SCIENTIFIC AMERICAN

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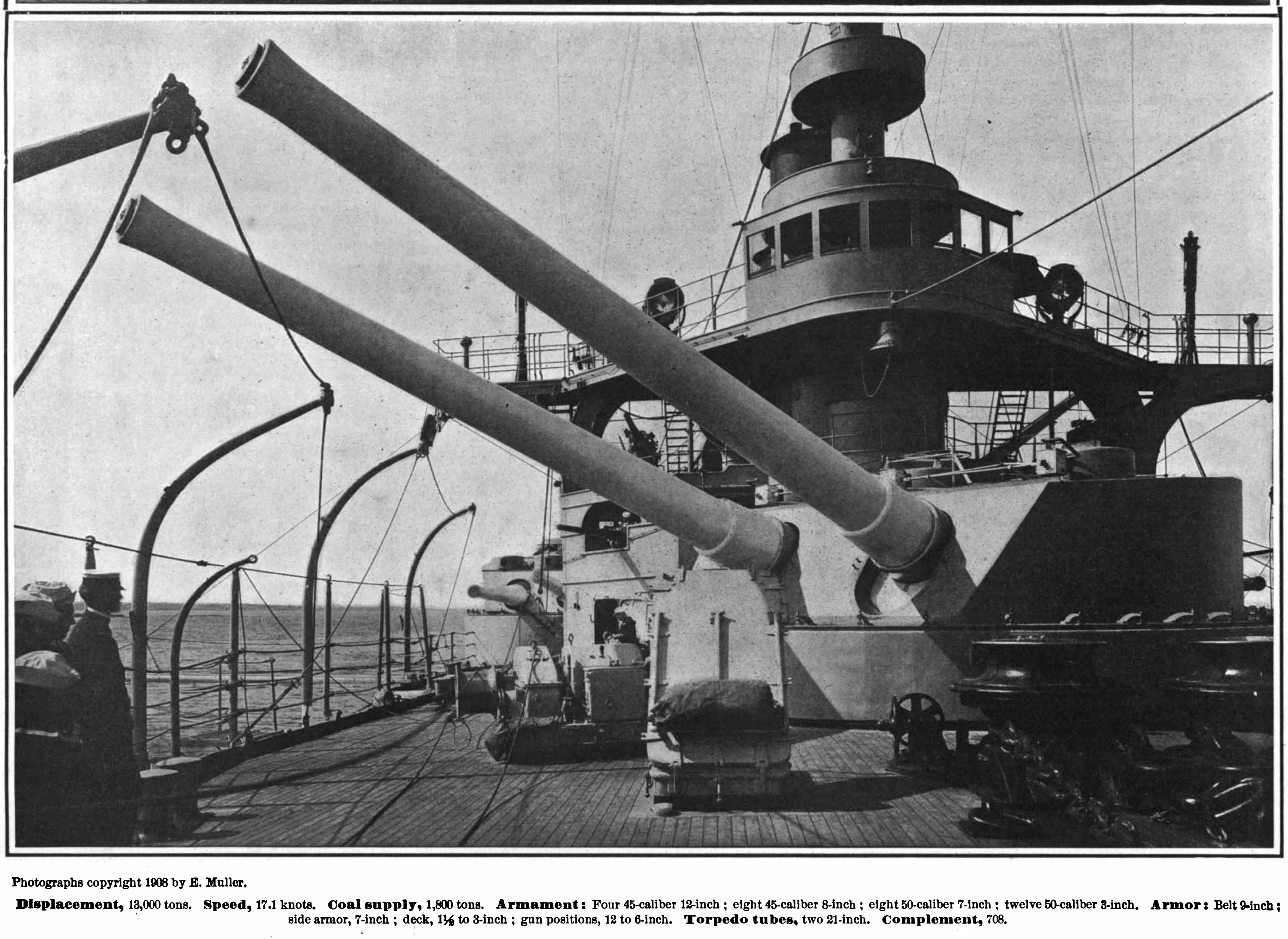

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Displacement, 13,000 tons. **Speed,** 17.1 knots. **Coal supply,** 1,800 tons. **Armament:** Four 45-caliber 12-inch; eight 45-caliber 8-inch; eight 50-caliber 7-inch; twelve 50-caliber 3-inch. **Armor:** Belt 9-inch; side armor, 7-inch; deck, 1½ to 3-inch; gun positions, 12 to 6-inch. **Torpedo tubes,** two 21-inch. **Complement,** 708.

In the upper illustration the ship is shown stripped for battle. The mainmast, to be of the latticework type, is not yet in place.

THE NEW UNITED STATES BATTLESHIP "MISSISSIPPI." SISTER SHIP TO THE "IDAHO."—[See page 406.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MAY 29th, 1909.

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

TO KEEP THE PEACE.

There is a growing sentiment throughout the world in favor of arbitration with its concomitant disarmament. The enthusiastic promoters of the peace movement call for the immediate institution of an international tribunal and the immediate reduction, if not entire abolition, of armaments and military forces. These good people, however, lose sight of the fact that an international tribunal, if its findings are to be of any value, must have behind it some strong physical force wherewith to back up its decisions; put down with a strong hand any opposition thereto, and permanently preserve the world's peace. The mere reduction of naval and military forces until each nation maintains only what is judged to be sufficient for the support of its own government in the administration of its internal affairs, would not meet the case; for the several armies would be relatively as strong as they are in their present overgrown condition. Moreover, should any nation disagree with a decision of the international tribunal, it would be in a position to repudiate the findings of the court; and it is conceivable, nay, even probable, that the parties in dispute would resort to the final arbitrament of war. The possession of their several armies, even in a depleted condition, would breed distrust, and would constitute a standing menace to the peace of the world.

The institution of an international court of arbitration carries with it, then, as an inseparable corollary, the abolition of independent national armies and navies, and the substitution therefor of an international army, subject to the international court of arbitration, and maintained solely for the purpose of enforcing its decrees. It is undeniable that in the recent discussion of disarmament and arbitration, recognition of the necessity for the maintenance of an international force of some such character as this has become increasingly evident. In a discussion of the problem by Arthur H. Dutton, late of the United State navy, in a contemporary journal, the writer outlines the character of the force which would be necessary for this purpose. He proposes that an international army be formed; a "compact, thoroughly trained, well-equipped and mobile force, to the personnel of which each civilized nation would contribute its quota in proportion to the population." It would be the international police force, and would stand in the same relation to the nations of the world that the United States army does to the States of the American Union. Among the civilized nations to-day there are taken from industrial pursuits, during peace times, no less than 4,250,000 able-bodied men, whose maintenance costs nearly $2,000,000,000 annually. These many millions would be returned to peaceful occupations, and their place would be taken by an international army of arbitration of 500,000 men, costing annually about $150,000,000. To co-operate with this army there would be an international navy, in which there would be no battleships, consisting only of cruisers, gunboats, and transports for the moving of the troops. The international army would be concentrated in three divisions of 100,000 each, one in Europe, one in North America, and one in the Orient, with the remaining 200,000 scattered in smaller detachments. The decree of concentration of the three great armies would be a matter for decision of the strategists. All the permanent fortifications would be abandoned, and the nations, having disbanded their national armies, would depend upon their civil police for the execution of their own local laws. Each nation would agree to maintain no individual military force whatever; and the intelligence bureau of the international army would see that this obligation was fully lived up to. Military training would be restricted to international schools, the manufacture of arms and munitions of war to international factories.

Although the time may not be fully ripe for the sweeping change advocated by Lieut. Dutton, it cannot be denied that the alarming growth of the cost of our present methods of maintaining the world's peace, is driving the nations into an *impasse*, the readiest escape from which would seem to be by the broad and honorable road of disarmament and armed arbitration.

STATION ANNOUNCERS ON TRAINS.

One of the greatly needed improvements for rapid-transit service is some form of automatic station announcer placed in a conspicuous position on the car. The present method, under which the name of the next station is called out by the guard, is little better than a farce. On some lines, and this is particularly true of the surface trolley roads, the name is frequently never announced at all; and on other roads the din and confusion of traffic is so great, that the station name is inaudible to the greater part of the passengers on the car. Add to this the fact that many of the conductors and guards drawl out the names with a pronunciation, or rather a mispronunciation, which renders them completely unintelligible, and it will be understood that, while the present system is confusing to the regular patrons of the line, it is "confusion worse confounded" to the "stranger within our gates." Since the vocal announcement of stations is a failure, the question arises whether some other more satisfactory system cannot be devised.

The simplest solution of the problem would be to place in some conspicuous position on the car a visual announcer, on which, immediately upon the car leaving a station or street crossing, the name of the next following station or crossing would appear in clear and easily readable letters or numbers, the change of sign being made by the conductor or guard, or, preferably, by means of some automatic trip or other form of contact arranged between the car and the several stations or stopping places. That the idea is mechanically practicable is proved by the many very creditable devices of this kind which have been invented, a large number of which are recorded in the files of the Patent Office. The advantages of station announcers are so many and obvious, that these devices began to make their appearance early in the development of the trolley car. At first they were operated merely by mechanical means; but later, with the advent of electrical traction, the many advantages of electricity for the purpose led to the invention of electrically-operated signs.

In view of the conspicuous usefulness of this system, it is a matter of surprise that it was not universally adopted long ago; and there is little question that its failure to come into general use has been due not a little to the reluctance of the transportation companies to go to the expense and trouble incidental to the operation and maintenance of the necessary apparatus. A notable instance of this occurred only a few years ago, at the time of the opening of one of the most important subways in this country. The management instructed its engineers to work out an automatic, electrically-controlled announcer, which was to consist of an oblong case, depending from the roof at the center of the car, which would display on each side of it the name of the next station at which the train stopped. The scheme would have been an immense convenience to the traveling public; but at the eleventh hour objections were raised on the ground that it would interfere with the advertising signs in the car, obscuring them or detracting public attention from them, and the system was never installed. That the objection was altogether absurd and puerile is shown by the fact that a device of this general character has recently been installed in a car of the Hudson and Manhattan tunnel, which, according to the latest reports, is working greatly to the satisfaction of the public. The new indicator consists of an oblong glass box, attached at the center of the car. A lettered sign bears the words "Next Station." Below this is a blank space, in which the name of the station following appears in brilliant letters. Undoubtedly the Public Service Commission will observe the operation of this device with close attention. Should it prove to be thoroughly practical, as we have no doubt it will, the Commission would add one more to its many valuable services rendered to the public, by ordering the equipment of all rapid-transit cars with devices of the same general character.

COMPARISON OF STEAM AND PRODUCER-GAS MARINE PLANTS.

One of the most instructive comparisons, showin the relative advantages for marine purposes of a steam plant and a producer-gas plant, that has yet been made, is contained in a paper presented at the last meeting of the American Society of Mechanical Engineers by Mr. C. L. Straub. For the purpose of comparison, the writer takes a modern lake freighter, built last year, and shows what would be the weight of and how much space would be occupied by an installation of producers and gas engines capable of driving this ship at the same speed of 12 knots. The freighter is 306 feet in length, 45 feet beam, and 24 feet deep, and is driven by a single-screw, triple-expansion engine, which indicates 1,050 horse-power. Steam is supplied by two single-ended Scotch boilers of a working pressure of 180 pounds to the square inch.

