. A number of these clocks may be operated in synchronism by removing the pendulums from all but one clock, and using this as a master clock with the others connected properly in circuit.

The current consumption is very small. One good dry cell will operate the clock for many months, and when exhausted may be renewed at a nominal expense.

The clock is now being made by the Tiffany Electric Clock Company, whose president is Mr. J. Van Inwagen, of Momence, Ill.

STRAINER FOR LOCOMOTIVES.

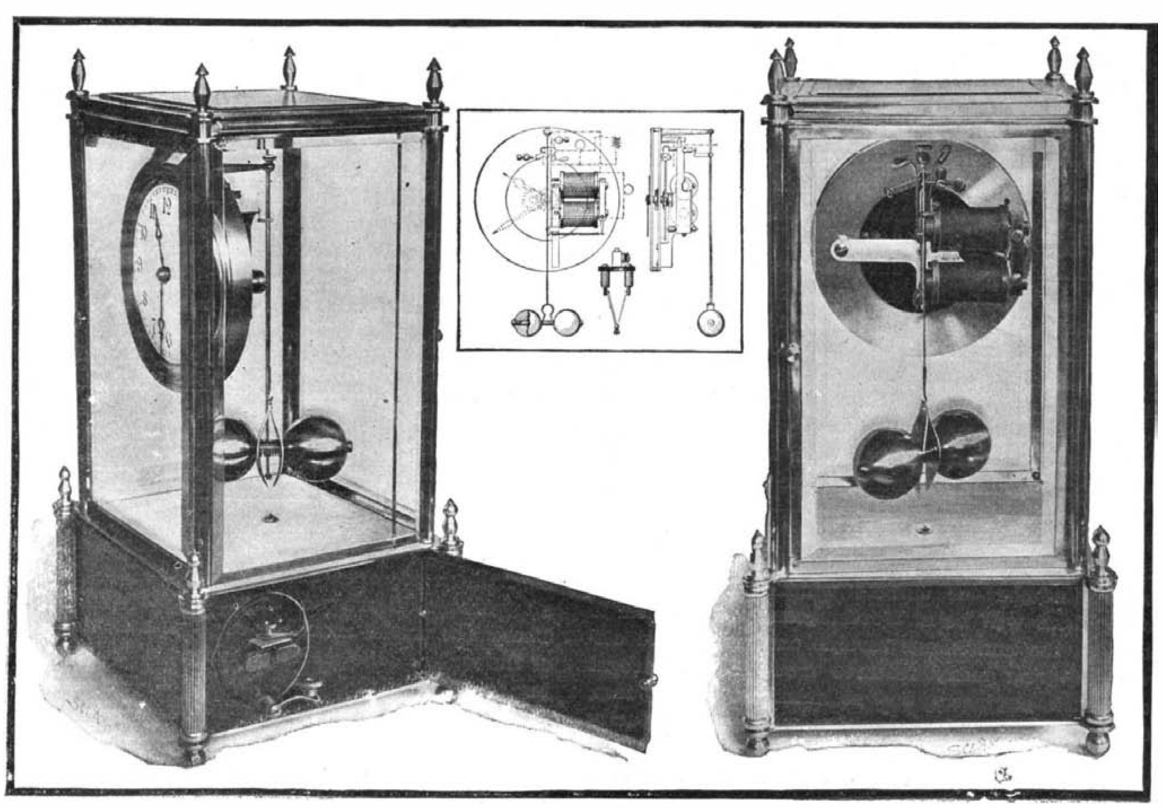
A new form of strainer which has recently been invented by Mr. Francis B. Brown, of Kingman, Ala., will be found very useful for purifying the water in the feed pipes of locomotives. The strainer, as illustrated herewith, is very simple in construction, and the parts are readily accessible, thus facilitating the making of repairs when necessary. Furthermore, provision is made for cleaning the strainer of any accumulated filth without removing any of the parts. The strainer casing is interposed between sections of the vertical feed pipe of the locomotive. The lower or inlet section is provided with a three-way valve, which is normally turned to allow the water to flow through the strainer, but which, when it is desired to clean the strainer, may be turned to permit discharge of the cleansing fluid. The strainer proper is of cylindrical form, and extends obliquely from the inlet port to an opening near the top of the casing, where it is seated in a cap which closes this opening. The strainer is formed at each end with a metal band, and these fit snugly in their seats, holding the cylinder securely in place, and at the same time spacing it from the wall of the casing. In operation, as the water flows up through the strainer, any impurities will be caught by the meshes of the strainer cylinder. When it is desired to purify the cylinder, the three-way valve is turned to cut off the inflow of water, and connect the strainer with the discharge pipe. Water or steam is then admitted to flow in the return direction to the strainer, to wash the meshes free of the accumulated impurities. In case of any accident to the strainer, the cylinder may be removed by unscrewing the cap which forms its upper seat in the casing.



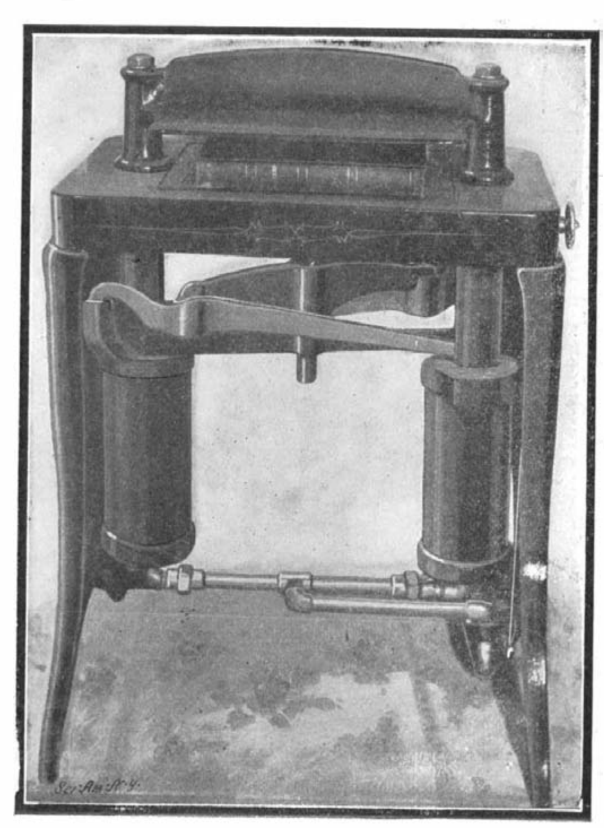
STRAINER FOR LOCOMOTIVES.

THE HYDRAULIC LETTER PRESS.

Letter presses are in such common use in railroad, telegraph, steamship, express offices, etc., that it is really surprising that no one before has thought of rendering them automatic. A patent for such an automatic press has recently been granted to Mr. Walter A. Rosenbaum, of 35 Broad Street, New York city, and the invention offers several important advantages. No physical effort is required to operate it. The pressure applied is equally distributed over the surface. Several tons pressure may be obtained, if desired. The construction is simple, and the power used is obtained

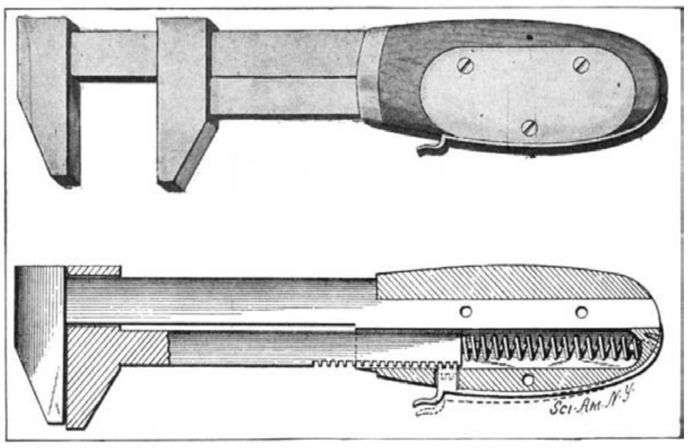


THE TIFFANY ELECTRIC CLOCK.



HYDRAULIC LETTER PRESS.

from the city water supply. The water power is led to two hydraulic cylinders, secured by means of brackets to the table or standard of the letter press. These brackets are hollow, to receive the pistons, and fulcrumed to each cylinder is a lever which, at its outer end, enters a slot in the bracket of the opposite cylinder, and bears on the top of the piston. The arrangement is such that the two levers lie parallel, and an equalizing lever is placed diagonally across them. The equalizing lever transmits pressure to a platen through a ball-and-socket joint, the socket being formed with a



A NEW WRENCH.

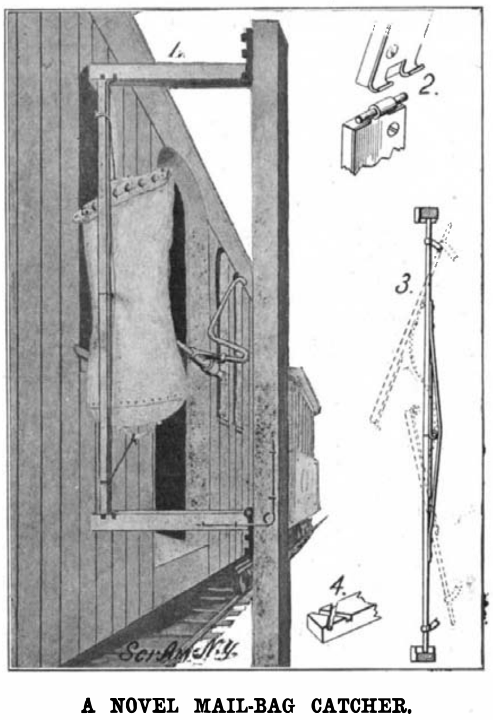
circular rubber cushion to take up any inequalities in the thickness of the book, and render the pressure uniform over the entire book surface. The copying book is pressed upward by the platen against a pressure plate, which is mounted on extensions of the cylinder bracket. The flow of water in the cylinders is controlled by a three-way valve, which is operated by a small hand-wheel conveniently placed near the top of the table.

A NOVEL MAIL-BAG CATCHER.

The essential requisite of a good mail-bag catcher is rapidity of operation, which means quick-acting devices to release the mail-sack when caught. This requisite seems to have been attained by William M. Falen, Wakefield, Kan., in a recently patented invention of his.

Mr. Falen's mail-bag catcher is provided with the usual bar and catching arm on the car. The novel features of his invention are to be found in the devices mounted adjacent to the roadbed. Upon a vertical post set in the roadbed, and provided with brackets, two horizontal arms are pivoted, the lower one of which is spring-controlled. These arms support between them the mail-bag holder, which consists primarily of two swinging members, separately hinged together by the peculiar form of hinge shown in Fig. 2. Attached to the two parts of the holder is a flexible connection such as leather, the purpose of which is to hold the two parts in alinement when not under strong pressure.

When the arm on the car comes into contact with the mail sack, the joint, formed by the hinged parts illustrated in Fig. 3, will be broken. The parts will separate and the bag will be swept into the car. Grooves at the ends of the horizontal arms between



A NOVEL MAIL-BAG CATCHER.

which the mail-bag holder is supported will cause this operation to take place without the sliding of the members of the holder in the grooves. When the sack and holder are removed, the horizontal arms previously referred to, will swing in toward the vertical post, the upper one by gravity, and the lower one by means of its spring. In Fig. 3 is shown, by dotted lines, the course which the members of the holder take in their operation.

A NEW WRENCH.

Thomas H. Barry, of Empire, Oregon, is the inventor of an improved wrench of the type having a fixed jaw on the end of a handle-lever, a sliding jaw on the lever, and an arrangement for holding the sliding jaw at a selected point on the lever.

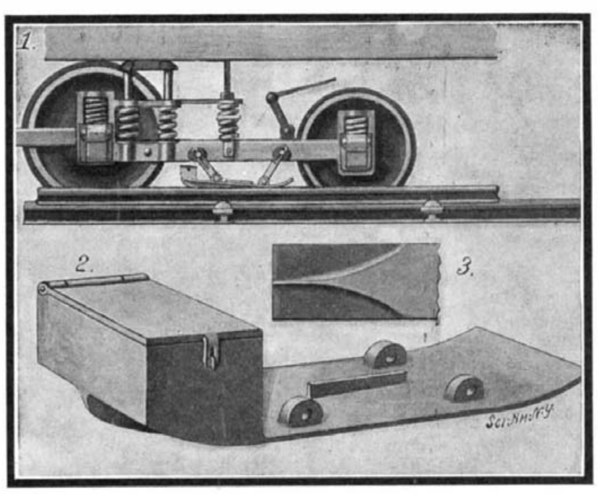
The handle-lever, with the fixed jaw at one end, has at the opposite end a shank reduced in width to form a shoulder. The movable jaw slides on the handle lever and is provided with a rack, the teeth of which are located on the edge near the free end. A handle-block is apertured to receive the shank, and abuts against the shoulder. The handle-block of the shank has a number of perforations for the reception of screws. These serve to secure the handle upon the shank of the handle-lever. The block has a longitudinal chamber parallel with its aperture, which chamber at one end receives the toothed end of the rack-bar. An expansible spring in the chamber presses upon the rack-bar, which is thus forced by the spring toward the fixed jaw.

The means for detachably securing the movable jaw at any point consist of a curved, resilient arm, secured by one end on the end of a handle-block, a laterally-projecting dog at the other end of the arm with teeth projecting through an opening in the handle block for engagement with the rack-bar teeth, and a catch-lip on the resilient arm adjacent to the dog.

In adjusting the wrench to engage a nut or the like, the wrench is grasped by its handle and the slidable jaw is pressed upon the object. Pressure is applied simultaneously with the manipulation of the catch-lip to release the dog from the rack-teeth, thereby locking the rack bar and jaw at a desired point of retracted adjustment. The release of the dog by manipulation of the catch-lip permits the spring to expand and to force the movable jaw into contact with the fixed jaw or into closed position.

A COMBINED THIRD-RAIL CONTACT SHOE AND SLEET REMOVER.

The introduction of the third-rail system of electric traction in our large cities has brought with it a most



SLEET-REMOVING THIRD-RAIL CONTACT SHOE.

serious problem, namely, the removal of the insulating layer of sleet that forms upon the third rail during the stormy weather of winter. Naturally the problem has not been left unattacked by inventors. Of the many devices that have made their appearance of late years, one of the most promising seems an invention patented by Mr. Henry Rosenfeld, 773 East 174th Street, Bronx, New York city, N. Y.—promising because the contact-shoe itself is made to remove the sleet, so that it is unnecessary to depend upon auxiliary scrapers.

Mr. Rosenfeld's contact shoe is provided at the bottom with divergent ribs that meet at the front end of the shoe in a sharp edge so as to form a plow. As the contact-shoe moves along, the plow cuts into the sleet, pushes it aside, and enables the conducting metal of the shoe to pick up the current. In order that the plow-like ribs may perform their proper function, the forward end of the contact-shoe is weighted. A box filled with metal balls constitutes the weight.

The machinery exhibit at the St. Louis Exposition will be novel in a great many respects as there will be shown a number of designs which are quite new. Among them will be a Worthington pump which is known as the multi-stage turbine centrifugal and differs in a great many features from the centrifugal with which engineers are so familiar. The pump, which will be placed on exhibition, will have a capacity of delivering 500 gallons of water per minute against a headway of 250 pounds per square inch and with high efficiency.

Brief Notes Concerning Patents.

There have been a number of claimants for the honor of having discovered Portland cement, but it has been pretty definitely settled that it belongs to Joseph Aspdin, a native of Leeds, England, and effort is now being made by a number of Englishmen engaged in engineering and industrial pursuits, to have a memorial raised to the man who has done such a great work for the building industries of the world. It is said that notwithstanding the fact that the discovery was made in 1813, it was not until eleven years after that he decided to take out patent papers. The value of the cement was soon appreciated, and among the first to make use of it was the great Brunel, who used it on the Thames tunnel, where it attracted a great deal of attention.

James W. Gladstone, of East Orange, N. J., a former employe of Thomas A. Edison at the latter's laboratory, has been accused, by the great inventor, of infringement and making unlawful use of the knowledge obtained while engaged at the Edison works. The suit involves the manufacture of the new storage batteries which Edison has recently put on the market and on which he has been at work for some time. Subsequently, a suit was brought against Edison by Gladstone to restrain him from making use of a process which is said to be essential in the manufacture of the batteries. The bill of complaint alleges that the improvements were invented by Felix de la Laude, of Paris, France, who patented them in this country in 1892 and in the following year sold the rights to William M. Offley, of Washington, D. C., who in turn disposed of them over a year ago to Gladstone.

At the Chicago Exposition, twenty-five girls were kept busy all the time the Fair was in progress engaged in counting the admission tickets. The average daily capacity of these persons was 120,000. It is anticipated that the daily admissions at the St. Louis Exposition will be greater than this by far, and it is proposed to do this work of counting the tickets by machine. The device has been submitted to the Admissions Department, and Chief E. N. White is now engaged in giving it a test to prove its accuracy and rapidity. The inventor claims that four of these machines will handle all of the pasteboards as fast as they are taken up; and if his hopes are realized, the machines will be a great improvement over the old way of doing this work. Another mechanical novelty which is being experimented with by this department of the great show, is a machine ticket seller. It is said that these machines will dispose of the tickets to visitors much more rapidly than the human ticket seller and without any possibility of error or dishonesty.

A patent was recently granted covering the process of beer preservation by electricity. The inventor is Francisque Crotte, of New York. A tube-like receptacle of copper is introduced into the keg of beer to be treated, and this is filled with some preservative, such as boracic acid or peroxide of iron, either in solution or solid form. The beer is then subjected to an electric current of a somewhat high tension for about ten minutes. This is accomplished by making the tube one of the electrodes while the other is formed by means of some suitable contact on the outside of the barrel. The current is said to induce a catoriphic transference of the preservative substance through the receptacle into the beer. By this means the organic germ of life in the beer is rendered harmless, so that the beer will keep a great length of time without deterioration. The infinitesimally small quantities of antiseptic are introduced into the beer under the circumstances favorable for the most effective action and the quantity involved is so small that there is no foreign flavor imparted to the beer.

An exhibition of patents and copyrighted designs and patterns is in progress during the months of September and October at Bayreuth, under the auspices of the Central Association of Inventors. It is said that there are 200,000 copyrighted patterns and 140,000 patents, which have some value but which are not availed of, for the reason that the inventors are not able to exploit their inventions. It is rare that an inventor is equipped to get his work before the proper people after he has completed an invention, and the Central Association was formed to do this for him. Every assistance is given to inventors, and those without means are given space free at the exhibition, and no charge is made for effecting a sale. A somewhat similar organization has been recently formed in Philadelphia. It is known as the Inventors' League, and has secured permanent quarters in the center of the city, which are open not only for the members but to all persons interested in this character of work. There is a model room where a permanent exhibition of the work of the members is held, and efforts are being made to attract the attention of investors and industrial people to the exhibition. There is also a reading room where there are a number of periodicals to be found as well as other reading matter likely to be of interest to the members in their work.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

BATTERY-CELL.—E. WHITMAN, Lynn, Mass. This invention relates to cells admitting of general use, and more particularly to a form of cell serving as a cathode and also as a containing vessel. The outside portion of the cell is applied while in a liquid state and permeates the pores of the porous carbon. The effect of the glass is to prevent leakage of the battery fluid through the porous carbon, and to fill its pores. The interior of the porous carbon is provided with ribs to increase the internal surface of the cell. The bottom of the cell is rendered comparatively thick, so as to confer greater strength.

STORAGE BATTERY.—A. V. MESEROLE, New York, N. Y. In this case the object of the invention is to make an efficient and desirable battery of comparatively light weight in which the mechanical strain is distributed by a novel arrangement of the electrodes and their supporting devices. The invention relates to storage batteries and further to the composition of the active material to be used therein.

Hardware.

IMPLEMENT FOR DETACHING BOARDS FROM STRUCTURES.—F. GUENTHER, Springvalley, Ill. In the present improvement the object is to provide a practical device having features that adapt it for easy use to remove boards that have been nailed to studding, joists, or the like, the work being greatly facilitated and accomplished with little exertion in a superior manner without injury to the material or bending the nails.

Machines and Mechanical Devices.

COIN COUNTING AND DELIVERY MACHINE.—L. SUMNER, Colorado Springs, Col. The present invention relates to counting and delivery machines for coins. One of the principal objects is to overcome numerous disadvantages and objections found to exist with many machines hitherto devised for similar purposes and to provide a comparatively inexpensive machine of this kind which is accurate as well as effective and reliable, and which may be easily manipulated and quickly regulated according to requirements.

BOLTING-MILL.—A. RENAULT, Chateauroux, and G. CUSSON, St. Genon (Indre), France. This apparatus comprises, essentially, a certain number of smooth-surfaced cylinders arranged horizontally and placed one above another. It is based upon a particular property of powdered impalpable substances, such as flour, which being thrown upon a smooth-surfaced rotating cylinder partly adheres to this surface, which carries them, while the least fine portions and the impurities do not possess this property and are thrown off with the portion of the flour not carried along. The apparatus purifies and sifts flour, cement, lime, phosphates, etc.

CRANE.—L. S. FLECKENSTEIN, Easton, Md. Mr. Fleckenstein's invention is more particularly an improvement upon a former crane for which he received Letters Patent. The present improvement pertains particularly to the friction-clutch by which the power mechanism is engaged with or disengaged from the hoisting mechanism, also to the means for engaging and disengaging the clutch and the arrangement of the winch or drum with certain connected parts forming the hoisting mechanism.

BALLOTING-MACHINE.—W. M. DOUGHERTY, St. Joseph, Mo. In this patent the invention relates to certain improvements in the balloting-machine disclosed in a prior patent granted to Mr. Dougherty. The present improvements lie in the devices for operating the numbering or counting means, and by these improved devices he provides against the possibility of casting a vote for more than one candidate for an office by a single voter.

DRAIN-PIPE ATTACHMENT FOR REFRIGERATORS.—MARTHA MCNAMARA, New York, N. Y. The intention in this case is to provide means for preventing the overflow of the usual drip-pan by the continued accumulation of water after the pan shall have become filled. Further, to provide means for automatically opening a valve when the pan is placed in position below a refrigerator, the valve being closed by automatic devices when the water in the dry-pan reaches a certain level.

MACHINE FOR REGISTERING MAIL-MATTER.—D. DI BRAZZA SAVORGNAN, Rome, Italy. Mr. Savorgnan's purpose is to provide a machine easily operated by a person sending the mail-matter after the proper coin or coins shall have been inserted or after the postage shall have been otherwise paid, and, further, to so construct the machine that a copy or copies of the original receipt delivered to the sender will be retained in the machine and bound in book form, the retained copy or copies for use of the postal authorities. The mail-matter deposited will be consecutively numbered and numbers printed on receipts to correspond with numbers on the mail deposited.

ICE-CREAM FREEZER.—J. PRADE, Waco, Texas. Primarily the invention seeks to provide an apparatus in which the operation of freezing the cream may be continuous, and in its generic nature it comprehends a peculiar construction of a freezing-cylinder and means for feeding the refrigerant and the cream thereto and in which the several parts are so designed and co-operate whereby power is saved by scraping and stirring and discharging the cream before too much of the same accumulates within the freezing-cylinder.

Metallurgical Improvements.

CONCENTRATING SLUICE-BOX.—C. M. CARTER, Sultan, Wash. The objects of the invention are, first, to insure the accumulation of the metallic particles in the riffles with a minimum agitation of water and without packing of the sand or gravel, and, second, to allow the collected minerals to be quickly removed or washed from the riffles without causing practically a cessation in the operation of the sluice-box.

GOLD-SEPARATOR.—J. W. KORFHAGE, Denver, Col. In this patent the invention refers to improvements in machines for separating and amalgamating free-milling gold from gravel, clay, and from pulp. In placer-mining clay containing gold and also clay with gravel containing gold are found, and great difficulty arises in separating the metal from the sticky clays. The object is to produce a device adapted to work under such conditions and make a thorough separation.

Of General Interest.

HAIR-CLAMP.—W. J. KOENIG, New York, N. Y. The invention relates to a device for holding and ornamenting hair braids; and it constitutes an improvement over two former patents granted to Mr. Koenig. The prime object is to simplify prior devices in this class, so that they may be made and sold at a low cost. The clamp may be fitted to braids of any size within a reasonable range. It is easily applied.

ARTIFICIAL LEG.—L. DUGGAN, Rocky Mount, N. C. An object, among others in this case, is to provide a novel construction at the knee-joint and also to provide means in the foot whereby to render the cushioning operation more effective in the use of the device. No disagreeable click will be heard as the leg straightens into standing position.

PNEUMATIC MASSAGE APPARATUS.—F. H. CRABTREE, Anaconda, Mont. The inventor has especially in view the provision of a massage apparatus which may be used with convenience and safety and which through the peculiar correlation of its parts will when in operation cause the tympanum of the ear and small bones of the inner ear to vibrate or move, this movement being produced by the apparatus alternately creating a pressure and a vacuum.