In the gas-driven ship the place of the steam engine is taken by a 4-cylinder, 4-cycle, double-acting gas engine. The length, fore and aft, between bulkheads necessary to contain this engine is 19 feet 6 inches, and the engine room weights are 105,000 pounds. The length between bulkheads in the steam engine room is 22 feet, and the engine-room weights are 182,000 pounds. The boiler-room weights, with the water in boilers and no fuel, of the steam plant are 170,000 pounds. The weight of the two down-draft gas-producers with no water and no fuel is 82,000 pounds. The length of the boiler room, including bunkers, which is 30 feet in case of the steam plant, is cut down to 15 feet for the producer-gas plant. For supplying the boilers of the steam plant, bunkers of 340,000 pounds capacity are necessary; the bunker capacity for the producer-gas plant is 160,000 pounds. The total weight of machinery and fuel in the steam plant is 692,000 pounds, and the total length of the machinery space 52 feet; the total weight of machinery and fuel for the producer-gas plant is 347,000 pounds, and the total length of the machinery space 34 feet 6 inches. The value of this comparison is enhanced by the fact that it is made by Babcock & Penton, the firm which built the steam-driven ship; and as they guarantee one horse-power for one pound of good bituminous coal, the estimate of the engineers who have been working on this problem would seem to be not unreasonable, that the saving in fuel due to the fuel economy, and the increased cargo carried due to the saving in space and weight, would pay for the cost of the complete plant in two years of operation. If only a sister ship to the steam freighter could be built and operated in the same service, an ideal opportunity would be offered for obtaining valuable data as to the all-round efficiency of the present, and what we believe to be the coming, motive power of the freight steamship.

DEFENSE AGAINST DIRIGIBLES.

The Krupp guns for defense against dirigibles, a detailed description of which appears in the current SUPPLEMENT, have attracted much attention, as might have been expected, from military experts of other countries.

The Revue Militaire Suisse and other periodicals present some pertinent criticisms, coinciding with the view uniformly held by the SCIENTIFIC AMERICAN, that the only adequate means of defense against dirigibles lies in other dirigibles.

The chief value of balloon guns rests on the fact of the well-defined limitations of the field of use of the balloon, namely, for scouting purposes. Thus dirigibles will be mainly employed in determining the regions of concentration of troops and their lines of march, the position of lines of railway and of navigable rivers, the fortification of frontiers and ports, and the movements of fleets. Hence, the problem of placing ordnance for defense is greatly simplified.

As for the automobile gun, most experts agree that its only value would be for scouting and for rapid movement to any desired point of defense. Even on first-class and open roads it would have great difficulty in following the course of a dirigible; whereas rapid and unfettered movement across a country when the roads were not only indifferent, but blocked by the movements of cavalry, of infantry, of provision trains, as well as by the disordered flight of terrified inhabitants, would be unthinkable.

The only formidable foe of a dirigible, then, is a better dirigible. And in direct combat between two airships, the two factors of speed and lightness would doubtless determine the victor—speed, because it would enable its possessor to determine the moment of attack, and lightness, or "lift," because an absolute advantage must rest with the crew which can open the attack from above. Such attack would consist in the dropping of fire balls, the piercing of the lower craft by volleys of scattering shot, the lowering of scythes with toothed blades to tear the envelope of the enemy's balloon, etc.

In this connection a French critic notes the singular psychological phenomenon that troops are quickly demoralized by the sight of a novel and unexpected method of attack, or evidence of being observed by spies. Unless they feel that they can meet such attack with similar weapons, they lose confidence in their officers and become panic-stricken.

ENGINEERING.

It is gratifying to learn that the application of block signaling on the railroads of the United States is increasing; although we could wish that the rate of progress were more rapid. The last report of the Interstate Commerce Commission shows that the total length of road operated under the block system at the beginning of the year was 59,548 miles, a net increase over the previous year of 879. The comparatively small increase is attributed to the financial depression.

The special commission appointed by the Canadian government to prepare plans for a new Quebec bridge is having made an extensive series of tests of the strength of riveted joints in nickel-steel plate. The tests, which are to be made at the Engineering Experiment Station of the University of Illinois, require the testing to failure of about one hundred joints, in which any movement of the joints will be measured to one-ten-thousandth of an inch.

That the speed of battleship construction is liable to be delayed by the failure of the government to deliver material as fast as it is called for, is shown by the case of the "North Dakota." On May 1st, when the ship was 81.5 per cent completed, the builders were still lacking armor for three turrets, and eighteen plates of the upper casemate armor which had been rejected by the government and which will have to be remade. It had been hoped to complete the trials of this battleship during the present year.

The trees which are used in the government work of reforestation are grown at eight government nurseries in the Western Forest Reserves. The preliminary stage of forest planting has been passed, and the eight stations now contain some 9,000,000 trees from one to three years old. Several planting stations have produced, already, trees of sufficient growth for planting on the permanent sites, and about 700,000 of these were planted during the winter and spring of 1907.

The advisability of making the overhead trolley line of specially strong construction, on such stretches of electrified road as are used jointly by steam locomotive and electric trains, was illustrated last week on the Long Island Railroad at Far Rockaway, when a wire from the overhead trolley broke from its fastening and struck the engine. The shock threw the engineer from his seat, and the broken wires, coming in contact with the gas piping, ignited the gas tanks beneath the cars and started a conflagration.

According to a dispatch from Berlin, the Krupp firm has contributed $2,500 per year to enable Prof. Weichert of Goettingen to prosecute his experiments with an aerial or "flying" torpedo, for which extraordinary speeds are claimed. The object of Prof. Weichert's present investigation is to work out a system of wireless control. Although such details as have been made public are so confusing as to scarcely warrant repetition, there can be little doubt that experimental work of this character is being seriously undertaken.

The Public Service Commission is to be credited with inaugurating a most valuable improvement in rapid-transit travel in New York city, by securing the introduction of the center-door type of car on the New York Subway. This is the type of car preferred by the operating company, which has built an experimental train that has given good results. To prevent passengers on the train from blocking these new doorways, the entrance space is bisected by a railing, which extends from the door sill nearly to the middle of the aisle. With the space thus divided, an obstructing passenger would be swept into or out of the car by the rush of traffic.

The United States Reclamation Service announces the completion on May 1st, 1909, of the Pathfinder dam, which has been built on the North Platte River, Wyoming. It consists of a vertical, concrete-rubble arch, 215 feet in height, which closes the river where it flows through a narrow gorge. The length of the dam on its crest is only 500 feet, yet the storage capacity is 1,025,000 acre-feet or 358,000,000,000 gallons. Its great capacity is shown by a comparison with the largest reservoirs in the East, of which the Wachusett dam has a capacity of 192,000 acre-feet, the new Croton dam of 92,000 acre-feet, and the Ashokan dam now under construction of 368,000 acre-feet.

That the British government places great value on the maintenance of friendly relations with the private ship-building establishments is shown by the following statement of the First Lord of the Admiralty at the recent launch of one of the "Dreadnoughts," when he said: "I am glad to have the opportunity of saying how much we prize the good feeling that exists between the Admiralty and the great firms which supply us. Unless we could rely on these firms, and know that in any emergency they would be ready to put everything within their resources at our disposal, we never could answer to Parliament and the country for the necessary supplies to maintain the supremacy of the fleet. I regard the existence of the firm which built this ship as a great national asset."

AERONAUTICS.

The first meet and flight exhibition of the Aeronautic Society at Morris Park has been postponed to Saturday, June 5th. An additional prize of $150 has been offered for the machine having the best points of design and construction.

Announcement has just been made of the formation at Berlin of the Wright Flying Machine Company, Ltd. This company has a capital of $125,000 and is backed by the Krupps, the Allgemeine Elektricitaets Gesellschaft and the Ludwig Loewe Company. It is to purchase the exclusive rights for the Wright aeroplane for the German empire, its colonies and protectorates, as well as for Sweden, Norway, Denmark, and Turkey. The arrangement will extend over a period of fifteen years, the company to be entitled to all improvements made by the Wrights during this time. The brothers have also made arrangements with the Italian government, while in England they are building a half dozen machines for private sale. No less than forty Wright aeroplanes are said to be under construction in France at the present time.

The first national balloon race of the Aero Club of America will start from Indianapolis in the afternoon of June 5th. Six balloons are entered in this event, most of them being new ones constructed for this race. Mr. A. H. Forbes, the acting president of the A. C. A., and Mr. Charles Walsh will be the only representatives of an Eastern club. Particular interest attaches to Mr. Forbes's new balloon "New York," constructed by Capt. Baldwin, since the envelope has no less than 20 films of rubber laid upon and vulcanized to two layers of cotton fabric, whereas eight films of rubber is the greatest number that has heretofore been used. Mr. Walsh will go up in the balloon "Hoosier."

President Taft is eager to witness an aeroplane flight by Orville or Wilbur Wright, and if possible arrangements will be made for one or the other of the brothers to make an exhibition flight at Washington on June 10th, when the President will present them with the medals of the Aero Club of America at the White House. A special train will convey the members of the Aero Club to Washington, and it is expected that fully 100 will make the trip especially to witness the presentation. On May 20th M. Paul Tissandier, one of Wilbur Wright's French pupils, made at Pau a flight lasting one hour and ten minutes.

On the 18th instant Wilbur R. Kimball, the secretary of the Aeronautic Society, tried his new aeroplane at Morris Park. This machine has eight 4-foot propellers arranged in line between the two planes. The propellers are driven from a 50-horse-power 4-cylinder, 2-cycle motor by means of a small wire cable. The test was successful as far as the propellers were concerned, as they operated satisfactorily and developed sufficient thrust to send the machine along at good speed. Unfortunately it could not be steered when on the ground, and it ran off the track and damaged the horizontal rudder.

Prof. Henry H. Clayton, who for sixteen years has occupied the position of meteorologist at the Blue Hill Observatory, expects to cross the Atlantic in the near future in a balloon. He believes there are upper air currents flowing constantly eastward, which would make it possible to do this in three or four days. He expects to use a very large balloon, of about 230,000 cubic feet capacity. He is at present in San Francisco, from which point he intends to make a preliminary test flight across the continent. Prof. Clayton's project is similar to that proposed lately by Joseph Bruckner, who expects to perform the same feat in an airship by making use of trade winds which blow to the eastward during a certain part of the year.

A. Gaston Dauville, asserts that aviators make a mistake by practising soaring flight in a horizontal plane. This method makes use of air resistance to overcome weight and in this way excludes all development of progress. He adds that the proper course would be an undulating flight, which would first use air resistance to overcome weight and then use weight to overcome air resistance. In support of this view he cites the experiments of Capazza and Lilienthal. According to this view, in undulating flight gravity would furnish a motor destitute of weight, using no fuel, and of unlimited power, the only motor able to produce speed comparable to that of birds and to overcome the action of the strongest winds. M. Dauville criticises aeroplanes hitherto constructed in that their construction is too light to resist sudden gusts.

Chinese ink is made by carbonizing a mixture of colza or sesame oil, varnish, and lard, and mixing the product with gum water and a little camphor and musk. The paste thus obtained is beaten with steel hammers on a block of wood. A metallic luster is given to the ink by adding from 25 to 140 leaves of gold to each pound. The ink is then pressed and dried in wooden molds.

SCIENCE.

For several years past the sheepmen of the Southwest have suffered serious losses from a disease known among the Mexican herders as "pingué." "Pingué" is popularly supposed to be caused by eating either the leaves or roots of a plant which has in the last few years been quite prominent in the public eye as the rubber plant or rubber weed. Hot water and salt is an efficacious remedy.

The value of X-rays in superficial carcinomata is well established. But their value in deep-seated malignant diseases is doubtful. Dr. G. F. Phaler has published an important paper based on the treatment of 35 sarcomata and 304 deep-seated carcinomata. The results are encouraging, considering the hopeless character of the cases. In over fifty per cent of carcinomata he obtained recoveries.

A tribe of Brazilian Indians, living on the island of Pacoval at the mouth of the Amazon River, clothe themselves in nothing more nor less than a piece of pottery. The "tanga," as this piece of earthenware clothing or more properly apron is called in Portuguese, is simply a curved piece of earthenware triangular in contour, the convex surface of which is elaborately ornamented. It is surmised that the first tangas were simply pieces of broken earthenware.

A large plot of ground in New York city has been given by Mrs. C. P. Huntington to the American Geographical Society, on the condition that the society raises money for the erection of a building on the site. The society has accepted the condition. It may be of interest to note that the society is the oldest in the United States, having been founded in 1852, when there were but twelve similar associations in the world.