HAT-RECEPTACLE FOR AUDITORIUMS.—J. T. HENDERSON, 312 Suydam Street, Brooklyn, N. Y. This receptacle is connected with theater chairs and the like. The body forms a square connected with a wire to the under part of the seat. A hat, cape, or light coat may be put into the opening in front. The main object is to avoid the necessity of ladies holding their hats in their laps and thus escaping cloak room annoyances. Silk hats and other articles are kept absolutely safe and sound, and against any interference from persons seated in the rear. Any size hat is held. In panics the boxed articles are not encumbrances, and conduce to speedy exit.

DISPLAY-STAND.—W. G. WINANS, Spokane, Wash. In this instance the invention is an improvement in display-stands for use as a medium for exhibiting articles offered for sale. The advantage in this over the stands in common use consists in the apparatus being adapted to be held at any point of a store or shop counter, or slid along to any required place, or clasped firmly while the top portion may be revolved at will for showing goods or obtaining easy access thereto.

VEST AND DRAWERS HOLDER.—A. LUSTIG, Corsicana, Texas. This invention is an improvement upon that for which Mr. Lustig received a former Letters Patent. The clasp arm is pivoted to the main bar, so as to swing free thereon, the bar being provided with a slidable extension, whereby its length may be varied, also with fixed pins, projecting oppositely, whereby the device may be quickly attached to and detached from a vest and held by tension of arm carrying the clasp. In one of the forms the device is without pins or attachment means and adapted to be inserted and held in a pocket formed in the vest's inner side next its front edge.

CAMERA.—W. F. FOLMER, New York, N. Y. The stereoscopic camera is so constructed that in focusing the object will be perfectly blended, appearing with all depth, detail, and definition obtainable when the object is viewed through a proper instrument. The camera is provided with focusing mirrors having means to prevent any light except that entering through lenses to reach the plate. There are means for bringing mirrors simultaneously to focusing position and holding them there, and means for releasing mirrors from focusing position and carrying them to an upper light-tight position out of the cone of light of the lenses.

ATTACHMENT FOR WINDOW-SHADES.—G. F. DICKINSON, JR., Morristown, N. J. The particular application of this improvement is to an article adapted to be attached or fastened to the stiffening strip or stick placed at the bottom of a shade, whereby the cord connected to such stick is so arranged that it may stand the strain without tearing the shade. The practice is to insert a screw-eye or hook in the lower edge of a curtain stick and to connect the shade-cord to such eye, but after short use the hook will be pulled from the stick and the curtain damaged. The present invention overcomes this disadvantage.

DENTAL HANDPIECE.—L. H. CRAWFORD, Dallas, Texas. This handpiece is adapted for holding a bur or other form of abrading-tool for preparing teeth for filling, crowns, etc., the same being so constructed that the bur may be adjusted at various angles ranging from naught to one hundred degrees and still work steadily. Dr. Crawford provides for this purpose an adjustment easily and quickly made, and the instrument may be clamped for holding the bur fixed at the desired angle. The adjustment reduces friction and wear.

HEATING-STOVE.—J. COCKRELL, Fargo, N. D. In this patent the invention relates to heaters designed to warm and ventilate rooms of buildings; and the object is to secure the greatest heating results and also economy of fuel. The improvement consists of the particular arrangement of the cold-air jackets, in which cold air is heated and discharged into the hot-air pipe to be carried to the most remote parts of the house.

SKATE.—T. SPACIE, Globe, Ariz. Mr. Spacie's improvements are intended more especially for use with ice or "runner" skates, though applicable in part to "parlor" or roller type; and an object is to provide a skate with effective and reliably-operating devices for enabling the same to be readily fitted to the soles and heels of shoes of different sizes and again detached therefrom and also to provide these devices with the capacity for long and repeated service.

SAFETY-PIN.—E. L. SANDS, Webb City, Mo. This pin is formed of a single length of wire, bent substantially at its center forming back and pin members, an inwardly-extended eye midway of the bend between the back and pin, a portion of the back member at the end opposite the eye being curved to form double loop members, and the end of the wire coiled around the back member and having a flattened portion extended between the loop members.

SUSPENSORY BANDAGE.—W. A. TAINSH, Portland, Me. The object in this case is to provide details of construction for a supporting appliance for male generative organs which adapt it for convenient application, afford means for adjustment of support to suit the physique of the wearer under all conditions of its service as a support, and permit an exchange of the suspensory sack to replace a soiled sack with a clean one when required.

HITCHING-POST.—T. C. BUTTERWORTH, San Francisco, Cal. When not in use this post will be nearly flush with the surface of the pavement, so as to involve no obstruction to traffic or injury to itself. It may be conveniently lifted and erected by a telescopic action from an underground chamber to an altitude for hitching teams or automobiles or support of bicycles, the parts being so designed as to avoid much leakage of water and the danger of freezing up and from which foreign matter may be easily removed.

TALLY DEVICE.—L. L. FROST, Highland, Kas. It is sought in this invention to provide a construction by which figures can be carried from a lower to a higher order without resorting to the use of subordinate figures, thus simplifying the device and the method of making calculations thereby. The present is an improvement on the tally device disclosed in a prior application for Letters Patent filed by Mr. Frost.

HOSE, ROD, OR PIPE COUPLING.— A. W. HUHSMAN, Staunton, Ill. The intention of this improvement is to provide a coupling which will be exceedingly simple and economic, and wherein the parts of the coupling are capable of being expeditiously and conveniently brought into locking engagement and rapidly disconnected, the coupling practically comprising two main parts and a locking-ring for these parts.

HOTEL-REGISTER DESK.—J. I. HAYCRAFT, Linneus, Mo. This contrivance is an improvement in desks for holding registers or similar books in hotels or other places. In operation the register-desk is used upon a desk or counter, and it is desirable to turn the register so it can be made to face the clerk or the guest, and to facilitate this the top is mounted rotatably upon the base and means are provided to connect the parts. Spaces for advertisements will not only cover the initial cost, but will prove a source of income.

BLOTTER ATTACHMENT FOR DESKS.— J. I. HAYCRAFT, Linneus, Mo. This attachment is especially for use on desks employed for supporting hotel-registers and similar books. The blotter is always in position, cannot get out of the way, is retracted and incased when not in use, and can be quickly drawn to position for use upon a book or sheet of paper, or envelope, or otherwise.

KRAUT-DISPENSING BARREL.—T. W. MCFARLAND, Jackson, Mo. The object in view in this case is to provide a barrel or receptacle with a press mechanism which is adapted for holding the kraut below the level of brine or other preservative liquid, whereby the kraut may be kept in a submerged condition without the necessity of inverting the barrel or cask in which the commodity is packed.

GAME-BOARD.—D. STANGER, Glassboro, N. J. The invention relates to that class of game-boards comprising a table having an inclined top with projecting pins, ball-receiving pockets, and side alley-ways. The invention consists in the peculiar arrangement of projecting pins, ball-receiving pockets, and other features. The special object is to provide a game-board to admit of the game of base-ball being played thereon and making a complete score from the game, such as the record of the outdoor game of ball.

Of Interest to Farmers.

BEET-HARVESTER.—H. M. HEILIG, Tecumseh, and M. H. REED, Blue Springs, Neb. The invention refers to improvements in beet-harvesters; and the objects in view are first to provide means for digging embedded beets from the soil, and, second, to provide means which insure the loading of beets on a suitable elevator or conveyor and also tend to loosen the dirt adhering to the beets. These inventors have also invented another beet-harvester, the object being to provide means for removing the tops of beets, while in the ground. An automatic adjusting mechanism makes the cutter devices slice the tops uniformly, however high they may project. The position of the cutter devices is regulated by hand. Means are included for ejecting cut tops and refuse out of the machine's path. Active parts of certain devices are kept from being obstructed by vegetable matter and the devices are arranged to automatically adjust and clear themselves from clods, earth and stones in the path.

Pertaining to Vehicles.

SUPPORT FOR BICYCLE HANDLE-BARS. —R. H. TATE, Portland, Ore. The main purpose in this instance is to provide means of throwing the handle-bar in a line position with the front wheel or parallel with the line of travel of the wheel and automatically locking it in such position and returning the handle-bar at right angles to the line of travel of the front wheel or at right angles to its axle-support with equal ease, where the bar is again automatically locked in riding position.

VEHICLE-WHEEL.—L. LANGE, New York, N. Y. The present invention relates to a class of vehicle-wheels wherein the peripheral portion of the wheels is held to rotate upon the body of the wheel, and has for its object to provide details of construction for a wheel that adapt a rubber tire and its shoe to receive anti-frictional support on the wheel-rim, that is held concentric with a wheel-hub by a series of spaced radial spokes.

FASTENER FOR CLIP-BANDS.—C. L. POPE, Ely, Nevada. Mr. Pope's invention has for its aim the provision of features of construction for a clip-band fastener that may be readily applied to secure attachment of clip bands or rings upon wagon running-gear or the like, so as to hold in place trace-hooks or ring-eyes on the ends and centers of neck-yoke bars, whiffletrees, or on the ends of wagon-poles as may be desired.

RUNNER ATTACHMENT FOR AUTOMOBILES.—W. H. ANDERSON, New York, N. Y. The inventors' purpose is to provide a form of runner adapted to be fitted to the rear axle as a substitute for wheels and to provide the runners with propelling mechanism and driving devices for the mechanism, together with means for operating the devices from the driving axle of the automobile, the mechanism including means whereby the runners enter the snow or pierce the ice so as to sufficiently grip when the propelling-chain is operated to force the machine forward.

Prime Movers and Their Accessories.

BOILER.—H. W. WHITE, Youngstown, Ohio. In this patent the invention relates to boilers, and more particularly to a type of boiler adapted for use in connection with waste gases from which it is desired to extract the heat. The construction includes an inner shell rising centrally and an outer shell spaced from the former. Horizontal tubes connect the space outside of the outer shell with the interior of the inner shell, and on the upper section of the outer shell a head of special form is provided. Ashes, cinders and scale are easily removable.

STEAM-ENGINE.—F. LANE, Carthage, and O. E. OAKES, Joplin, Mo. This is a new and useful engine of the type known as "flashers" or steam-engines which have no boiler proper and carry no permanent body of steam, but inject upon heated surfaces small quantities of water at each piston movement, which quantity is instantly expanded into steam to give a single impulse to the piston and which injections of water and steam impulses are repeated at every movement of the piston.

ROTARY MOTOR.—T. EASTMORE, Jacksonville, Fla. In this instance the invention has reference to improvements in rotary motors of the turbine type, one of the objects being the provision of a rotary motor of simple and durable construction, easily reversed, and arranged to utilize the motive agent to the fullest extent.

Railways and Their Accessories.

CAR-STAKE.—J. E. PUCKETT, Richmond, Va. Mr. Puckett's invention is an improvement in flat railway-cars, and particularly in the stakes thereof for use in securing lumber, timber, and the like upon the flat platform. He provides a locking-rod adjustable or movable so it may be set to and secured in position to lock the stakes in their places or to position to release said stakes, so they may be adjusted out of the way, the locking-rod serving to secure the stakes to the car in the latter position and position for use.

AUTOMATIC PIPE-COUPLING.—C. O. COLE, Whatcom, Wash. Mr. Cole's invention relates to pipe-couplings for connecting air, steam, or other pipes of cars in a train with each other to form continuous pipe-lines. The object is to provide a coupler which is completely automatic in operation and insures a firm coupling of the pipes for the various lines without danger of leakage, allows automatic uncoupling on moving the uncoupled cars apart, and permits a manually-controlled relase of the coupling members by the operator.

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. 5460.—For manufacturers of road graders, also of hand power drills for quarries.

Inquiry No. 5461.—For makers of gasoline or hot air engines of about ½ horse power.

Inquiry No. 5462.—For makers of elastic webbing, such as used in suspenders.

Inquiry No. 5463.—For parties desirous of putting a new article on the English market.

WANTED.—Address of Manufacturers of Quaker Shade Roller. L. I. Manning, Morganfield, Ky.

Inquiry No. 5464.—For addresses of manufacturers of hardware specialties.

Inquiry No. 5465.—For a cheap device for cutting paper 6 and 8 foot down to 2 foot pieces.

Inquiry No. 5466.—For manufacturers of paper box machines.

Inquiry No. 5467.—For manufacturers of peat machinery.

Inquiry No. 5468.—For makers of thermostats for dry kilns.

Inquiry No. 5469.—For manufacturers of sporting gun and ammunition.

FOR SALE.—Patent machine for wrapping laundry soap. Will do the work of eight people. Ed. Nelson, 1104 Cherry Street, Kansas City, Missouri.

Inquiry No. 5470.—For manufacturers of electric runabouts.