The carbon dioxide recorder is a welcome addition to the modern boiler house equipment. It is the function of the recorder to take samples of the flue gases at intervals of two to four minutes, to analyze them for the percentage of carbon dioxide which they contain, and to record the results on a clock-driven chart. The record shows whether proper conditions for maintaining complete combustion have been preserved, and enable the fireman to stoke properly.

The very special subject of heredity of hair color has been exhaustively considered by Gertrude and Charles Davenport. From their investigations it follows that there are probably two main types of pigment in human hair—one a reddish yellow and the other a sepia-brown—and that "two parents with clear blue eyes and yellow or flaxen straight hair can have children only of the same type, no matter what the grandparental characteristics were; that dark-eyed and dark-haired, curly-haired parents may have children like themselves, but also of the less developed condition."

What is known as the Greenland Society, of Copenhagen, has been formed for the purpose of developing the natural resources of Greenland. The annual report states that interesting results have been obtained from the explorations made for a large Danish syndicate during the years 1903-1907 in Greenland, by Norwegian and German engineers. Up to the present about the only products known were cryolite, which deposits are now extensively worked, and coal deposits. The recent explorations show that there is to be found graphite of a very good quality, besides asbestos, mica, and copper. It appears that copper is abundant in Greenland. At present it is already taken out at the Alangossak mines.

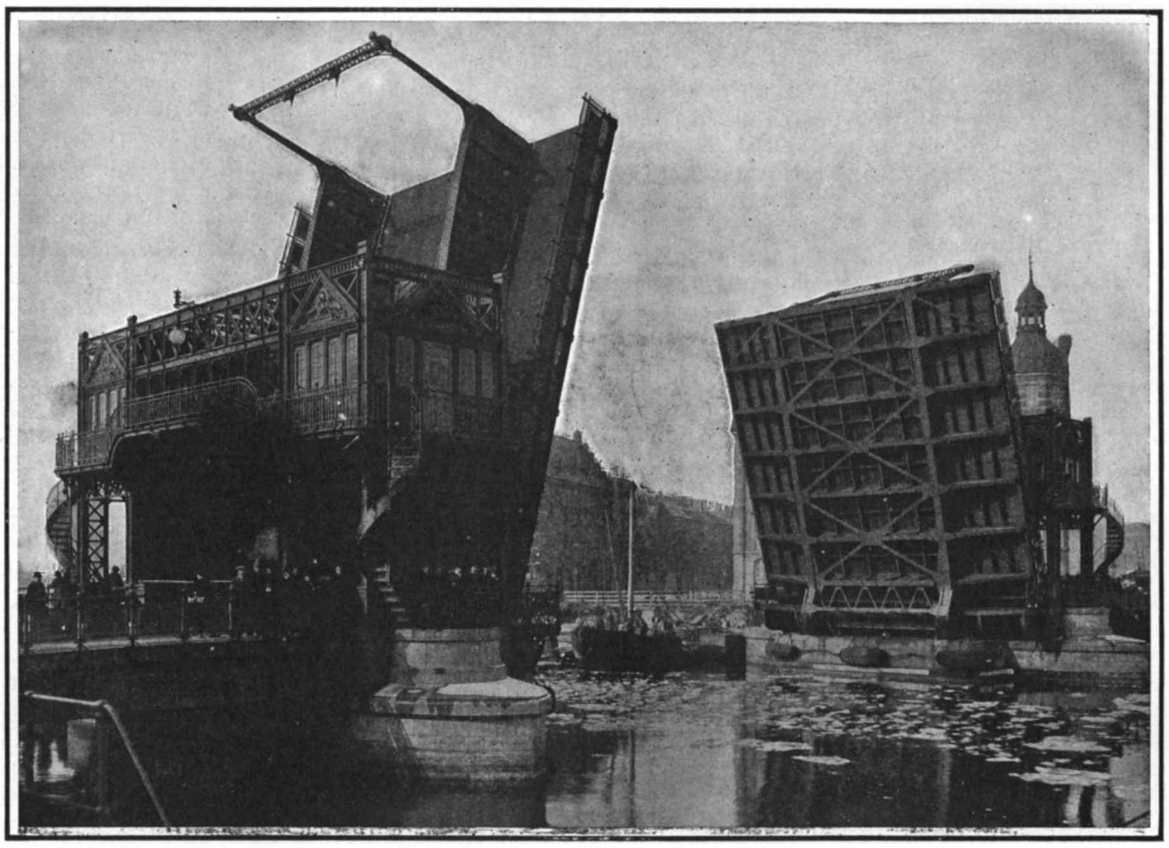
In Brussels an investigation has been made of the effect of ventilating fans in restaurants and other public places. Some of the ventilators simply agitated the air, while others were connected with openings in the wall. The experiments were made by determining the number of bacteria in a cubic meter of air before the ventilator had been started and after it had been running an hour or two hours. The results may be summarized as follows: In a number of cafés and restaurants the number of bacteria in a cubic meter of air, in the morning before the ventilators were started, ranged from 10,000 to 22,000. After an hour's running the number ranged from 17,000 to 48,000; after two hours' running the number ranged from 27,500 to 85,000. Another experiment was made in a laboratory where remedies for tuberculosis were prepared. Here the number of bacteria rose from 8,500 before the ventilator was started to 45,000 after one hour's running and to 75,000 after two hours' running. Another experiment was made in a private parlor. The number of bacteria per cubic meter, 650 before the starting of the ventilator, rose to 2,500 in one hour and to 4,000 in two hours. The ventilator was then stopped. Two hours later the number of bacteria per cubic meter had fallen to 700. These figures are so eloquent, that no further discussion is needed to show that the ventilators used in all these cases did far more harm than good, by creating a lively current of air which stirred up and carried with it dust containing bacteria.

THE NEW KNIPPELS BRIDGE AT COPENHAGEN.

BY OUR ENGLISH CORRESPONDENT.

Improved facilities for communication between Copenhagen and its suburb of Christianshavn on the island of Armager, which is divided from the city by the harbor channel, have recently been provided by the construction of a handsome new bridge of the bascule type. The present structure offers an interesting and convincing example of the possibility of carrying out a bascule bridge upon ornamental lines. In the preparation of the designs, due regard was given to the picturesque character of the neighboring buildings, with which the new bridge is in pleasing harmony. The bridge was constructed under the supervision of Mr. H. C. V. Moller, the chief engineer to the Harbor Board of Copenhagen, to whose courtesy we are indebted for the accompanying illustrations and particulars contained in this article. It was completed and opened for traffic at the end of 1908.

It is thrown across the waterway at a point directly north of the structure it superseded, and the banks of the channel had to be regulated and the bridge set at the correct angle to the current, so as to insure navigation on the river being completely satisfactory.



Width of opening, 92 feet 6 inches. Width of bridge roadway, 22 feet 7 inches. Width of each sidewalk, 10 feet 3 inches.

The new bascule bridge at Copenhagen.

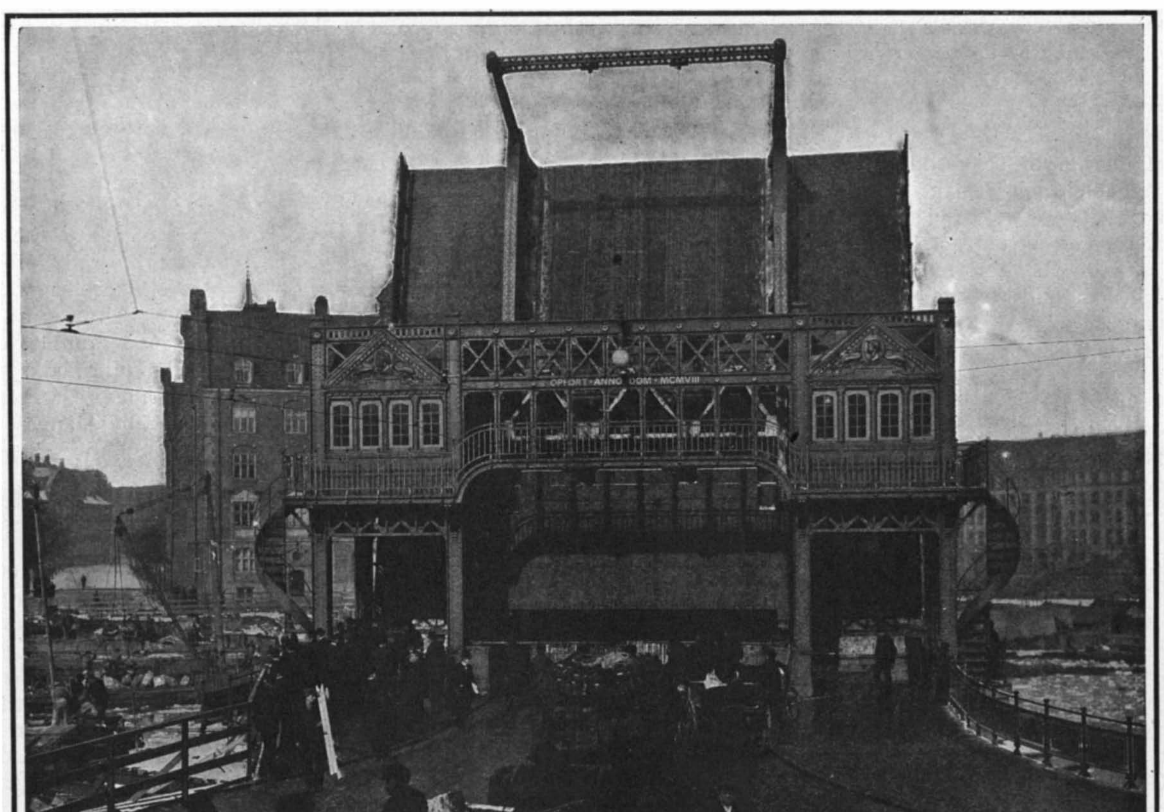
The channel which the new bridge spans has a total width of 257 feet 6 inches, with a depth of 25 feet 6 inches. The drawbridge itself spans a channel of 92 feet 6 inches clear width. The bridge is of the double-leaf type, the total length of the movable section being 109 feet 2 inches between centers. These are carried on two piers built in the channel, access thereto being gained from either bank over a short fixed span. The roadway of the bascule section has a clear width of 22 feet 7 inches, and carries two tracks for the electric surface tramway. On either side is a sidewalk 10 feet 3 inches wide on the bascules, opening out to 13 feet 8 inches wide at the approaches, where the whole bridge widens out funnel wise for the convenience of the traffic.

The erection of the work entailed the surmounting of several difficulties incidental to the heavy traffic on the waterway at this point. This was especially so in connection with the piers, the greater part of the building of which could not be done *in situ*, but had to be carried on at a convenient point in the harbor and subsequently towed into position and set upon the foundations.

The piers, which have an over-all length of 78 feet 8 inches and a width of 26 feet 6 inches beneath the bridge, are provided with chambers into which the tail ends of the leaves with their counterweights descend, when the bascules are raised, and they also contain a large proportion of the hydraulic machinery.

They were constructed on slips and were provided with strong watertight bottoms, built up of a ring-shaped iron girder and transverse members, to the under side of which the bottom plates were riveted. To the outside of the ring-shaped iron girder was attached the vertical sheet-iron plating forming the wall of the caisson. For purposes of launching this was only carried up to a height of a few feet. Launching was carried out in the usual manner. Concrete was then laid on the bottom to form a foundation for the masonry, which was so built as to form a circular wall, with transverse walls serving as buttresses and with locks between. This work was carried out while the pier was floating; and, as the mass gradually sank under the superimposed weight of the masonry, the sheet-iron lining was continued upward, a height of about three feet thereof always being maintained above water level. When the pier had been continued in this manner to the requisite height, the top was corbeled to receive the granite masonry forming the superstructure of the pier. To insure the pier maintaining an even keel during the attachment of the masonry, building was carried out symmetrically, and the parts filling out at the ends were subsequently removed.