Inquiry No. 5471.—For manufacturers of self-registering turnstiles.

Inquiry No. 5472.—For makers of steam excavators or navies, for trenching for sanitary work, about 4 feet wide by 16 feet deep.

Inquiry No. 5473.—For a machine for hulling strawberries.

Inquiry No. 5474.—For makers of working model engines.

WANTED.—Man capable of taking charge of factory making special machinery, who can also take $2,000 or $3,000 interest in established plant. N. B. Harrington & Co., 106 Broadway, Buffalo, N. Y.

Inquiry No. 5475.—For manufacturers of glass novelties.

Inquiry No. 5476.—For makers of hollow brass wire.

FOREMAN WANTED.—A thoroughly capable man to take charge of brass shop employing about fifteen men. Must be between 30 and 40 years of age, married. Reply by letter only, stating experience and references to Wm. H. Wilkinson Co., West Medway, Mass.

Inquiry No. 5477.—For makers of handles for artists' pencils, also parties making the machinery for making the same.

Inquiry No. 5478.—For manufacturers of or dealers in a patent dishwasher.

Inquiry No. 5479.—For machinery for making cotton batting.

Inquiry No. 5480.—For the manufacturers of the cigar lighter which was patented by Clyde J. Coleman, or makers of any other electric lighter.

Inquiry No. 5481.—For manufacturers of metal, nickel or aluminium egg shells.

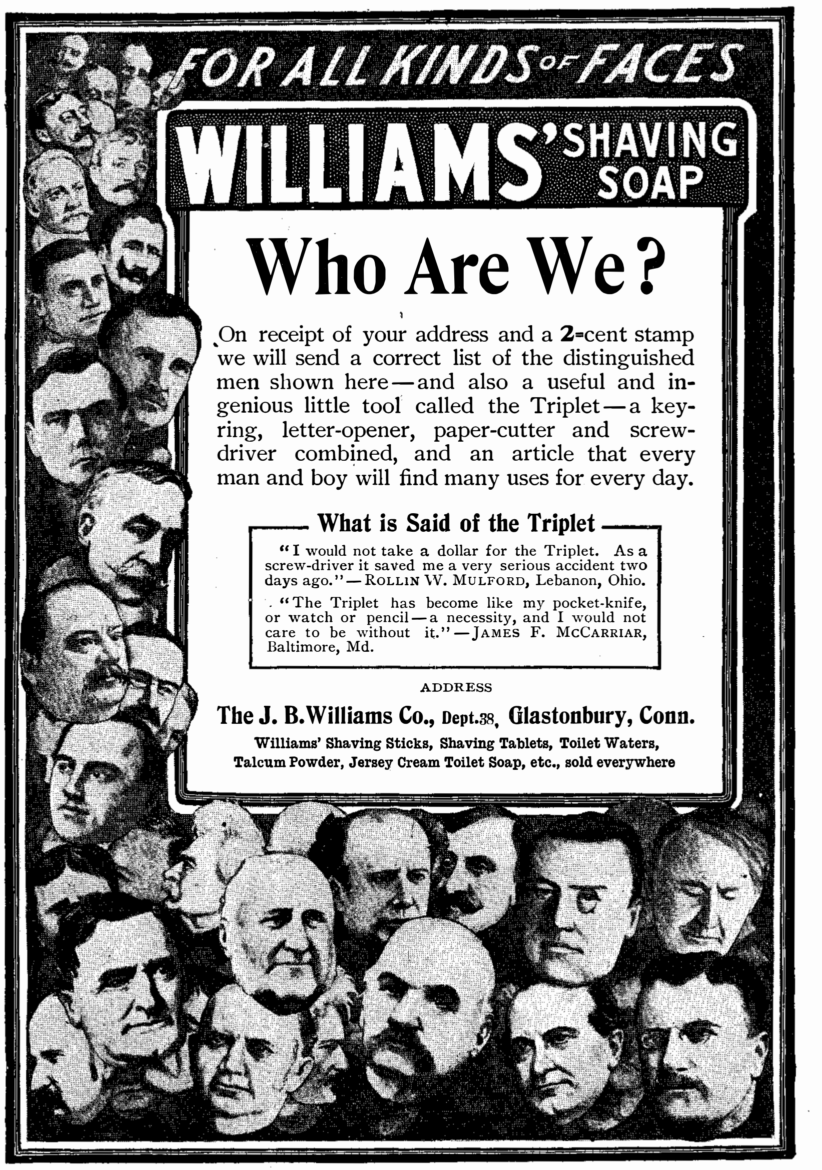
Inquiry No. 5482.—For automatic vending machines for selling liquors.

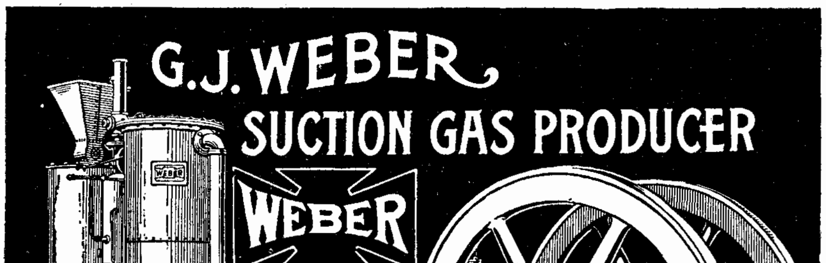
Inquiry No. 5483.—Wanted, to purchase a hardware store.

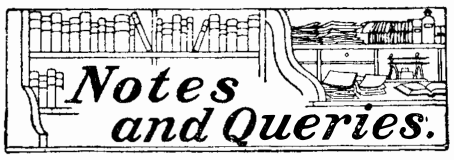
Inquiry No. 5484.—For machines for perforating paper patterns.

Inquiry No. 5485.—For manufacturers of metal garter trimmings, as hooks, slides, supporters and non-elastic garter web.

Inquiry No. 5486.—For makers of paper chair bottoms, imitation leather chair bottoms, also fiber and other material used for the same.







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.

(9380) L. E. G. asks: 1. How is a hand lead marked; that is, how are the marks and deeps laid off and how shown, also length of line? A. Sounding leads are generally laid off in fathoms below 5 and at 7, 10, 13, 17 and 20 fathoms, which latter is the usual length of the line with from 7 to 11 pounds weight. Deep-sea lines are usually 200 fathoms in length with 28-pound weights and marked at each 2 to 10 fathoms with leather and bunting tags so combined as to readily measure the fathoms as the line passes out. 2. How is a hand log marked? What is distance between marks, in feet or inches, on a log line to be used with a 30-second sand glass, or a 15-second sand glass? A. The hand log line is usually 150 fathoms long and should have 10 fathoms between chip and first knot for stray line. With a 30-inch glass the knot tags are 50 feet 8.03 inches apart and indicate sea miles or knots per hour. With a 15-inch glass the knot tags should be at one-half the above distance parts. 3. How is a 4 or 8 point bearing taken to tell distance of ship from land; that is, taken from bow to beam, or beam to quarter? A. The bow to beam or beam to quarter, or better, from bow to stern, may be taken as a measured base line and the angle of each end simultaneously taken from a shore mark, from which a triangle computation will give the distance. 4. What is the best material for a marine compass needle—ordinary soft iron or Norway iron? The compass cards I wish to use are 6 inches diameter and 1-32 inch thick pasteboard. Would needle 6x¼x1/16 inch be about right size? Being a marine compass, needle will be glued fast to card, of course. A. A compass needle should be made of tool steel, hardened and tempered. The card should be drawn on fine drawing paper and pasted to a thin piece of mica. Fasten to the needle with small lead rivets.

(9381) H. F. H. asks: Is the althea the true "Rose of Sharon"? Or which is the true or original "Rose of Sharon" mentioned in the Bible? Some claim the althea, others narcissus, and some again *Scilla maritima*. Is there any place where a person could get a copy of the flower as it grew or grows on the plains of Sharon? A. The article upon the "Rose of Sharon" in Smith's "Bible Dictionary" begins: "There is much difference of opinion as to the particular flower intended." If this is the case we cannot decide. There are no pictures dating back to the time of the writing of the Canticles, and no way whatever of determining the species of plant denoted by the name.

(9382) A. M. W. asks: A trolley car leaves the track a few feet. The trolley pole can reach the overhead wire. In running it back upon the tracks, the conductor made a connection between the rail and car wheel with the iron rod used to turn the switch; was it of any use? With a stated current carried by trolley wire, will the motors of a car show more power by having the rails of the track wired together, or is the bonding of the rails to prevent damage by the return current to other structures? A. The intention is to use the rails of the street-car lines for a return circuit of the current to the dynamo. If the rails are well bonded together this will result. If they are loosely connected the current will leak off and go by some easier path. On the way, it will take to pipes, water and gas, and destroy them. The bonding is to keep the return current in its proper place. When the conductor used a bar of iron to connect the rail to the wheel of the derailed car, he closed the circuit between the motor and the return path in the track, thus enabling the motor to get power from the line. With the earth connection only the resistance would be too high to allow enough current to flow to run the motor.

(9383) R. S. L. asks: Is it not a fact that the battleships and armored cruisers of our navy are built and are building without armored smokestacks? Are not the extremely lofty stacks of our later construction designed to obviate the necessity of forced draft? Would not these tall stacks be immediately riddled in an engagement, and thus deprive the vessel of a large part of her steam power when most needed, besides rendering the upper works untenable from smoke? Is it not a serious error to neglect to armor the stacks, and would it not be better for our constructors to follow in some respects the designs of Continental nations instead of the English? A. The armoring of smokestacks is a question that is attracting attention among naval designers, some of the latest vessels of the Russian navy being armored on that portion of the smokestack that is between decks. It would be impossible to carry the armor higher than this without making serious inroads upon the amount of armor that could be spared for other vital parts of the ship. We believe that as yet we have not been in the habit of armoring our smokestacks even at the bases; though we believe that the matter is now under advisement.

(9384) H. H. B. asks: We have a 50-horse-power side-crank, partially balanced valve Atlas engine in our mill. 1. Will this engine run without a wheel of any kind on the shaft? Our engineer says it will not, but I say that it will. Hence the argument and wager. A. A steam engine without a flywheel might possibly run with a jerky motion, which is not tolerable to good practice. Your engineer is about right. 2. Will a 55-horse-power boiler, now furnishing steam for a 50-horse-power engine considerably overloaded, furnish steam enough for a 75-horse-power Corliss engine? A. The 55-horse-power boiler should be of sufficient capacity, if not overrated, for 75 horse-power in a Corliss engine. 3. How much working advantage does a Corliss engine have over the same size plain engine? A. Plain engines vary in their consumption of steam per horse-power to a considerable extent, and for engines of equal cut-off there is a small percentage in favor of the Corliss engine.

(9385) A. F. O. asks: Is the following from the Scientific American of recent date, strictly correct? "A. It is not known why water expands in freezing. There are very few substances which do so. *Cast iron* and type metal are two others which have the same peculiarity, and which are very important to man." I always supposed that cast iron shrank at the moment of solidification. In the American Cyclopedia, Vol. IV., page 80, I read: "In the casting of cylinders, the shrinkage of the iron in cooling must always be particularly taken into consideration. This is quite uniform, and is 1 inch in 8 feet, or 1-96 linear measure." Do not pattern makers for stove castings always make the pattern a little larger than the size required for the finished casting? Regarding type metal, the textbooks on physics generally teach that *antimony* expands on solidification, and that that is why a proper admixture with lead secures the expansion necessary to give smoothness and sharpness to the type. In Fownes (Watts) Chemistry, p. 455, I am informed that antimony alone, like lead, will shrink on cooling, but that the *alloy* will expand. Will you kindly give me the exact truth in regard to both antimony and iron, but especially as to the latter? A. With reference to the change of volume at the moment of solidification—in which respect you criticise a recent reply to a query of ours—we may say that it is not supposed that any chemically-pure metal does increase in volume during the act of changing from the liquid to the solid state. The three substances which we mention, however, water, cast iron, and type, all expand in passing from the liquid to the solid condition in a marked degree. The quotation which you make from the American Encyclopedia, viz., "in the casting of cylinders, the shrinkage of iron in cooling must always be taken into consideration," is not to the point, since it particularly states that the iron is cooling, and the change into the solid condition must be complete before the substance can cool at all. This you will perceive if you refer to the subject of latent heat in any textbook of physics. When a liquid is in the act of solidifying it gives off a great quantity of heat without any change of temperature. Thus water cools to the temperature of 32 deg. before any ice forms, and when ice is formed it is still at the same temperature as the water in which it is floating, but you will observe that the ice could not float if it did not increase in bulk in freezing. Ice is approximately one-ninth lighter than water, and that one-ninth is the increase in bulk in solidifying. Similar reasoning will apply to any other substance. Most substances contract in the act of solidifying, and are in the solid form smaller and denser than in the liquid form. The result is that the solid sinks in the liquid. If you place a piece of wax in a dish and melt it—preferably such a dish as a test tube—the solid wax will remain at the bottom, while the melted wax overflows it; and this would be the case with the great majority of substances which can be melted by the application of heat. It is probably true, as you say, that type metal owes its expansion to the antimony which it contains, but the case of water is different. Ice formed from chemically-pure water floats upon the water in the same manner as ice formed in any lake or pond. So much for changes in the act of solidifying. Now, after the solid has been formed, it obeys the usual laws of expansion and contraction—heating expands and cooling causes a substance to contract. It is to this change the quotation you make above refers. The shrinkage of a metal in cooling must always be taken into account in making patterns for castings. But iron and type metal are the only metals which actually expand on solidifying, and which therefore may be employed for making exact reproductions of the fine lines and markings upon a mold. Lead, tin, etc., contract in solidifying, and always present rough surfaces in casting.