This method of construction was carried on until the bottom of the piers had sunk to a depth leaving only a space of about 12 inches between the under surface of the bottoms and the face of the foundations which were ready to receive them. The piers were ultimately towed into position above the foundations, and then slowly lowered until the iron ring girder of the piers bore upon the surface of the foundations. Divers then descended to see that the piers were in correct position, and drove wooden wedges between the rims of the plates of the bottoms and the foundations, and completed the clay packing all round to secure a water-tight joint. When this was done, the bottom of the pier was attached to its foundations by grouting with pure dissolved cement.



Note the treatment of the architectural features of the bridge to harmonize with the neighboring buildings.

Portal view of Copenhagen bridge with bascule raised.

THE NEW KNIPPELS BRIDGE AT COPENHAGEN.

The fixed spans are of the ordinary plate-girder pattern, and the movable leaves are constructed in accordance with the well-known Strauss trunnion bascule principles. The counterweight, when the spans are down, rests in a position high above the roadway in the towers, being pivotally carried on two legs on pins in the tail ends of the leaves, the movement of the counterweight above being controlled by the usual links constituting the characteristic parallel motion of the Strauss design. As the leaf rises the counterweight descends toward the roadway, finally disappearing into a pit, when the limit of the upward travel of the span is reached. The equipoise of the leaf and its counterweight during this movement is dependent on the four axes of rotation, viz.: the axle of the platform; the counterweight leg's point of support on the tail end of the leaf; the axis of rotation of the guiding member on the counterweight; and fourthly, the fixed axis of rotation of the guiding member on the tower structure, lying in the angles of a parallelogram. The advantage of this arrangement is that the length of the tail ends may be considerably reduced, and space rendered available for a large heavy counterweight. The leaves of the Knippels bridge each weigh 146 tons, and the respective counterweight 247 tons.

In order to eliminate all vibration arising from traffic, the bridge has been constructed in such a manner that the leaves are locked against each other by hinges in the upper part of the top chords, while the pressure is transferred to abutment hinges on trestles in the piers.

The first operation in raising the bascules is the lowering of the counterweights upon the tail ends, so that they counterbalance the weight of the leaves. This is carried out hydraulically. The leaves are then raised by means of electrically-driven gearing. Each of the leaf girders carries a spur gear meshing with a series of fixed pinions, and vertical shafts extending through the columns of the towers.

When the bascules have been lowered again to their correct position, the pressure of the counterweights on the tail ends of each leaf is removed by hydraulic pistons, which lift the legs of the counterweights until they cease to bear upon the tail ends of the span. The mechanical action of raising and lowering each leaf is carried out by means of two 54-horsepower electric motors, one in each tower. About 13 kilowatts is expended in the raising and lowering of both leaves, and the time occupied in either raising or lowering the bascules is about 25 seconds, the same time being occupied in removing the pressure of the counterweights from the tail ends. When a small steamer passes the bridge the traffic is stopped for about two minutes, this interval increasing proportionately to the dimensions of a larger vessel. The construction of the whole bridge has entailed an expenditure of approximately $286,000.

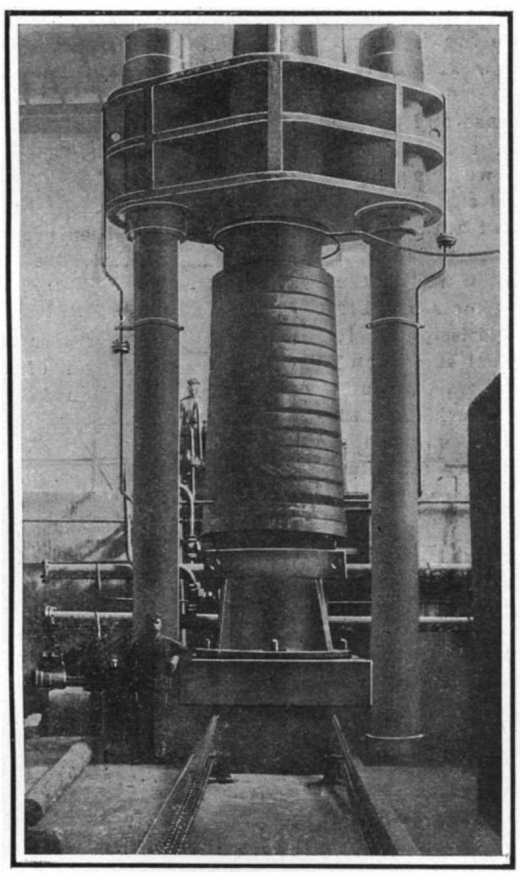
The United States government has given permission to Horace G. Herold to remove a 12-ton meteorite which he discovered in the Washington National Forest in December, 1907. This is said to be one of the largest, if not the largest, meteorites in the world.

FLUID COMPRESSION OF STEEL INGOTS.

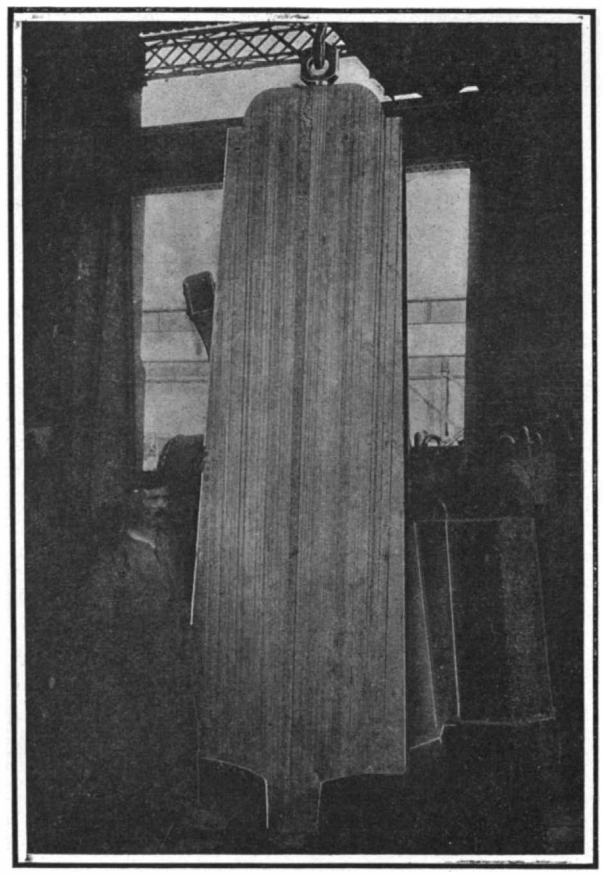
BY J. F. S. SPRINGER.

In the older days, when railway rails were made of wrought iron, the casting of ingots does not seem to have been attended with the grave disadvantage of piping so common to-day. It would appear that the tendency to pipe is clearly traceable to the carbon content of the metal, and that steels having higher percentages of carbon are more subject to this defect than the milder varieties. Consequently, with the high carbon percentages prevalent and necessary to modern rail steel, the piping of ingots has come into especial prominence, on account of the breakages of rails attributed largely to this cause.

A pipe is a cavity—of the form of an inverted cone—which forms in the upper part of the ingot as it cools subsequent to the pouring process. This cavity is sometimes short; at other times it extends downward 30 or 40 per cent of the length of the ingot. Apart from special methods of treating the steel, it is necessary to cut off this unsound portion in order to get perfect steel. In fact, it is really necessary to discard more than the portion actually piped in order to eliminate a further evil. This is the segregate. It is a locality where the carbon, sulphur, phosphorus, and other components of the steel are found in excess. This defective steel is usually found near the bottom of the pipe. To eliminate it, somewhat more than the strongly piped portion of the steel should be cut off.



A 3,500-ton fluid-compression press capable of taking a 22-ton ingot.



An 18-ton ingot sawn in two to show absence of piping.

Now, the great expense of securing sound steel by reducing to scrap such enormous percentages of the ingot as cast, long ago induced inventors to seek a more profitable solution of the problem.

Some few years ago a new process was developed in France, which seems to be exceedingly effective in eliminating the pipe and reducing the tendency to form segregates. This is the Harmet system of fluid compression by "wire drawing." It has been rather extensively adopted in Europe. The ingot is cast in a tapering mold, the smaller end being up. As the mold is at a much lower temperature than the molten metal, and is quite massive in addition, the freshly cast ingot soon solidifies upon its base and on the sides. While this shell-like portion goes on contracting as cooling proceeds, still it is at a slow rate. It remains of approximately the same size as when first formed. However, the contraction which took place upon solidifying has the effect of withdrawing the sides of the ingot from the mold. Moreover, the mold, expanding from the influx of heat, increases this separation. By the Harmet process, the bottom of the mold, which is movable, is forced upward by hydraulic means, bringing the ingot and the sides of the mold again into contact. The forcing of the bottom upward continues, however, and this results in the sides being forced in upon the fluid interior. The tapering form of the mold is the controlling factor in this compressing process. As it goes on, the internal mass feels the effects, and any cavity-forming tendencies are counteracted from the outset. This method has been termed a "wire-drawing" process. This is scarcely correct, seeing that, although a wire is passed through a reducing plate to which the tapering mold indeed corresponds, still the ingot is pressed from behind while the wire is drawn from the front—an essentially different procedure. In the diagram, we have a vertical sectional view of a Harmet press. There are two cross pieces, *AA* and *BB*. These are kept separated by the tie bolts, *C* and *D*. The lower cross piece may be sunk below the surface of the shop floor. Within this cross piece is arranged a hydraulic cylinder *E*, which is served by the pipe *P*. Within the cylinder is a piston, *F*, containing a well in which lies the plunger *G*. These three pieces, *E*, *F*, and *G*, are of forged steel. The cross pieces are cast iron. The plunger *G* passes up through an opening in the cross piece *BB*, and projects above the surface during the operation of the press. Within the upper cross piece *AA* is the cylinder *K*, containing a double-acting piston *L*. These are the main essentials of the press proper.

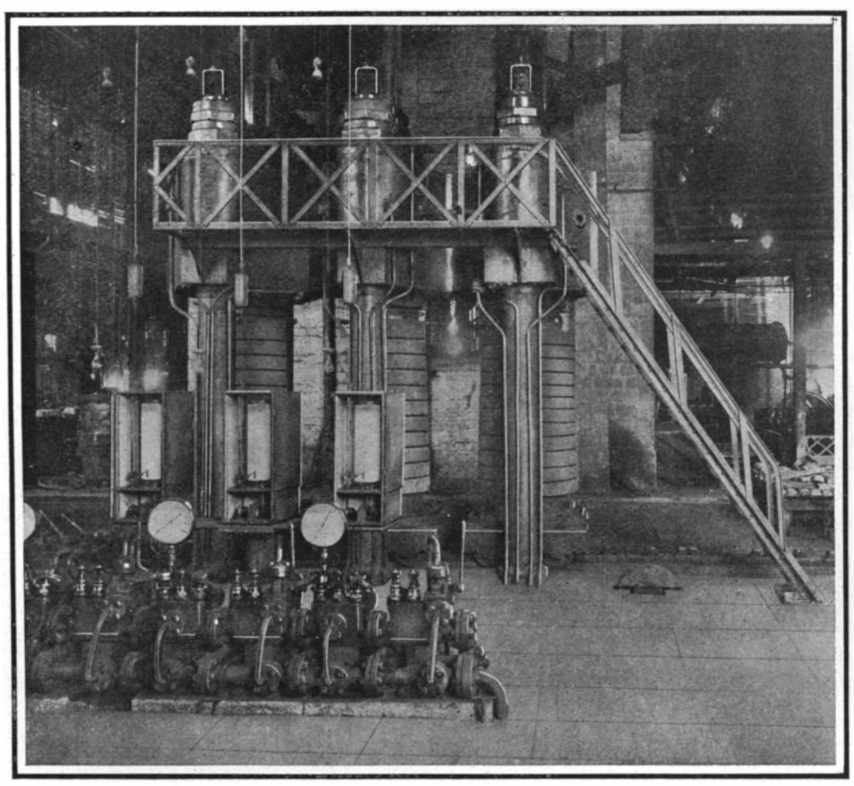
When it is desired to compress an ingot, the car *O*, which runs on a suitable track, is brought over the lower cross piece into an exact position mechanically determined. Upon this car is the mold *H*, reinforced by the metal bands *JJ*. This mold contains the freshly-cast ingot *K*. The double-acting piston *L*, controlling a plunger, may be let down until the plunger rests on the upper surface of the molten metal. The piston or plunger *N* forms a movable bottom for the mold. However, in order to preserve the surface of this piston, the removable piece *M* is inserted.

The tie bolts may be hollow. This permits of one (*D*) being used for the purpose of conducting the water to the cylinder *E*, by the pipe *P*. The hollow space in the other (*C*) affords a conduit for two cords attached to the piston *F*. These are not shown, however, in the diagram. Both of the cords pass through to the upper part of the apparatus, where one is connected with a recording device, while the other is connected with the accumulator.

In operating the press, the upper piston and plunger do not serve as compressors. They may rest idly, however, upon the top of the molten ingot. The lower piston *F* is the compressor. It is actuated by hydraulic power. As it is thus forced upward, it carries with it the plungers *G* and *N*, forcing the ingot upward into the tapering mold.

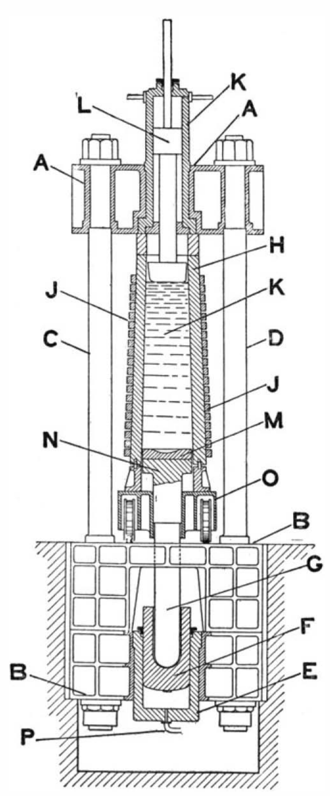
The compressing process is continued slowly from the moment a sufficient shell is formed until the entire ingot is solidified. This is a period which varies greatly on account of the difference in size of the ingots. An ingot of thirty tons would require about five hours, while the tiny block of 100 pounds would probably "freeze" in a very few minutes. Of course, form enters here, but the extremes given will afford an idea of the usual conditions.

When the ingot has been compressed to the moment of solidification, the upper piston and plunger are operated to discharge it from the mold. However, it is of advantage—if the press be of sufficient power—to

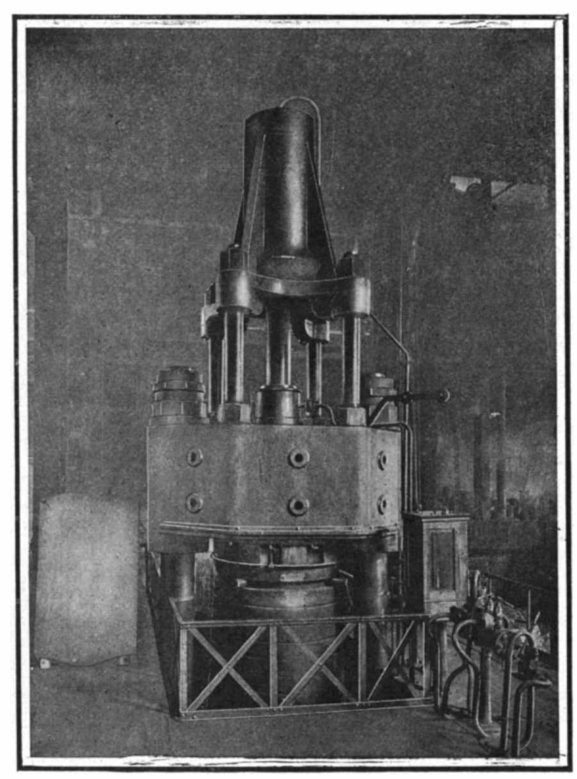


Group of three 1,000-ton presses.

In front of these are the three recording drums and the controlling apparatus.



Section through a Harmet fluid-compression press.



View of large Harmet press at St. Etienne.

View from the operating platform, showing the stripping cylinder, the cross-head, the massive tie bolts, and the upper part of reinforced mold.

FLUID COMPRESSION OF STEEL INGOTS.

continue compression until the ingot has fully cooled to some reasonably low temperature. This latter procedure is, however, scarcely applicable to the large ingots, on account of the enormous pressure requisite to maintain compression after the solidifying point has been reached. But for the small blocks this process is said to produce freedom from these defects arising from the internal stresses set up by contraction of the solid mass.

In carrying on this compression, it is important to go neither too fast nor too slow. The effort is just to exceed the continual contraction, thus producing a compressive effect. But to do this is not so simple as might at first blush appear. The molten mass lies within the solidified shell, and the purpose is that compression shall proceed just fast enough to have the fluid continually on the point of overflowing. The top of the ingot is, however, down within the apparatus and not favorably situated for observation. So, in order to determine the precise rate, the upper piston and plunger are removed, and a mirror fitted at an angle of forty-five degrees at the top of the press, in such position as to reflect to the eye the conditions at the top of the molten ingot. In this way one or more experimental ingots may be compressed. These may, indeed, be split open and examined. In the meantime, a record has been made through the agency of one of the cords running from the lower piston. This is kept in tension by a small drum and spring coil. The cord controls a pencil which slides up and down, in a vertical direction, in accordance with the rise and fall of the lower piston. While the pencil moves thus vertically, it traces a line on paper wound upon a drum which is rotated by clockwork. In this way a curve is drawn recording the movements of the piston in compressing the successful experimental ingot. In practice, this curve is duplicated, an attendant keeping watch during the operation of the machine.

Two of the very largest presses are now in operation in Great Britain—one capable of compressing a 34-ton ingot being in Scotland, the other competent to handle an ingot of 40 tons being in England. There are, scattered over Europe, thirty-two Harmet presses in actual operation.

It may be sufficient to say in reference to the quality of the steel that the French government accepts Harmet ingots with only a 5 per cent discard from the top of the block.

THE NEW UNITED STATES BATTLESHIP "MISSISSIPPI."

On March 3rd, 1903, Congress authorized the construction of two battleships, which were to be of 13,000 tons displacement and carry the maximum armor and armament and have the maximum speed compatible with this limited displacement. In the previous year two battleships, the "Connecticut" and "Louisiana," had been authorized; but in their case the displacement had been set by Congress at 16,000 tons. On that more generous allowance the naval constructors were able to provide an armament consisting of four 12-inch guns, eight 8-inch, twelve 7-inch, and twenty 3-inch. The protection consisted of a waterline belt from 9 to 11 inches in thickness, 12 inches of armor on the 12-inch gun turrets and 6½ inches on the 8-inch gun turrets, and the speed, with 16,500 horse-power, was 18 knots. Coal bunkers were provided with a capacity of 2,275 tons.

With a ship of the above characteristics before them, the naval constructors were presented with the problem of seeing how many of its effective elements they could retain in a ship of 3,000 tons less displacement. The result is seen in the two sister ships, "Mississippi" and "Idaho." Their length is 375 feet, beam 77 feet, and mean draft 24 feet 8 inches, as against 450 feet length, 76 feet 10 inches beam, and 24 feet 6 inches mean draft in the case of the "Connecticut." The distribution of the armor is as follows: There is a waterline belt 9 inches in thickness amidships, which extends from stem to stern, and gradually reduces to a thickness of 4 inches at the ends. Above the belt the sides of the ship are protected by 7 inches of armor to the level of the gun deck, and the 7-inch guns mounted upon the gun deck are also protected by 7 inches of armor. The protective deck, which is located at the level of the top of the main belt armor, is 1½ inches thick on the flat portion, and 3 inches in thickness where it slopes down to a junction with the bottom of the armor belt. The 12-inch gun turrets are protected by 12 inches of armor on the front plate and 8 inches on the sides and rear. The 9-inch gun turrets carry 6½ inches of armor on the front plate and 6 inches elsewhere.

The battery for a ship of 13,000 tons displacement is unusually powerful. It consists of four 45-caliber 12-inch guns, mounted in two turrets forward and aft. These guns are of great length, measuring 47 feet from breech to muzzle; and although the bore is 12 inches, they are so long that, in the deck view of the guns on our front page, this length, assisted by the fore-shortening of the photograph, makes the gun look like the proverbial "pipe stem." The intermediate battery consists of eight 45-caliber 8-inch guns, mounted in four turrets on the main deck, in the positions shown in our photograph. The axes, both of these and of the 12-inch guns, are about 26 feet above the water. On the gun deck is a battery of eight 7-inch guns mounted in broadside, two of which can be trained dead ahead and two dead astern. They are protected by side armor of 7 inches of steel and by circular gunshields fitting snugly in the opening, which are 6 inches in thickness. For torpedo defense a dozen 3-inch rapid-fire guns and fifteen smaller guns are mounted in various suitable positions throughout the superstructure and bridges. There are two submerged torpedo tubes for firing the new 21-inch turbine-driven torpedo.

So far, so good. The powers of defense and attack as represented by the guns and armor are very formidable for a ship of this size. When we come, however, to the questions of speed and coal supply, there is a serious falling off as compared with the "Connecticut," the bunker capacity being reduced from 2,275 tons to 1,800 tons; and the speed, which in the case of the "Connecticut" was 18.78 knots on her trials, falls to 17.11 knots in the "Mississippi." It is when we consider this question of coal supply and speed that the folly of Congress, in arbitrarily limiting the displacement to 13,000 tons, is evident. In these days of 19, 20, and 21-knot battleships, the possession of only 17 knots speed practically relegates the "Mississippi" to the position of a second-class battleship. If she took her place in line with our own "Dreadnoughts," their speed in battle would be limited to the 15 or at most 16 knots, which would probably be the best that the "Mississippi" could be depended upon to do, if called upon suddently during the long period of wear and tear incidental to a naval campaign. As a matter of fact, she would prove to be something of a handicap to the average battleships of the pre-"Dreadnought" period, such as the "Connecticut" and "New Hampshire," or the 19-knot vessels of the "Georgia" class. It is quite conceivable that in some critical maneuver of a sea fight, in which the possession of a knot or two of additional speed was of vital importance, the 17-knot "Idaho" and "Mississippi" might prove to be a decided handicap upon the remainder of the fleet.

This, however, is pure theorizing, and the chances are that if the "Mississippi" were ever called upon to cast loose her guns for an engagement, she would be able, at least with vessels of her own pre-"Dreadnought" type, to give and take the hard knocks of a sea fight with credit to herself and the flag she flies. Particular interest attaches to the "Mississippi" at the present time because of her voyage up the noble river of the same name.

The contract for the "Mississippi" was signed January 25th, 1904; her keel was laid May 12th, 1904; she was launched September 30th, 1905; and she went into commission February 1st, 1908.

Sir William Ramsay on the Transformation of the Elements.