(9386) R. M. asks: 1. Would you explain the difference between the automatic cut-off engine and the flyball governor engine? A. The difference in the two styles of engines is in the method of controlling the admission of steam to the cylinder. The governor of the automatic engine controls the cut-off point of the slide valve, while the flyball governor controls the throttle valve only, in ordinary slide-valve engines, and also the cut-off in engines of the Corliss type. 2. Explain the term sharp cut-off as used in reference to steam engine cylinders. A. A sharp cut-off is a quick action cut-off, as in the Corliss type and in some special designs of the slide-valve type. 3. What are the mechanical differences between a high-speed engine and an ordinary engine? A. The high-speed engines are generally of the automatic type with short stroke, and perfection of the moving parts required by high speed. 4. What is the pressure of water per square inch of surface in the change from a liquid to a solid? Does the pressure increase for each degree of change of temperature from 39 to 32? Is the contraction the same for each degree below 32? A. Water being incompressible, its pressure becomes immense, and will burst the strongest vessels, if confined. Water contracts from 39 deg. to 32 deg., and suddenly expands about one-tenth of its bulk in freezing, after which contraction continues by fall of temperature at a greater rate per degree than any other solid—about 0.033 of an inch per degree in one hundred feet.

(9387) B. W. N. asks: Would you kindly explain the following question through your column of Queries and Answers? Why does not the sum of the included angles of a triangle equal 180 deg.? I had been taught that the sum of these angles always equaled 180 deg., but I read in a book on astronomy that if imaginary lines be drawn from the sun to the star Sirius, and from Sirius to the polar star, and from the polar star to the sun, forming a triangle, the sum of the angles formed by these lines did not equal 180 deg. A. The theorem in geometry is that the sum of the three angles of a plane triangle is equal to two right angles. From this value there is no deviation; you may consider it absolutely correct. It is also a geometrical theorem that the sum of the three angles of a spherical triangle is greater than two and less than six right angles. Hence the angles included by the three arcs of circles drawn upon the celestial sphere from the sun to the star Sirius, and from Sirius to the pole star, and from the pole star to the sun again, need not and do not equal 180 deg. The position of the pole star and Sirius with reference to each other does not change to any great degree, but the sun is changing its position with reference to these two stars every day in the year, and twice in the year must be upon the circle of the celestial sphere which passes through both these stars, and at these times no triangle is formed by the three bodies, for they lie on the same circle. At all other times during the year there will be a spherical triangle formed by the three bodies, the sum of whose angles is continually changing between the limits specified in the theorem quoted above.

(9388) E. R. E. writes: Can you tell me how much water would be discharged at the lower end of a pipe 18 inches in diameter and 100 miles in length, with a fall of 800 feet in that distance? How much difference would it make if said pipe was 4 or 6 feet in diameter for the first few miles, or until it reached a fall of 100 feet, then gradually contracting to 18 inches? Would water running this distance keep in constant motion, or would it *freeze* if the pipe was on the surface of the ground; that is, *above* ground? A. The pipe line of 18-inch pipe, 100 miles long, laid with a fairly even slope of 800 feet, should deliver 252 cubic feet of water per minute. If 25 miles is of larger size to give full flow, the 75 miles of 18-inch pipe with 700 feet slope should deliver 275 cubic feet per minute. The 4 or 6 feet pipe, with say a slope of 100 feet in 25 miles, will be too large and too expensive for a feeder to the 75-mile line. If it is only 2 feet in diameter, it will supply 360 cubic feet per minute, which will give an initial pressure to the long line equal to nearly 100 feet, and increase the flow of the 75 miles of 18-inch pipe to 300 cubic feet per minute. Such a pipe line would not be safe against obstruction by freezing to several inches thick on the inside of the pipe in extremely cold weather and at times of low discharge. It should have some protection in your climate.

(9389) F. S. K. asks: 1. Is there any liquid better than water to use in a hydraulic of an oil gas bench? A. The hydraulic main of an oil gas works should be charged with water only. There is nothing better. 2. Is there any part of the gas that is taken out by its passing through the water of the main? A. A small quantity of tar and ammonia and possibly sulphur are absorbed or detained by the water of the hydraulic main. 3. What is the best substance to use to purify oil gas? A. Water from jets triculating through a bed of coke in a vertical cylinder with the gas passing upward is the best purifier for oil gas.

NEW BOOKS, ETC.

SUBMARINE NAVIGATION PAST AND PRESENT. By Allen H. Burgoyne, F.R.G.S. Illustrated. Two volumes. London: Grant Richards. New York: E. P. Dutton & Co. 1903. Price, $10.

Mr. Burgoyne's book, although primarily a history of submarine navigation, may be considered a strong plea for the more general introduction of the submarine boat in the British navy. Starting with the mythical attempts of the ancients at submarine navigation, the author passes to more modern times and discusses the inventions of such pioneers as Van Drebel, Norwood, Borelli, Bushnell, and other historic inventors. Although Americans have been behindhand in the development of the submarine boat, despite the inventions of Holland and Lake, still it must be said that the first successful attempt to use the submarine in modern warfare is to be found recorded in the annals of our Civil War. Mr. Burgoyne has not confined himself to a description of actually built submarines, but has even given accounts of craft that have never developed beyond paper. Many of these designs are mere fantasies, mechanically bad, and often displaying anything but a clear conception of the needs of submarine craft. Particularly valuable in this book are the chapters dealing with the development of the Holland and the Lake submarine boats. They, at least, show how success may be attained. Altogether, Mr. Burgoyne has succeeded in presenting a highly instructive book upon a subject with which most of the navies of the world are now concerning themselves.

MY AIRSHIPS. By Alberto Santos-Dumont. New York: The Century Company, 1904. 12mo.; pp. 400; 75 photographs and diagrams. Price, $1.40.

It can hardly be said that Mr. Santos-Dumont's book is a scientific work on aerial navigation. All that he has done is to tell in a very breezy, entertaining way the story of his airship experiences, outlining his career as an aeronaut from the time that he made his first balloon ascent to the time he built the Santos-Dumont No. 10. The book is frankly written for the man in the street. Still, many of the adventures which Mr. Santos-Dumont describes shed a flood of light upon the mistakes that are very frequently made in the construction of dirigible airships. Particularly is this true of the account of the collapse of one of the first, if not the first airship, that Santos-Dumont built. He dwells instructively upon the lessons which that accident taught him and upon the way in which it influenced the construction of his subsequent vessels. The book as a whole is striking, bright, and instructive.

LES AMALGAMES ET LEURS APPLICATIONS. Par Léon de Mortillet. Paris: Librairie Bernard-Tignol. 8vo.; pp. 52.

ENTROPY; OR, THERMODYNAMICS FROM AN ENGINEERS' STANDPOINT, AND THE REVERSIBILITY OF THERMODYNAMICS. By James Swinburne. Westminster: Archibald Constable & Co., Ltd., 1904. 8vo.; pp. 137. Price, $1.80.

This volume is made up of a series of articles printed last fall in Engineering, and dealing with the oft misunderstood subject of entropy. Instead of treating this subject in the usual mathematical and, to most people, vague and puzzling way, Mr. Swinburn has looked at it from a common-sense point of view and has used language (not figures) intelligible to the ordinary lay mind. The treatment of the subject, which is somewhat novel in order to make the theory clear, is along lines laid down in a paper on "The Reversibility of Thermodynamics," found at the end of the book. This paper was read before the British Association last year for the purpose of drawing out the criticism of men well up in the subject; but it resulted in very little discussion, and so the author considers the views set forth in it to be approved. The book is well written and concise, and will be found useful to engineers generally who desire enlightenment on this somewhat obscure subject.

THE METALLURGY OF STEEL. By F. W. Harbord, Assoc. R.S.M., F.I.C. With a Section on The Mechanical Treatment of Steel. By J. W. Hall, A.M. Inst.C.E. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1904. 8vo. Pp. 258, 595 cuts. Price, $9.

The subject matter of the book is divided into four sections, which treat of (1) The Manufacture of Steel; (2) Reheating; (3) The Mechanical Treatment of Steel; and (4) Finished Steel. Section I. describes the theory and practice of steel manufacture, special attention being given to recent developments in the same both here and abroad. The latest types of steel furnaces, gas producers, mechanical appliances, Bessemer and open-hearth and crucible plants are fully described and illustrated. Sections II. and III. describe the treatment of the ingot and the appliances used in shaping it into the finished section. The third section, by Mr. Hall, treats of the rolling, hammering, forging, wire-drawing, and fluid compression of steel, and includes detailed descriptions of the latest modern rolling mills, hammers, forging presses, and other labor-saving devices in common use. The section on Reheating contains a description of the most recent type of coal- and gas-fired reheating furnaces, mechanical chargers, and various appliances for handling the materials at the reheating furnaces and transferring them to the mills. Section IV. describes the properties of finished steel. The influence of impurities on the mechanical properties of steel is thoroughly discussed, as is also the important subject of its heat treatment and the pyrometers used in connection with the same. The relation of microstructure to heat treatment is fully illustrated by numerous micro-photographs, and the latest theories on hardening, tempering, and other matters of much interest and importance are discussed. The question of specifications, both as regards chemical composition and mechanical properties of various steels, is treated in an appendix. Other appendices contain valuable matter on the relation of percentage of carbon to tensile stress, and on the rapid determination of phosphorus and manganese.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending April 26, 1904.