In the course of his recent presidential address before the Chemical Society, London, Sir William Ramsay said, as reported in the London Times, that his subject was the hypothesis that the genuine difference between elements was due to their gain or loss of electrons. The question was whether, to take a concrete example, an atom of sodium by losing or gaining electrons remained an atom of sodium, or whether the loss or gain of electrons did not cause it to change into some other element or elements. Having stated some theoretical arguments in favor of the possibility of transformation, he went on to describe some experiments bearing on the question. He first mentioned the transformation of radium emanation into helium, which had been amply established. He next referred to his experiments on the action of emanation on solution of copper sulphate and nitrate. Four experiments were made, and with each exactly similar duplicate experiments were tried in which no emanation was employed. A larger residue was obtained in each case from the emanation solutions than from the duplicates, and while the residues from the emanation solutions showed a faint trace of lithium, those from the duplicates failed to give spectroscopic evidence of the presence of that element. The fact of the experiments having been carried out in duplicate rendered inapplicable the criticism of Prof. Hartley that accidental contamination with lithium was probable. As regards the alleged repetition of the experiments by Mme. Curie and Mlle. Gleditsch, who, using platinum vessels, obtained no greater residue and no trace of lithium, there were two possible replies—either the conditions were varied, or conceivably a trace of lithium from the glass vessel employed (which, however, had been tested for lithium with negative result) was dissolved in presence of emanation and copper but escaped solution in absence of copper or of emanation. A research on the action of emanation on solution of silver nitrate contained in a silica bulb yielded negative results, but he had stumbled across a case of apparent transformation while working in a totally different direction. On December 20th, 1905, 270 grammes of purified thorium nitrate was dissolved in about 300 cubic centimeters of water, and the flask in which the solution was contained was repeatedly evacuated by a mercury pump until no gas could be pumped off. The stopcock attached to it was then closed, arrangements being made so that if any leakage occurred it would be detected. After the flask had stood for 168 days the gas in it (5.750 cubic centimeters) was pumped out and examined for helium with doubtful results. The flask was again closed, and on August 3rd, 1907, after 173 days, the gas in it was again examined. Again the presence of helium was questionable, but 1.08 cubic centimeter of carbon dioxide was found. At the next examination, on March 30th, 1908, there was distinct evidence of a helium spectrum, and the gas contained 1.209 cubic centimeter of carbon dioxide. It was then thought possible that the carbon dioxide had been produced from the grease of the stopcock, and therefore a little mercury was introduced into the capillary tube leading to the stopcock so that the latter was protected from contact with the thorium solution. After 310 days the gas was again withdrawn. Instead of three or four cubic centimeters, no less than 180 cubic centimeters was collected; it was almost pure nitrogen, but in all 0.622 cubic centimeter of carbon dioxide was separated from it. These experiments, Sir William Ramsay said, rendered it at least probable that thorium engendered carbon dioxide, or, in other words, that carbon was one of its degradation products. Experiments further indicated that the action of radium emanation on thorium nitrate solutions was also attended with the formation of carbon dioxide, and the same was the case with an acid solution of zirconium nitrate. An experiment with lead chlorate proved blank, but with bismuth perchlorate the formation of carbon dioxide appeared certain. In conclusion Sir William Ramsay, after mentioning that every precaution which could be thought of was taken to exclude foreign gas, said that while these were the facts, no one was better aware than he how insufficient was the proof, and that many other experiments must be made before it could be confidently asserted that certain elements, when exposed to "concentrated energy," underwent degradation into carbon.

Oxygen and Water Vapor on Mars.

After a careful study of the spectrum of Mars, Director W. W. Campbell of the Lick Observatory has decided that oxygen and water vapor in the atmosphere of Mars do not exist "in sufficient quantities to be detected by the spectroscope as available." Prof. Campbell refers to the study of this subject by such eminent scientists as Sir William Huggins and Vogel and others in the sixties and seventies and by himself in 1894 and 1895. Prof. Campbell quotes the words of Mr. Slipher of the Lowell Observatory at Flagstaff, Arizona, whose observations of the spectrum of Mars show no selective absorption not found in that of the moon photographed under the same conditions. This conclusion from the Lowell Observatory, confirming the visual observations of Prof. Campbell in 1894 and of his photographic work in 1895, and of Prof. Keeler's photographic work of 1897, is opposed to the well-known theories of Huggins, Vogel, Maunder, and others.

Transatlantic Record Reduced.

The transatlantic record from Queenstown to Sandy Hook was again reduced on the last trip of the "Mauretania." She left Queenstown on Sunday, and anchored at Quarantine on Thursday night, reaching her dock in New York at 7:30 Friday morning, May 21st. The time of the passage from Daunt's Rock to Ambrose Channel lightship was 4 days, 16 hours, and 53 minutes, and the average speed for the whole trip was 25.62 knots.

Another victory for the air-cooled Franklin engine was in the third annual Harrisburg endurance contest recently concluded. The contest included four days of touring, covering 694 miles of very varied and often very bad roads, followed by a minute examination of all parts of the competing machines by a committee of experts, marks being deducted for wear or any dislocation of working and other parts after the trials as well as for any stops for repair during the run. The fact that not a single perfect score remained at the end of the third day shows the severity of the conditions; and the combination of this with the fact that not a single complaint or protest was made by contestants, is a tribute to the tact and justice with which the officials conducted the trial. The winning Franklin car was a 4-cylinder 28-horse-power driven by C. S. Carris; a 30-horse-power Pullman, and a 50-horse-power 6-cylinder "Peerless" were second and third, only two marks apart; and a 20-horse-power White steamer car was fourth out of fourteen cars, of which only two failed to finish.

Correspondence.

AN EARLY HELICOPTER.

To the Editor of the Scientific American:

I send you a brief account of the experiments in flying machines made about fifty years ago by my father, the late George W. Dow of Brooklyn, N. Y. He always had great faith in aerial navigation, and frequently asserted that when an engine should be constructed light enough and with sufficient power, it would be accomplished. His experiments were recently recalled to me, when I discovered among his papers a wood-engraving block which was used by your valuable paper about fifty years ago in publishing his original idea, which was that of lifting screw propellers that working vertically raised the car, and by inclining the shaft or shafts in any given direction, would carry it forward or steer as desired. I go back in memory to my childish distress when he cut one of my humming tops in two; and my subsequent delight when, after fastening blades or wings at an angle on the surface and using the spinning handle inversely, he caused it to soar gracefully into the air. Following this experiment he made a small model with four propellers on vertical shafts in the corners, and which easily flew about the room by means of clockwork machinery. It was shortly after your publication of my father's first crude idea that the flying top appeared from France, and I remember his questioning whether this toy was suggested by that publication or if, as not infrequently happens in the world's inventions, some Frenchman had been working at the same time on similar lines. At the present day engines light enough and strong enough having been made, my father's prophecy seems about being fulfilled; and it is not improbable that the lifting and steering will be accomplished in the manner which he conceived, perhaps in conjunction with some kind of an aeroplane, these having more recently come into successful prominence.

Wakefield, N. H. Abbot Low Dow.

SLIPPING OF WHEELS ON CURVES.

To the Editor of the Scientific American:

I am a constant reader of your paper, and consider it one of the best publications in America, but have noticed one or two errors recently. One of them is in your description of the Alaska-Yukon Exposition that is to be, in which it is stated that Mount Rainier is the highest mountain in the United States. California can lay claim to that distinction in Mount Whitney, which is 14,501 feet above sea level. This is the highest outside of Alaska. I live in the shadow of this mountain, and like all other residents of this community feel proud of our Mount Whitney.

Another is the often-asked question about the train going around the curve, and the outside wheel being compelled to travel faster than the inside one, etc. Your answer has been that the inside wheel would have to slip. I beg to differ with you, for the following reason: When the train is going around the curve, the momentum to go forward is inclined to cause the wheels to hug the rails close to the flanges of one wheel or one side, while the rail on the other side or inside curve is naturally away from the flange of the wheel. The wheel is larger near the flange than away from it, consequently the diameter of the wheel on the outside rail while going around the curve is greater than on the inside, and consequently travels faster. I think you will have no trouble in seeing the point.

Visalia, Cal. B. F. Liggett.

[When a train is rounding a curve, the resultant of gravity and centrifugal force inclines toward the outer rail. This produces an increased frictional resistance between the outer wheels and the outer rail, both on the tread and the flange. As the resistance to slipping is, other things being equal, proportional to the pressure, the inner wheels will be the first to slip. Theoretically, there is something in the suggestion that the outer wheel can travel a longer distance than the inner without the latter slipping, because the outer wheel rolls on a larger circumference of the coned surface, but in practice the taper of the wheels is not sufficient to make the difference, and has in recent years been reduced.—Ed.]

SOME MORE LUNAR SUPERSTITIONS.

To the Editor of the Scientific American:

Reading your article, "Lunar Superstition and Potatoes," calls to mind many other equally as superstitious and uncalled-for ideas. Many farmers plant corn in the moon, kill hogs in the moon, deaden timber, build a fence, and do almost everything by the moon. As a basis many refer to the Scripture, Genesis, first chapter, fourteenth and sixteenth verses. But few people realize that the moon is as large when it is new as it is when it is full, and that the sun shines on the same amount all the time; and it is owing to position that makes the different phases of the moon. Some semi-scientific men claim that if corn is planted in the dark of the moon, when it comes up the nights are light and cause it to grow faster. Many regard the moon as a weather indicator. If it is on its back when new, it will rain within the first quarter. If it is on its point, the water has all spilled out and it will be a dry moon. Being north or south of an eastern or western line indicates cold or warm weather, not realizing that it has its regular path, and is approximately in the same position at the same time of the year each year.

McKenzie, Tenn. W. R. Crawford.

SIGNALING TO MARS WITH MIRRORS.

To the Editor of the Scientific American:

In the Scientific American of May 15th, in an article on "Signaling to Mars," are these statements:

"A correspondent of the New York Sun, who states that he is a practical heliograph man, calls attention to a fact which seems to have been overlooked.

The heliograph man points out that a pocket mirror two inches square will do as much work as a mirror that is ten feet square. All that any mirror can do is to reflect a single image of the sun. He states that it is possible to flash from 6 to 48 miles with a shaving glass."

I have been thinking on the subject, and would like to submit the following. If there is anything wrong with the reasoning, please correct me.

Any plane mirror will reflect all of the sun's rays that fall upon it. Every boy has thrown sunlight on the wall or ceiling by a piece of glass. The spot of reflected sunlight is of the size and shape of the reflector, whether that be an irregular piece of glass, a shaving glass, or the family "looking glass." Those rays that enter the eye direct from the mirror form a single image of the sun, and that image will be larger or smaller, according to the distance of the mirror from the eye.

The diameter of the sun is about 32 min., circular measure, so 32 min. will be the "angle of vision" subtended by the sun. A little figuring will show that the arc of 32 min. is 0.0093 of the radius of a circle. If we consider the eye as the center of a circle, the distance of the mirror will be the radius. Therefore a mirror held at a distance from the eye will not take in a full image of the sun unless it has an angular diameter of 32 min. or an absolute diameter of 0.0093 of its distance from the eye.

At a distance of one yard, this diameter will be 0.334 inch; that is, the image of the sun, reflected in a mirror one yard away, will be about one-third of an inch in diameter. At 100 feet this image will be increased to 11.16 inches in diameter, and a mirror placed one mile distant would need to be 49.1 feet to reflect a full image of the sun. Every additional mile of distance would require 49.1 additional feet to the diameter of the mirror. To reflect millions of miles would require a *very large* mirror to give a full image of the sun; a "2-inch" or a "10-foot" mirror certainly would not.

This can be verified by observing the reflection of the sun in an ordinary window. If the observer be close to the window, he will see a small, round image of the sun; as he recedes from the window this image will increase in size, and at a distance of 50 or 75 rods the entire window will be lighted up with a single image of the sun. Often, while standing at the Pennsylvania Ferry in Jersey City, I have observed the image of the setting sun reflected from the high office buildings of New York, one mile distant, and that image extended over several windows. The shaving glass, or heliograph reflector, 4 inches in diameter, if more than 40 feet from the observer, will not reflect an entire image of the sun. While it may "flash a signal from 6 to 48 miles," that reflection will be but a *very, very* small portion of the full image of the sun.

From this we see that the amount of light reflected from a distant mirror is directly proportional to the surface of the reflector, and in signaling to Mars, large mirrors will be more powerful than small ones.

As to the practicability of the experiment, or its success, these are beyond the range of mathematics.

Elizabeth, N. J. George Fleming.

The Current Supplement.

A new departure in locomotive construction is described in the opening article of the current Supplement, No. 1743. The locomotive in question is fired with liquid fuel, and can be reversed without the use of any intermediate gearing, both the power and speed being controlled by altering the steam charge in the cylinder, without resorting to the expedient of different ratios of transmission. George P. Floyd, an old-time railway conductor, describes most interestingly the life of early conductors, men who were usually recruited from the ranks of stage-coach drivers. A Japanese engineer, Wadagaki, has made the suggestion of using the exhaust steam from the main engines in a turbine which should drive a turbo-compressor, taking the steam from the boilers and delivering it to the main engines in a compressed and superheated condition. A critical comment on this scheme is published. The successful management of a modern farm depends upon the efficiency of the equipment with which the work is performed. The repair of the equipment is a vital consideration. Mr. W. R. Beattie tells how the equipment can be kept in good order. James Arthur writes on ancient chariot wheels, and shows that the wheel can be traced back 3,500 years. Herbert Chatley's splendid paper on aero problems is concluded. Prof. F. Henrich reviews recent work in radio-activity. The pearl-button industry is described at length. Mr. C. H. Clark illuminatingly writes on magnetic ore separation and the electrical operation of mining machinery. The usual engineering notes, trade notes, and science notes will be found in their accustomed places.

The gasoline tank should be filled through a hose connection from the pump, or if, as in the largest garages, it is impracticable to run the cars to the pump, a portable tank on wheels, of a capacity of about fifty gallons, fitted with a pump to which is attached a hose, should be used. The portable wheel tank is run to the pump and filled, and can then be moved from car to car. Either of these methods of filling tanks reduces the fire risk to a minimum, as the gasoline is not exposed to the air, and cannot vaporize. These methods do away with the excuse for open pails and buckets partially filled with gasoline, and constantly giving off explosive vapor. The workmen should not be allowed to use gasoline for washing their hands or cleaning the cars. In either case the gasoline is pumped or poured on the floor and allowed to evaporate. To prevent this, the pump should be equipped with a lock, and the key kept by the foreman, or man in charge, so as to prevent the pumping of gasoline on the hands.

THE MANUFACTURE OF FRENCH POSTAGE STAMPS.

BY JACQUES BOYER.

All of the postage stamps, postal cards, letter cards, money orders, and pneumatic cards and envelopes which are used in France and the French colonies are made in the national factory in the Boulevard Brune, Paris, by 320 employees, men and women, who are appointed by the Secretary of Posts and Telegraphs. With the aid of the improved machines which are shown at work in the accompanying photographs, this small force of selected workers turns out the immense quantity of matter detailed below. The figures are for the year 1907.

Postage stamps (of which 1,500 millions are of the denomination of 10 centimes, equivalent to 2 cents)	2,700,000,000
Postal cards	20,000,000
Letter cards	45,000,000
Pneumatic cards	4,000,000
Pneumatic envelopes	400,000
Domestic money orders bound in books of 50 or 200	45,000,000
International money orders	2,000,000
Colonial stamps	50,000,000

In making postage stamps, the first step is to order from a celebrated artist the design of the engraving. The design is drawn on a large scale, and reduced by photography to the exact dimensions of the stamps. The reduced image is given to a skillful engraver, who engraves it upon wood or steel. When this engraving has been approved by the artist, it constitutes the original plate. From this plate, which does not bear any mark of value, an impression is taken in wax, if the plate is wood, or in lead if the plate is steel, and from this impression electrotypes are made. The electrotypes, having been carefully retouched, go back to the engraver, who inserts the figures of value. Thus is obtained a series of plates corresponding to the different denominations of stamps. From each of these plates impressions in lead are taken. These are grouped in fifties, and thus electrotyped. In order to strengthen the thin sheet of copper, which forms the "shell," or electrotype, its edges are turned up, and a backing of melted type metal is poured upon it. The plate thus obtained, after being further retouched by the engravers, is ready for printing.

One of our photographs shows artists examining shells with a lens, and erasing small defects with the burin.

The printing is done by the usual methods but, naturally, with very great care. Each sheet of stamps contains 300 or 600 stamps, and the operator must assure himself that every portion of the six or twelve engraving plates shall be subjected to exactly the proper degree of pressure. In this way it sometimes happens that several days elapse between the arrival of forms at the press and the actual impression.

The presses are of two different types, platen and cylinder. The former work less rapidly than the cylinder presses, and are used particularly for printing stamps in several colors. In order to facilitate the control of the operation, the edge of every sheet has impressed upon it the date, the number of the press, and the letter designating the pressman. We shall not go into details concerning the presses, most of which resemble those found in other modern pressrooms, but we shall describe more particularly the new rotary press designed by the Marinoni firm, for the purpose of printing money orders and postal notes, and purchased by the government at the commencement of 1908.

Previously, French money orders and postal notes had been printed on flat presses of various types, not capable of printing more than 1,000 per hour, and their manufacture included five impressions (the safety background, the main design, the numbers in color, the serial numbers in black, and the black in black). The new Marinoni press performs all these operations at once, and delivers sheets of ten money orders, completely printed and numbered, at the rate of 6,000 or 8,000 sheets per hour. The operation of the machine is shown in one of the photographs. A continuous band of paper, running from a reel, receives a first impression from a cylinder which carries the plates of the safety background, and a second impression on the face from another cylinder carrying the engravings of the main design. Simultaneously a series of printing drums carry numbers of three figures, which change at each turn of the press cylinder and are printed in color on the paper. On another series of drums are the numbers of six figures, which change for each fifty or one hundred sheets. A special mechanism allows this numbering to be done without any shock, despite the great speed of rotation. The serial numbers in black are impressed as the band unrolls, and at the same time the back receives its impression from two other cylinders. The printed blank is then cut into sheets, each containing ten postal orders, which are automatically arranged in piles of five and placed on a table which moves once for each one hundred sheets, so that the money orders which are to form a book are properly arranged and numbered and need only be cut from the pile of printed sheets. In order to arrange conveniently all these sheets by the old system, it is necessary to have an assembling table, behind which stand men who take a sheet from each pile as it passes before them. When the revolution is accomplished the book of money orders is complete. It is then taken to the binding machines, which fasten it with three wires and put on the cover.

To return to postage stamps: The printing finished, they are counted and go to the gumming machine, where an operator places the sheets on a cylinder which presses them against the gum roller. After this the sheets are seized by claws and carried by a long chain into the drying apparatus, which is formed of a series of vertical shafts of metal containing gas burners for the purpose of heating the air, which is kept in motion by fans. In these machines the sheets travel 350 to 400 feet in about ten minutes and are then dry. The two boys who receive them from the gumming machine have only to pile them regularly on the table. The gummed sheets, after being again counted, go to the perforating room, where they are perforated very rapidly by a machine. The sheets are cut in two or four pieces according to size, and are presented in piles of five to the machine, which instantly punches out thousands of minute disks. The 600 stamps are perforated in less time than it takes to describe the operation. The stamps then leave the factory for the storehouse of the responsible agent, where they are again counted.

In addition to postage stamps and money orders the government factory makes pneumatic envelopes, pneumatic cards or "*petits bleus*," stamped newspaper wrappers, letter cards, and postal cards. The envelopes and "*petits bleus*" are cut out by hundreds from the printed sheets. Then a girl inserts the pieces separately in an apparatus which folds and fastens them. The flap is then gummed by another machine. A workman lays the envelopes on long strips of canvas which, moving continuously, carries them to the gum roller and then to other endless bands arranged horizontally over a distance of 130 feet. At the end of this journey the envelopes, now dry, fall upon other

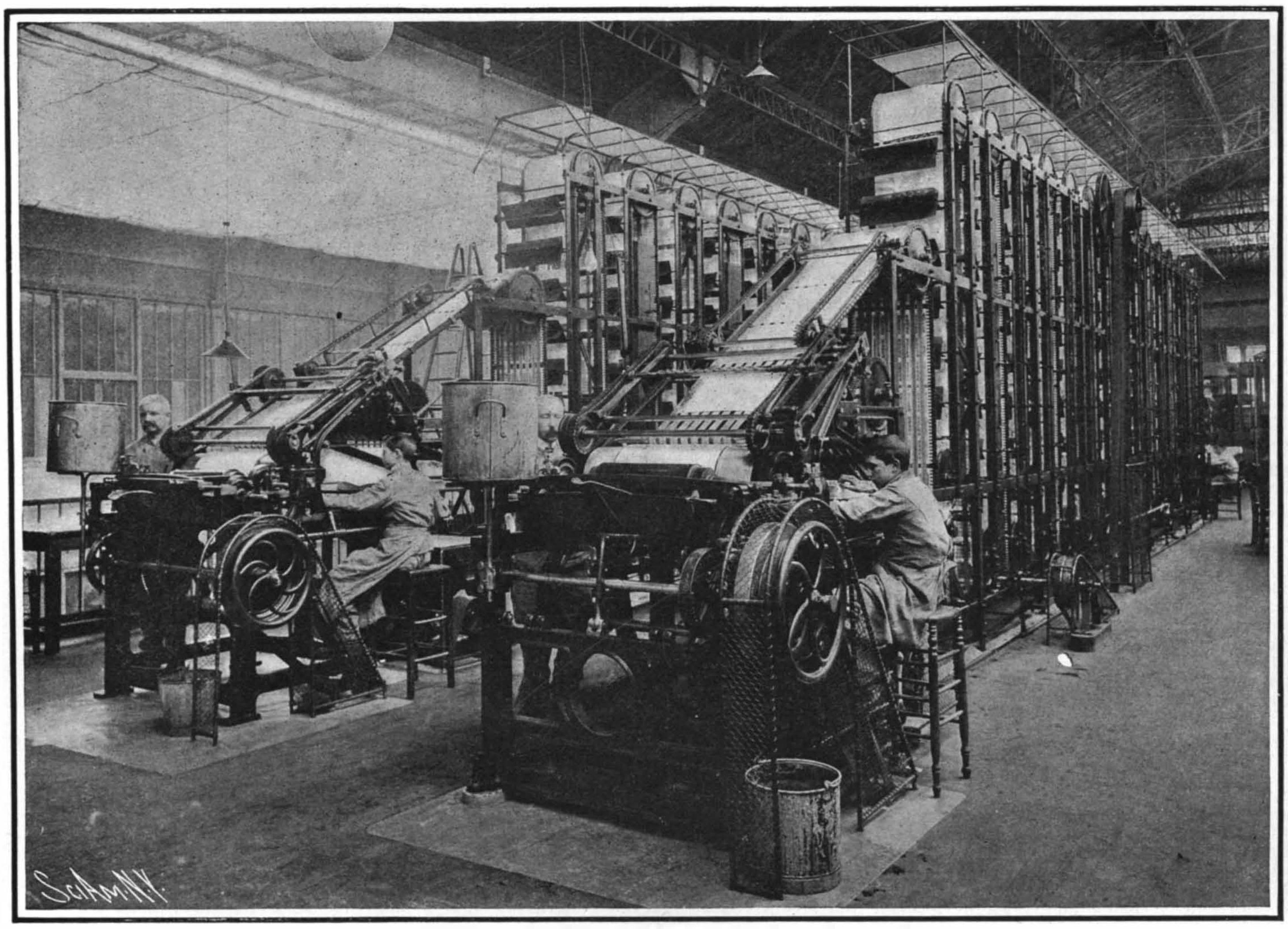


Fig. 1.—Gumming sheets of postage stamps by machine.