AND EACH BEARING THAT DATE

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

Adding and recording machine, A. S. Dennis 758,052
Adding machine, T. A. Wheeler 758,198
Adjustable protective frame, A. L. C. Marsh 758,372
Air brake train pipe testing device, W. S. De Camp 758,427
Airship, Greeuw & De Jong 758,062
Alarm lock, Miller & Kunzinger 758,554
Amusement apparatus, Traver & Nichols 758.341
Animal trap, J. B. Harig 758,208
Animal trap, self-setting and ever-set, L. H. Simon 758,481
Automatic sprinkler, C. B. Garrett 758,522
Automatic supply regulator, E. H. Gold 758,437
Axle box, car, J. Spurr 758,483
Bailing press, J. J. York 758,492
Bank, savings, R. J. Thompson 758,340
Bath apparatus, J. R. Hamilton 758,207
Beaming mechanism, H. Van Winkle 758,489
Bed bottom, J. G. Peace 758,276
Beehive, H. Davenes 758,203
Belt, driving, A. Fritz 758,356
Belt loop attachment for garments, button, J. D. Burns 758,350
Belt or girdle, extensible, G. Farrell 758,240
Belt shipper for pulleys, E. Kottusch 758,081
Belting and making same, L. P. Warner 758,286
Bench dog, J. H. Belser 758,407
Binder, temporary, J. F. Cordes 758,050
Boat lowering device, life, J. F. Becker 758,043
Bolt, F. P. Pfleghar 758,333
Book, account, H. Sixbey 758,220
Boring and tapping, combination tool for, Allendorfer & Owens 758,038
Bottle cap, E. Norton 758,273
Bottle, non-refillable, D. S. Cooke 758,298
Bottle, non-refillable, C. A. Taylor 758,395
Bottle, non-refillable, G. W. Lovejoy 758,543
Bottle opener and temporary closure, capped, C. Cady 758,235
Bottle stopper, G. Kirkegaard 758,319
Bottles, etc., means for packing, W. Ducart 758,239
Bowling alleys, machine for use in constructing and repairing, J. F. Darrell 758,424
Box. See Knockdown box.
Box covering machine, H. B. Blackinton 758,502
Box or container for bottled beverages, P. D. Laible 758,369
Braid, skirt, J. W. Schloss 758,564
Brick for the construction of arches, S. H. Clarke 758,417
Bridge construction, W. R. Diehl 758,428
Brush, C. Gruneberg 758,063
Brush, sweeping, G. L. Lamb 758,082
Brush, tooth, H. E. Sandiford 758,109
Bucket dumping device, automatic, J. McKinnon 758,271
Buckle, trace, J. Mensen 758,187
Building construction, G. A. Behrnd 758,500
Buoy, S. W. Roberts 758,218
Burglar alarm, A. F. Schiffling 758,389
Bushing, bung, G. H. Ricke 758,386
Bushing for crank bearings, shifting segmental, L. T. Weiss 758,397
Bushing forming and setting machine, J. Jacobsen 758,364
Button, cuff, J. Pejchar 758,101
Button, detachable, A. H. Brownley 758,602
Buttonhole cutting and stitching machine, E. B. Allen 758,037
Calipers, F. Shafer 758,283
Can or vessel opening attachment, S. L. Sheldon 758,152
Car air cushion, M. Downer 758,604
Car attachment, F. Freadreazea 758,519
Car bolster, C. A. Lindstrom 758,542
Car brake, M. Mabrey 758,186
Car brake beams, signal operated by, S. N. Wilcoxson 758,398
Car brake head, J. H. Graham 758,176
Car brake mechanism, J. Shelton 758,391
Car brake slack adjuster, E. E. Crowell 758,423
Car coupling, A. A. Moss 758,268
Car coupling, automatic, L. Bottenstein 758,408
Car door, grain, W. L. Carson 758,414
Car door mechanism, J. F. Streib 758,392
Car door mechanism, C. A. Lindstrom 758,456
Car draft rigging, railway, W. H. Miner 758,144
Car, dumping, A. D. Harrison 758,135
Car emergency brake, street, P. Flood 758,131
Car friction gear, motor, W. Seck 758,113
Car heating systems, train pipe terminal for, J. F. McElroy 758,269
Car loading apparatus, E. R. Abbey 758,493
Cars, automatic brake coupling for railway or electric, K. Geucke 758,059
Carbonating apparatus, liquid, J. F. & D. Youngblood 758,403
Carpet stretcher, W. Reichle 758,562
Cart, H. A. Bienhoff 758,126
Cart, garbage, R. D. Wirt 758,343
Case. See Mail delivery case.
Casein composition and producing same, W. A. Hall 758,064
Celluloid compound, A. Schmidt 758,335
Cement floors or concrete, bar for strengthening, J. F. Golding 758,061
Centrifugal machine, J. W. Macfarlane 758,457
Chandelier, E. Witzenmann 758,163
Child's safety harness, A. Weis 758,123
Chimney, P. Dickinson 758,510
Chum delivering apparatus, F. E. Forster 758,434
Clamp, P. Lyden 758,262
Clamp, R. Rossler 758,476
Clamp for hoops, bands, etc., W. P. Rice 758,385
Clamp for stop cock for flexible tubes, O. L. Jeralds 758,449
Clip, D. E. Mapother 758,547
Clock case, A. M. Lane 758,454
Cloth rerolling machine, C. Krause 758,322
Clothes drier, J. Judelson 758,451
Clothing rack, J. A. Hockersmith 758,072
Clutch, friction, M. C. Nixon 758,272
Coal breaker, E. S. Decker 758,302
Coaling station, W. Robertson 758,191
Coat, rain, B. E. Terwilleger 758,487
Coat, storm, T. A. Jones 758,182
Coffee extract, preparing, F. J. Reichert 758,384
Coil, radiating condensing, R. Jardine 758,077
Column, metallic, E. Ohnstrand 758,331
Combustion structure, G. C. Savage 758,281
Commutator brushes, means for preventing arcing between, E. Thomson 758,157
Compensating device, W. Y. Cruikshank 758,584
Compressing mechanism, W. M. Holmes 758,253
Concentrator, W. L. & F. S. Card 758,413
Concentrator, L. C. Graupner 758,438
Condenser, O. H. Mueller 758,090
Conveyer, stock house, T. A. Edison 758,432
Core drying oven, W. J. Breen 758,409
Corn husker, R. N. Thomas 758,196
Corset stay, C. H. Cunningham 758,585
Cot or bed, folding and convertible, J. W. Jones 758,211
Cotton gin mote board, C. G. Bodungen 758,166
Crane, C. H. Howland-Sherman 758,254
Cranes, track or the like for, R. Wilke 758,399
Cross section tester, H. E. Smith 758,221
Crusher and pulverizer, M. F. Williams 758,288
Cultivator disks, dust proof journal for, N. S. Barger 758,582
Cultivator wheels, dust proof journal for, N. S. Barger 758,581
Current collector, J. E. Greenwood 758,528
Current motor, alternating, R. McNeill 758,378
Curtain fixture, Reiss & Bradbury 758,216
Curtain holder, J. D. Tieken 758,570
Cut off, A. Martin 758,265
Cut off, rain water, J. J. Sandvig 758,479
Damper regulator, E. A. Prahl 758,471
Dash foot and brace combined, H. C. Swan 758,393
Dental matrix retainer, W. Crenshaw 758,422
Doll, dancing, Y. F. Pinnick 758,469
Drier, W. R. Macklind 758,327
Driving mechanism, H. M. Pope 758,147
Easel, H. C. Cady 758,351
Elastic fabric, H. J. Gaisman 758,435
Electric conductor ground connection, Fuller & Walsh 758,057
Electric conductor support, F. C. Locke 758,324
Electric heater, E. Eckmann 758,303
Electric motor, A. Vanderbeck 758,225
Electric switch, A. R. Fergusson 758,306
Electric switch, J. H. Rusby 758,478
Electric time switch, H. C. Little 758,084
Electrical impulses, transmission of, J. S. Richmond 758,406, 758,598
Electromagnet, H. W. Chamberlain 758,236
Elevator safety device, C. N. Pollock 758,470
Ellipsograph, J. F. Hanlon 758,314
Embossing punch, R. Woodman 758,491
Embroidery hoop or ring, W. N. Howden 758,535
Emergency brake, F. B. Corey 758,173
Enameled ware, manufacture of, T. M. Lunan 758,325
Engine. See Explosion engine.
Engine base clamp, C. P. Shertzer 758,114
Engine controlling mechanism, explosive, R. Jardine 758,076
Engine cylinders, means for cooling explosive, Marsh & Nichols 758,373
Envelop opening machine, A. Hess 758,315
Envelops, etc., safety fastener for, J. Noseworthy 758,379
Excavating shovel, J. W. Page 758,380
Exhibitor, curtain, P. Jr. & H. Roush 758,149
Explosion engine, McMillen & Robinson 758,189
Fabrics, machine for uniting looped, G. O. & H. E. Harbaugh 758,248
Fan, electric, A. R. Fergusson 758,305
Fanning mill for cleaning grain, etc., J. L. Doub 758,511
Fare register, H. Tyler 758,488
Fastening device, R. M. Pancoast 758,332
Feed water heater, T. Y. Stewart 758,484
Feeder and band cutter, J. A. Anderson 758,290
Feeding device, mechanical, T. L. & T. J. Sturtevant 758,119
Fence, G. Bronson 758,046
Fence, I. Haws 758,593
Fence brace, A. W. Whaley 758,576
Fence material, J. Stickley 758,154
Fence post, F. Hedrick 758,178
Fence post, J. B. Goundry 758 591
Fencing, wire, C. B. Baumgartner 758,125
Ferrules, etc., machine for contracting, Schweinert & Kraft 758,195
Fertilizer distributer, J. S. Kemp 758,537
Fibers together, felting or matting, G. Goldman 758,244, 758,311
Fibers together, matting or felting, G. Goldman 758,243
Fibers together, uniting or matting, G. Goldman .... 758,245 to 758,247
Filing cabinet, H. W. Andrews 758,039
Filter, K. Abraham 758,345
Filter, O. Selg 758,390
Fire extinguishing apparatus, E. W. Hicks 758,362
Firearm, automatic, T. C. Johnson 758,318
Fireproof door, F. A. Howell 758,316
Flask, H. Struben 758,339
Flexible joint, T. W. Moran 758,556
Floor or ceiling, W. N. Wight 758,577
Floors, ceilings, sidings, etc., tool for removing, W. O. Harmon 758,442
Floors, partitions, etc., construction of, V. Moeslein 758,555
Flour non-hygroscopic, making, O. Avedyk 758,346
Fluid pressure brake, J. W. Cloud 758,049
Fluids, air or gas lift for, W. B. Harris 758,360
Flushing tank, F. Findeisen 758,307
Flushing tank, B. Walker, Jr. 758,396
Friction device, G. L. Harvey 758,066, 758,067
Fulling mill stop motion, J. P. Ryan 758,107
Furnace charging apparatus, blast, Blacklund & Burman 758,498
Furnace combustion apparatus, V. Zanetti 758,404
Fuse, blow out, F. B. Corey 758,172
Garment fastener, B. M. Burr 758,507
Garment supporter, F. S. Boedefeld 758,201
Gas burner, C. A. Campbell 758,411
Gas burner, furnace, N. Cote 758,420
Gas burning apparatus, W. H. Bradley 758,294
Gas fireplace heater, A. B. Schofield 758,111
Gas generator, acetylene, F. E. Way 758,159
Gas machine carbid feed, J. T. & T. C. Hays 758,249
Gas producer, J. Reuleaux 758,475
Gases, apparatus for the filtration of, G. C. Stone 758,222
Gate, P. Oppenheim 758,559
Gear, friction, D. L. Lindquist 758,323
Gear, frictional reversing, A. Adamson 758,494
Gearing, electromagnetic, E. M. Bentley 758,293
Glass drawing bait, J. H. Lubbers 758,544
Glass drawing bait, R. S. Pease 758,560
Glass gathering machine, L. Miller 758,553
Grading machine, road, Powlison & Erb 758,148
Grain binder attachment, Williams & Evans 758,161
Grain binder shocking attachment, J. C. McDougall 758,093
Grain germinating apparatus, V. Lapp 758,083
Gramphone reproducer support, E. R. Johnson, reissue 12,213
Grapple, T. Alexander 758,199
Grinder, corn, M. H. Hatfield 758,068
Grinding harvester knives, etc., machine for, M. C. Nixon 758,558
Gripping device, F. H. Lamb 758,260
Hammer, power, H. W. Hathorn 758,361
Handle. See Tool handle.
Harness hook, B. H. Wilson 758,124
Harvester reel, Friend & Bolton 758,241
Hat, coat, and umbrella rack, combined, W. R. Clark 758,509
Hat pin, W. Wittigschlager 758,289
Hay loader, E. C. McConvill 758,557
Heating system, low pressure, E. H. Gold 758,436
Hinge, box couch, C. W. Gross 758,530
Horseshoe, J. Groenning 758,358
Horseshoe calks, machine for making, J. H. Vinton 758,607
Hose connection, F. H. Paradice 758,099
Hose coupling, G. Stroh 758,155
Hose drier, C. M. Bowman 758,168
Hot blast air feeding center tube, R. A. Culter 758,237
Hydrocarbon lighting apparatus, F. E. Mavrogordato 758,087
Igniter mechanism, sparking, C. C. & E. A. Riotte 758,217
Implement, combination, B. F. Schubert 758,282
Index, H. M. Rudasill 758,477
Ingot, compound metal, R. Rowley 758,387
Inkstand, C. Keller 758,257
Inkstand, G. A. Griggs 758,439
Insulating material saturating machine, G. M. Gest 758,132

ELECTRO MOTOR, SIMPLE, HOW TO make.—By G. M. Hopkins. Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

RADIUM AND RADIO-ACTIVITY

The SCIENTIFIC AMERICAN SUPPLEMENT has published the most complete information on the subject of Radium and Radio-activity that has thus far appeared.

The following articles, written by men who have played a prominent part in the discovery of the marvelous properties of radium, should be read by every student of chemistry and physics:

RADIO-ACTIVITY AND THE ELECTRON THEORY. By SIR WILLIAM CROOKES. SCIENTIFIC AMERICAN SUPPLEMENT **1402.**

THE RADIO-ACTIVITY OF MATTER. By PROFESSOR HENRI BECQUEREL. SCIENTIFIC AMERICAN SUPPLEMENT **1379.**

SOME PROPERTIES OF THE RADIO-ACTIVE SUBSTANCES. By PROFESSOR HENRI BECQUEREL. SCIENTIFIC AMERICAN SUPPLEMENT **1427.**

PRODUCTION OF HELIUM FROM RADIUM. By SIR WILLIAM RAMSAY. SCIENTIFIC AMERICAN SUPPLEMENT **1444.**

THORIUM: A RADIO-ACTIVE SUBSTANCE WITH THERAPEUTICAL POSSIBILITIES. By DR. SAMUEL G. TRACY. SCIENTIFIC AMERICAN SUPPLEMENT **1470.**

RADIUM IN MEDICINE. By DR. SAMUEL G. TRACY. SCIENTIFIC AMERICAN SUPPLEMENT **1455.**

A RÉSUMÉ OF RECENT SPECIAL STUDIES OF RADIUM AND RADIO-ACTIVITY. SCIENTIFIC AMERICAN SUPPLEMENTS **1468, 1471, 1479.**

RADIUM AND RADIO-ACTIVE SUBSTANCES. By WILLIAM J. HAMMER. SCIENTIFIC AMERICAN SUPPLEMENT **1429.**

A COMPLETE MANUAL OF RADIUM TECHNOLOGY, clearly explaining the methods of obtaining radium, conducting experiments with the substance and measuring its radio-active force will be found in SCIENTIFIC AMERICAN SUPPLEMENTS **1475, 1476, 1477.**

These SCIENTIFIC AMERICAN SUPPLEMENTS comprise what may well be considered an admirable text-book on the subject of radio-activity.

Price of Scientific American Supplements TEN CENTS BY MAIL for each number mentioned. Order through your newsdealer or from

MUNN & CO., 361 Broadway, New York

Insulation, E. E. Bechtold 758,165
Insulator, S. C. Cutter 758,175
Insulator supporting pin, line, J. D. Hilliard, Jr. 758,179
Jar closure, W. B. Fenn 758,515
Jewelry mounting, A. A. Boismaure........ 758,167
Key can, T. F. Whitmarsh 758,287
Knockdown box or crate, J. F. Reul........ 758,105
Knockdown gate, C. G. Hunter........... 758,181
Lace fastener, C. O. Johnson 758,366
Lamp filaments to leading in wires, device for securing incandescent, Miller & McDonnell 758,328
Lamp flame regulator, F. A. Cortis........ 758,299
Lamp, gas, A. E. Lovett 758,261
Lamps and burners, flexible drop light tubing for gas, W. S. Edwards 758,054
Land clearing machine, W. M. Seymour.... 758,480
Latch, H. Harden 758,441
Lathe, combination, J. B. Ehrlich 758,514
Lathe machine attachment, J. Denault.... 758,238
Lavatory or shampooing bowl, M. Housholder 758,447
Lawn edge trimmer, A. E. Fuller 758,310
Ledger, loose leaf, H. W. Ayres.......... 758,292
Legging, J. M. Braun 758,349
Light controlling system, H. Faltermayer.. 758,589
Linotype machine, W. H. Randall 758,103
Linotype machine attachment, P. Shea.... 758,284
Liquid heating or cooling apparatus, Braselmann & Lunnemann 758,045
Liquids in tanks, apparatus for circulating, G. E. Dunton 758,430, 758,513
Liquids, means for storing, R. Jardine 758,078
Lock. See Alarm lock.
Lock, J. Szucs 758,394
Lock, V. B. Kerr 758,452
Loom, bead, H. B. Mees 758,376
Looms, means for guiding the jacks in Crompton dobby, G. Schwabe 758,219
Lubricators, automatic force sight feed pump for, G. C. McCune 758,460
Magnetic brake, J. D. Ihlder 758,140
Mail box, A. M. Hoes 758,446
Mail chute, J. W. Cutler 758,128
Mail delivery case, rural, A. M. Kindwall 758,258
Mailing card, coin, O. Mussinan............ 758,091
Mailing tube closure, H. Del Mar.......... 758,129
Malt turning machine apron, D. D. Weschler. 758,227
Massage machine, J. Graves 758,205
Match box holder, E. A. Parker 758,467
Match package, J. A. E. Criswell 758,583
Match safe, S. Quee 758,215
Measure, line, S. Kline 758,320
Measuring and cutting off machine, R. Thirsk 758,223
Mechanical movement, F. A. Yokoum 758,578
Metal bars or beams and structural work, manufacture of flanged, H. Grey...... 758,529
Metal box, hermetically sealed, S. Jacoby.. 758,255
Metals by chemical process, apparatus for extracting, T. B. Joseph 758,367
Mineral separator, H. L. Orr 758,464
Mining machine engine, J. Heenan 758,533
Mirror, L. B. Prahar 758,382
Molding machine, F. W. Hall 758,313
Motor, J. Vinson 758,226
Mower attachment, lawn, W. G. Johnson.. 758,080
Muffler, exhaust, C. E. Yackel 758,402
Musical instrument, automatically operated, H. E. Sharps, reissue 12,215
Necktie holder, L. Hodecker 758,073
Needle lubricator, E. C. Reed 758,473
Negative printing attachment, gas light, G. W. Harse 758,444
Newspaper or periodical, S. B. Hutchinson.. 758,139
Nut lock, Douglas & Bartleson 758,512
Oar lock, E. F. McIntyre 758,270
Oil burner, crude, Grundell & Tucker...... 758,206
Oil burning system, Tucker & Grundell.... 758,224
Oil press mat, R. F. Werk ....758,572 to 758,575
Ophthalmoscope, C. McCormick 758,092
Ore concentrator, W. L. & F. S. Card...... 758,412
Ore concentrator, J. Shier 758,565
Ore separator, dry, E. W. & W. H. Noakes.. 758,097
Ores, treating, W. F. Hannes 758,532
Organ wind chest, pipe, T. Clausing...... 758,048
Packing box, J. J. Hinde 758,138
Packing cup, R. Burnside................. 758,410
Pad or tablet cutting machine, C. F. Taylor 758,156
Paper coating machine, M. Cashin 758,169
Paper machine, A. W. & L. W. Case...... 758,127
Paper, photographic developing, F. Gunther 758,312
Paper, producing platina copy, A. Lurz..... 758,086
Pedometer, Bartel & Kuhn................ 758,405
Pen, Fountain lettering, O. Payzant........ 758,381
Perfumes, etc, case for use with solidified, J. Bardin 758,234
Phonograph, P. Gabler 758,521
Phonographic records on mandrels, means for sliding and holding, Manahan & Waldeck 758,546
Photographic plates and prints, apparatus for developing and fixing, W. A. Peters 758,277
Piano, W. C. Hamilton 758,531
Pictures, etc., reproducing multicolor, A. von Beust 758,501
Pin. See Hat pin.
Pipe coupling, S. H. Powers 758,102
Pipe cutter, H. F. Renner 758,334
Pipe hanger, C. MacTaggart 758,458
Pipe joint, W. M. Rapp 758,278
Pipe joint, machine for uniting sheet metal, J. J. Mulvaney 758,330
Placket closer, D. A. Moon 758,459
Planter, broadcast seed, S. B., C. G. & J. C. Abbott 758,231
Planter check line button, W. Winkel...... 758,162
Plate holder and adjuster, W. H. Golding.. 758,242
Plumbing fixtures, waster control for, E. L. Angell 758,040
Pneumatic dispatch apparatus, C. F. Stoddard 758,569
Pocket or other knife, I. Kinney 758,142
Poke, animal, J. P. Montgomery........... 758,213
Powder box, tooth, M. M. Fletcher 758,309
Power transmitter, Merritt & Wall 758,550
Printer's galley, J. L. Lee 758,540
Printer's plate catch or clutch, J. L. Lee... 758,370
Printing apparatus, J. J. A. Jones......... 758,210
Printing machine envelope feeding and ejecting mechanism, C. A. Belknap 758,044
Printing, photomechanical, E. Spitzer...... 758,338
Printing, planographic, R. J. Sachers...... 758,108
Printing plate, R. J. Sachers 758,599
Printing press, W. Scott 758,112
Printing process, M. Rudometoff 758,192
Printing roller, B. J. Such................ 758,486
Printing wheel, J. J. A. Jones 758,256
Pulley, clutch, G. A. Medlin .... 758,[illegible]48
Pump, air, J. E. Fisher 758,516
Pump cylinder, J. H. Miller 758,377
Pumps, concentric valve for compressor, A. Kryszat 758,183
Punch, check, T. K. Davison 758,425
Punching bag, H. Rhodes 758,279
Rail clamp, guard, Kelly & Riordan 758,536
Rail clearer, H. C. King 758,538
Rail joint, Evans & Strange 758,055
Rail joint, G. W. Dickey 758,586
Rail joint bridge piece, W. Goldie.......... 758,526
Railway brake, J. H. Graham 758,177
Railway bridle rod, A. H. F. Cottrall 758,421
Railway cross tie, E. S. Keefer 758,368
Railway gate, automatic, J. P. Fowler..... 758,518
Railway or tramway rolling stock, mounting of, C. T. M. V. de Bange............ 758,233
Railway signal apparatus. C. W. Coleman.. 758,297
Railway signal, electric, W. S. Jackson... 758,594
Railway signal or alarm, R. F. Stuart..... 758,485
Railway switch, automatic, U. A. Woodbury 758,401, 758,490
Railway tie, Nichols & Neff 758,463
Railway tie and fastening, J. F. Smith... 758,115
Railway tie seats, apparatus for forming, W. Goldie 758,525
Railway track, W. Goldie 758,523
Railway tracks, forming, W. Goldie 758,524
Railways, ice cutter for third rail electric, S. B. Stewart, Jr. 758,153
Ram, hydraulic, J. M. Kline 758,259
Ratchet mechanism, C. E. Mitchell........ 758,329
Reeding attachment for dresser reels, Johnson & Geb 758,079
Refrigerator car, J. S. Bashaw 758,406
Rheostat, W. C. Yates 758,164
Riveting machine, M. C. Machado 758,263
Rock and ore crusher, H. M. Sackett 758,280
Rope or cable grip for haulage purposes, J. Aspinall 758,496

Rotary engine, M. E. Knight ... 758,321
Rotary motor, J. Nielsen ... 758,214
Sand blast, F. Sticker ... 758,118
Sanding system, W. Schaake ... 758,194
Sash fastener, F. B. Clapp ... 758,416
Sashes, antirattling device for window, F. Huberti ... 758,075
Saw clamp and file guide, H. W. Merwine 758,551
Sawmill head block shifter, J. T. Simpson. 758,337
Sawmill set works, W. E. Dillard ... 758,429
Scale, automatic shifting weight, C. Schenck 758,388
Screw jack, trestle, H. Edeline ... 758,431
Sealing envelopes, machine for automatically, L. C. Babcock ... 758,497
Sealing machine, envelope, Harrington & Schermack ... 758,359
Seat shaping implement, J. P. Bolding ... 758,504
Sectional case, O. O. Buice ... 758,506
Seed cleaning machine, cotton, J. Davidson 758,300
Seeding machine, force feed, H. C. Ham ... 758,134
Self clearing rake, J. Morrison, Jr. ... 758,267
Separator. See Mineral separator.
Sewing machine, button, R. L. Lyons ... 758,326
Sewing machine, overseaming and welting, F. Malsch ... 758,264
Sewing machine thread holding mechanism, J. H. & J. B. Ursbruck ... 758,121
Sewing machine work clamp, buttonhole, E. B. Allen ... 758,036
Shade and curtain fixture bracket, P. Gallagher ... 758,357
Shade bracket and curtain rod holder, combined, J. E. Verkler ... 758,158
Shade retaining device, window, H. Witte.. 758,344
Shade roller and curtain pole holder, combined, W. A. Nordling ... 758,098
Shade roller bracket and curtain pole support, combined, D. J. Cooke ... 758,419
Shaft carrier or thill tug, D. B. Shirk ... 758,566
Shaft collar, C. H. Melius ... 758,549
Shaving paper holder, W. P. Nelson ... 758,096
Sheet feeder, pneumatic, A. Lagerman ... 758,453
Sheet metal vessels, forming, Blevins & Whittaker ... 758,503
Sidewalk, E. A. Langenbach ... 758,184
Sidewalk cleaner, T. C. Hiles ... 758,071
Sign frame, C. G. Mixer ... 758,088
Sign switch mechanism, electric, F. S. Wahl ... 758,342
Signal receiving apparatus, alternating current, G. W. Pickard ... 758,468
Signaling and operating system, H. C. W. Graham ... 758,527
Signaling apparatus, block, J. A. Lehr ... 758,541
Sink bracket, J. J. Mahoney ... 758,545
Skirt supporter and shirt waist holder, C. B. Peterson ... 758,146
Solutions, preparing highly diluted, E. Joseph ... 758,450
Sorting machine, Rettich & Berger ... 758,104
Sound records, apparatus for electroplating, G. K. Cheney ... 758,352
Speed changing mechanism, C. J. Reed, 758,474, 758,561
Speed indicator, Moore & O'Neill ... 758,596
Spinning apparatus, ring, G. Paley ... 758,275
Spring back chair, J. Gilson ... 758,133
Stacker, pneumatic straw, Walsh & Bretney 758,606
Stacker, straw, J. C. Hendricks ... 758,136
Standard, A. M. Moylan ... 758,089
Steam and vapor generator, electric, T. W. Neely ... 758,094
Steam, generating, T. W. Neely ... 758,095
Steam generator, E. A. Briner ... 758,505
Steamer, tank, S. Holmes ... 758,074
Stereoscopic apparatus, H. C. Snook ... 758,117
Stitch separating and indenting machine, Thon & Wolf ... 758,601
Stock loading device, W. Dawson ... 758,426
Store service apparatus, E. R. Gill ... 758,060
Stove, gas, E. Flannigan ... 758,433
Stove or furnace, J. M. & S. R. Crowner.. 758,051
Strainer and filter, G. A. W. Schilling ... 758,150
Sugar, producing milk, W. A. Hall ... 758,065
Suspenders, G. W. Scott ... 758,151
Swing, G. P. Armstrong ... 758,579
Switch, H. Trumbull ... 758,120
Switch operating mechanism, J. H. Miller. 758,552
Talking machine, E. T. Palmer ... 758,466
Tank heater, H. D. Meyer ... 758,143
Telegraph, printing, C. L. Healy ... 758,250
Telegraph receiver, L. Cerebotani ... 758,202
Telegraph transmitter, C. Adams-Randall.. 758,232
Telegraphy, wireless, L. de Forest ... 758,517
Telephone climber's seat, J. E. Bennett ... 758,200
Telephone instrument, A. C. Christopher ... 758,415
Telephone, office desk, A. R. Fergusson ... 758,304
Telephone receiver, M. R. Hutchison ... 758,363
Telephone switchboards, supervisory signal apparatus for, E. H. Smythe ... 758,116
Testing machine, W. R. Cock ... 758,418
Thill coupling, C. A. Sager ... 758,193
Thill support, C. D. White ... 758,160
Thread dressing machine, G. A. Fredenburgh ... 758,520
Threshing machine, W. Colwell ... 758,603
Tin by electrolysis, obtaining, E. Quintaine, reissue ... 12,214
Tire, A. Hendey ... 758,209
Tire cover, pneumatic, Shilton & Schultze 758,336
Tire inflator, F. H. Geisler ... 758,058
Tires to fellies, mechanism for securing rubber, Place & Keys ... 758,605
Toaster, bread, R. M. Reams ... 758,472
Tool, compound, A. O. Highsmith ... 758,070
Tool handle, pneumatic, C. H. Peck ... 758,100
Top, spinning, F. Ansley ... 758,291
Towel rack, S. A. A. Stenberg ... 758,600
Toy, J. Chein ... 758,047
Toy, A. M. Siebelist ... 758,567
Toy elevated railway track, H. C. Ives ... 758,448
Toy gun, J. B. Mason ... 758,374
Trace end supporter, D. M. Allen ... 758,495
Track claw, A. P. Nichols ... 758,462
Track gage, A. P. Nichols ... 758,461
Track sanding device, W. H. Kilbourn ... 758,141
Train control system, H. E. White ... 758,230
Trap. See Animal trap.
Traveling case, W. D. Chase ... 758,170
Trestle, adjustable, W. A. Drummond ... 758,130
Tricycle propelling gear, O. Heynsohn ... 758,251
Trolley head, Hean & Egan ... 758,445
Trolley, safety, Gruner & Fink ... 758,592
Trolley wheel, Fletcher & Waters ... 758,355
Truck bolster center bearing, C. T. Westlake ... 758,228
Truck frame, railway car, C. T. Westlake.. 758,229
Truck dowel pin and lift O. Rangnow ... 758,383
Truss, adjustable, M. O. Hallowell ... 758,440
Tubes, mechanism for flanging the ends of, A. F. Nordenskjold ... 758,145
Turbine governing mechanism, J. Wilkinson ... 758,400
Turbine, reversible, C. F. de Kierzkowski-Steuart ... 758,595
Turn button, locking, G. W. Coulson ... 758,353
Twist drills, forming, R. L. Barclay ... 758,041
Type bar construction, F. X. Wagner ... 758,197
Type writer, E. Runge ... 758,563
Type writer, C. Wasmuth ... 758,571
Type writer adding attachment, J. W. Magness ... 758,371
Type writing machine, F. W. Hillard ... 758,252
Type writing machine ribbon feed mechanism, E. G. Latta ... 758,455
Undergarment, G. A. Mattern ... 758,375
Unloading device, F. G. Pace ... 758,274
Vaccine point, H. K. Mulford ... 758,597
Valve, J. A. Desmarteau ... 758,053
Valve, air brake controlling, F. B. Corey.. 758,174
Valve for air brake control, equilibrio intercepting, E. G. Shortt ... 758,285
Valve gear engine, O. Jackson ... 758,317, 758,365
Valve, steam engine cutoff, F. J. Waters.. 758,122
Vault cover, illuminating, J. T. Harrop ... 758,443
Vault or safe, Hibbard & Gaston ... 758,069
Vegetable washer, J. F. Fugazzi ... 758,056
Vehicle, motor, B. C. Hicks ... 758,137
Vehicle top storm curtain, D. C. Lawless... 758,185
Vending machine, T. M. Day ... 758,301
Vending machine, automatic, R. Schlemm .. 758,110
Vending machine, cigar, Erickson & Fagan. 758,588
Vending machine, coin controlled, M. Hofheimer ... 758,180
Vending machine, coin controlled, O. Kreter 758,539
Vending machine, coin controlled, W. T. Drew ... 758,587
Vending machine coin controlled mechanism, cigar, C. M. Dodson ... 758,204
Vessel handle, T. W. Forster ... 758,590
Vessel rig, sailing, B. W. Collins ... 758,171
Wagon brake, V. Fingoust ... 758,308
Washer. See Vegetable washer.
Washer stapling machine, Maier & Howe.. 758,212

Washing machine, clothes, Loux & Butterfield 758,085
Waste paper box, street, G. C. J. Engelland 758,354
Water heater, S. Bernstein 758,347
Water softening apparatus, H. Breda 758,295
Water tank, J. Miller 758,188
Water wheel, horizontal, E. Ortwein 758,465
Wheel rim, J. F. W. Rethmeyer 758,190
Wheel wrench, J. H. Chappell 758,508
Windmill, W. P. Brett 758,296
Window attachment, L. K. Bohm 758,348
Wood cutting machine, A. A. Bartlett 758,042
Wrench, C. G. Molin 758,266
Wrench, C. F. Beach 758,499
Wrench, W. E. Snediker 758,568
Wrench, J. S. Barclay 758,580

DESIGNS.

Badge, F. C. Fane 36,886
Badge, N. M. Kirshner 36,887
Badge or similar article, A. Schickerling 36,888
Range or stove, cooking, C. M. Liphart 36,894
Spoons, forks, or similar articles, handle for, W. C. Codman 36,889
Spoons, forks, or similar articles, handle for, G. P. Ittig 36,890, 36,891
Spoons, forks, or similar articles, handle for, J. Rothlisberger 36,892, 36,893
Stock, F. Sollee 36,896
Trimming for ladies' underwear, Kerwin & McGinley 36,895

TRADE MARKS.

Antiseptic and disinfecting preparations, Jeyes' Sanitary Compounds Co. 42,485
Boots and shoes, leather, Middlesex Shoe Co. 42,468
Boots and shoes, leather, Moore-Shafer Shoe Manufacturing Co. 42,469
Chemical, certain named, Chemisch-Technisches und Hygienisches Institut, Dr. Popp & Dr. Becker 42,486
Chemical substances, certain named, Knoll & Co. 42,487
Cigars, E. A. Kline & Co. 42,488, 42,489
Coffee, Direct Coffee Co. 42,492
Confectionery, Belle Mead Sweetsmakers 42,490
Confectionery, D. Arnould 42,491
Cooking utensils made of aluminium and aluminium alloys, Aluminium Cooking Utensil Co. 42,501
Costumes, theatrical, L. D. Gardner 42,465
Cream, toilet, E. M. Kane 42,478
Dress waists and suits, ladies', Frank Winch Co. 42,466
Flour, wheat, Rives Milling Co. 42,493
Food for stock and poultry, prepared and mixed, G. M. Thomas 42,494
Knitted overshirts and sweaters, M. S. Ely 42,467
Leather polishes, Whittemore Bros. & Co. 42,495
Logging tools, certain named, Champion Tool & Handle Works 42,517
Lubricating compounds, certain named, O. F. Zurn Company 42,496, 42,497
Medicine for the cure of certain named diseases, Sneezo Company 42,482
Medicines, certain named, Greenville Medicine Company 42,481
Oils and greases, lubricating, O. F. Zurn Company 42,498, 42,499
Paper, toilet, Scott Paper Co. 42,479, 42,480
Pipes, brier, E. Deguingand & Son 42,476
Razors, Kraut & Dohnal 42,500
Remedies, dyspepsia, Underwood & Judd 42,483
Remedy for pneumonia, Gowan Medical Co. 42,484
Rubber belting, Gorham Rubber Co. 42,471
Rubber boots, shoes, and sandals, Bentley & Olmsted Co. 42,470
Rubber packing, Gorham Rubber Co. ..... 42,472 to 42,474
Sewing machines and attachments, Davis Sewing Machine Co. ..... 42,503 to 42,514
Sewing machines, attachments, and parts thereof, Singer Manufacturing Co. 42,515
Shaft hangers, Standard Pressed Steel Co. 42,516
Soap, laundry, Lenox Sprayer and Chemical Co. 42,477
Stamps, premium, Sperry & Hutchinson Co. 42,475
Talking machines, parts and supplies therefor, and records, Universal Talking Machine Manufacturing Co. 42,502
Trimmings and hardware for carriage tops, Crandal Stone & Co. 42,518

LABELS.

"Chickasaw Plantation," for molasses, C. E. Coe 10,994
"Commercial Seal," for cigars, A. C. Henschel & Co. 10,999
"Dr. White's Specialty for Diphtheria," for medicine, W. White 11,000
"Gold Coin Cattle Fattener," for fattening foods for cattle, Gold Coin Stock Food Co. 11,009
"Gold Coin Egg-a-Day Poultry Food," for poultry food, Gold Coin Stock Food Co. 11,005
"Gold Coin Foot Remedy," for live stock medicine, Gold Coin Stock Food Co. 11,001
"Gold Coin Germ Killer," for live stock medicine, Gold Coin Stock Food Co. 11,002
"Gold Coin Hog Fattener," for hog fattening foods, Gold Coin Stock Food Co. 11,008
"Gold Coin Quick Cure Condition Powder," for condition powders for live stock, Gold Coin Stock Food Co. 11,007
"Gold Coin Scientific Heave Cure," for live stock medicine, Gold Coin Stock Food Co. 11,003
"Gold Coin Special Horse Tonic," for horse tonic, Gold Coin Stock Food Co. 11,006
"Gold Coin Worm Powder," for live stock medicine, Gold Coin Stock Food Co. 11,004
"Grape Nut Bread," for bread, Kopp & Mordan 10,991
"Harmony Brand," for canned salmon, R. D. Hume 10,992
"Louisiana Purchase Souvenir Puzzle," for puzzles, L. F. Jordan 11,010
"Maltinatte," for beverages, A. L. Saake 10,997
"Paraiso Mineral Water," for mineral water, E. E. Scamell 10,995
"Pineapple Soda," for carbonated beverages, American Soda Fountain Co. 10,996
"Regina," for music boxes, Regina Music Box Co. 11,011
"Sugar Glen," for molasses, C. E. Coe 10,993
"Swansdown Prepared Table Salt," for table salt, S. S. Pierce Co. 10,990
"Wedderburn Rye," for rye whisky, J. Wedderburn 10,998

PRINTS.

"Don't Suffer and Cuss Buy Your Shoes From Us," for shoes, O. McCormick 981
"Extra Pale," for bottled beer, Wm. J. Lemp Brewing Co. 985
"Faultless Day Shirts," for day shirts, E. Rosenfeld & Co. 978
"Faultless Night Shirts," for night shirts, E. Rosenfeld & Co. 979
"Faultless Pajamas," for pajamas, E. Rosenfeld & Co. 980
"New Styles Always on Hand," for shoes, O. McCormick 982
"Ontostay," for hat pins, J. Uhry 977
"Our Customers Smile," for shoes, O. McCormick 983
"Poole Pianos," for pianos, W. H. Poole 986
"The Beer to Which the South Points With Pride," for beer, Chattanooga Brewing Co. 984

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.