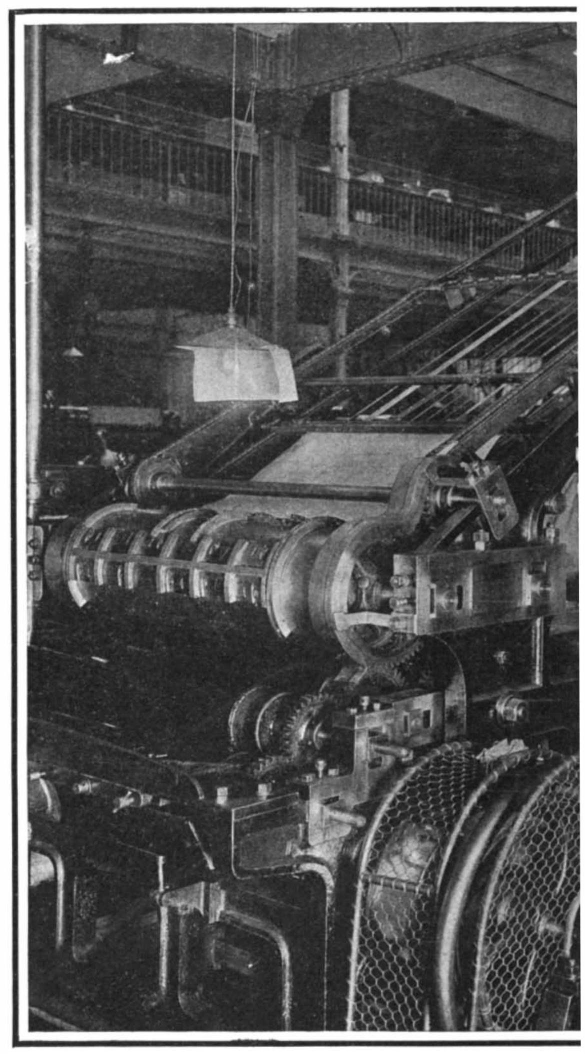


Fig. 7.—Machine for gumming a

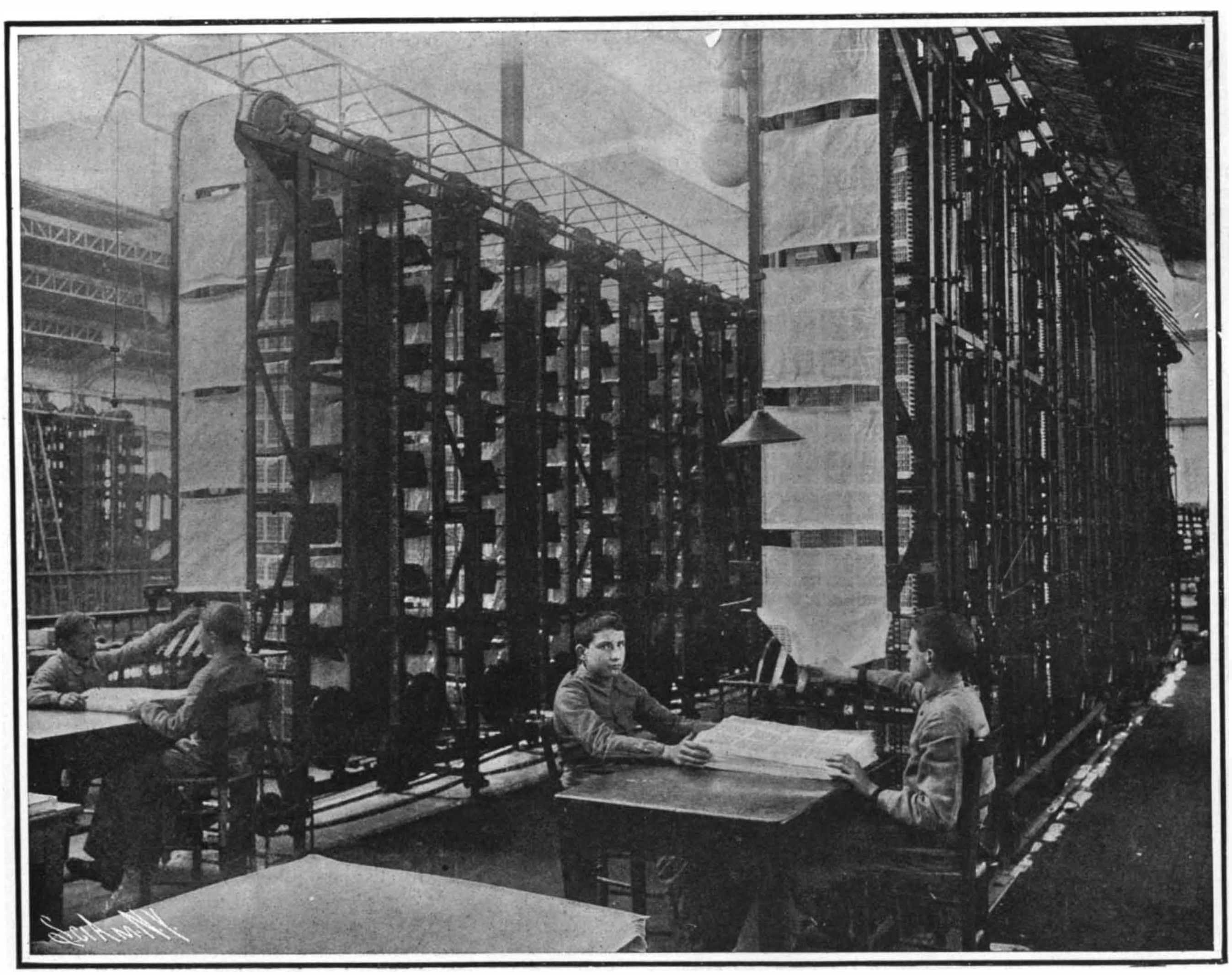


Fig. 2.—The drying apparatus.

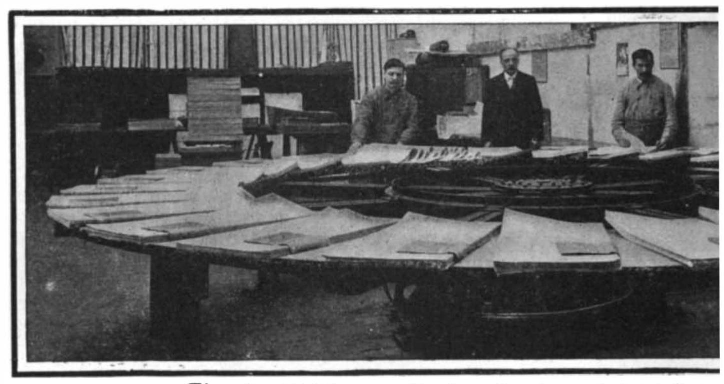


Fig. 4.—Making up books of money orders from

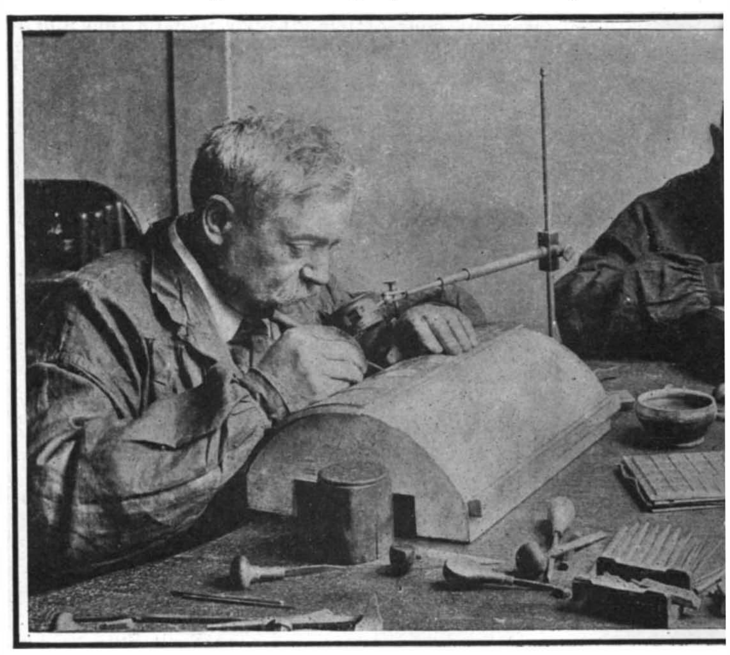


Fig. 5.—Engraving the plates from which posta

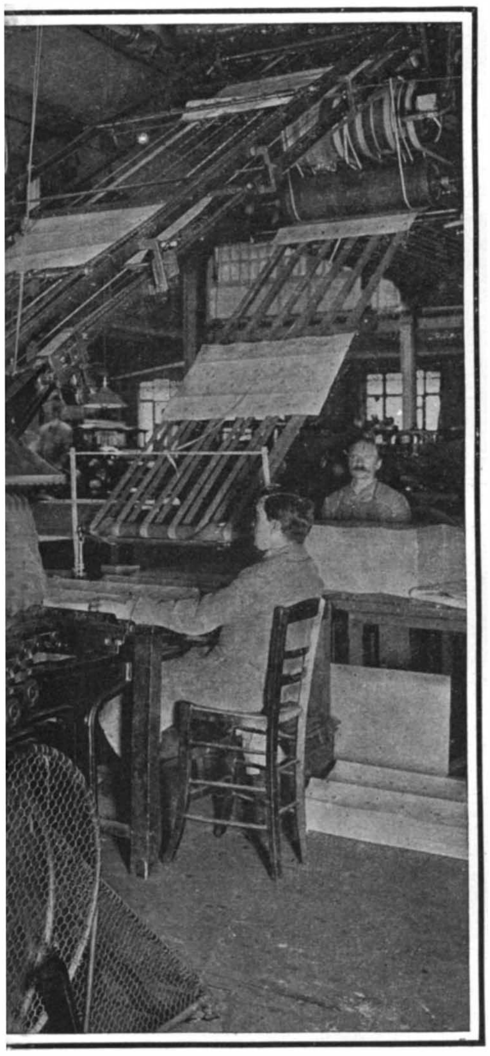
THE MANUFACTURE OF FRE

ands of canvas moving within reach of a man who iles the envelopes on a table. The stamped wrappers are made more easily. After printing they are ut out by a cutting wheel, arranged on tables, ummed with a brush operated by hand, and placed n racks to dry. The letter card department requires complicated apparatus and long operations. The ards must be printed, cut, folded, gummed and perorated. The perforation is for the purpose of facilitating the opening of the cards after they have been ealed. The folding is done with a small machine perated by a boy, who lays each card on a plate, over slit, into which the card is forced by the descent of dull knife moved by a treadle. In this way one boy can fold from 4,000 to 10,000 letter sheets in eight hours. The gumming is done in the same way as in the case of the envelopes. The operator in charge of the perforater has nothing to do but to present the folded card to the teeth of the machine.

Postal cards are printed on flat presses from copper plates and are then cut out with a wheel, counted, and packed.

It should be observed that with a selected but very small force of workers, whose daily wages are about 40 cents for boys, 65 cents to $1.05 for women, and $2 at most for men, the government manufactures postage stamps at the extremely low cost of about 20 centimes or 4 cents per thousand; thus the 10-centime stamp sells for 500 times its actual value. These are advantages that are scarcely found to-day in the most prosperous manufactories, but they serve to support a vast administration which extends its ramifications to the smallest villages of France, and when it is recalled that the annual receipts of the French postal telegraph and telephone services amount to about 300 million francs or $60,000,000, it must be admitted that this money is employed to good purpose.

It seems that bacteria of different species can be separated by employing what may be termed "bait." Thus, bacteria concerned in the process of putrefaction may be attracted or separated from the rest by offering them oxygen. Many organisms are allured by the salts of potassium, while others find asparagin or the sap or juice of raw potatoes irresistible.



nd drying letter cards.

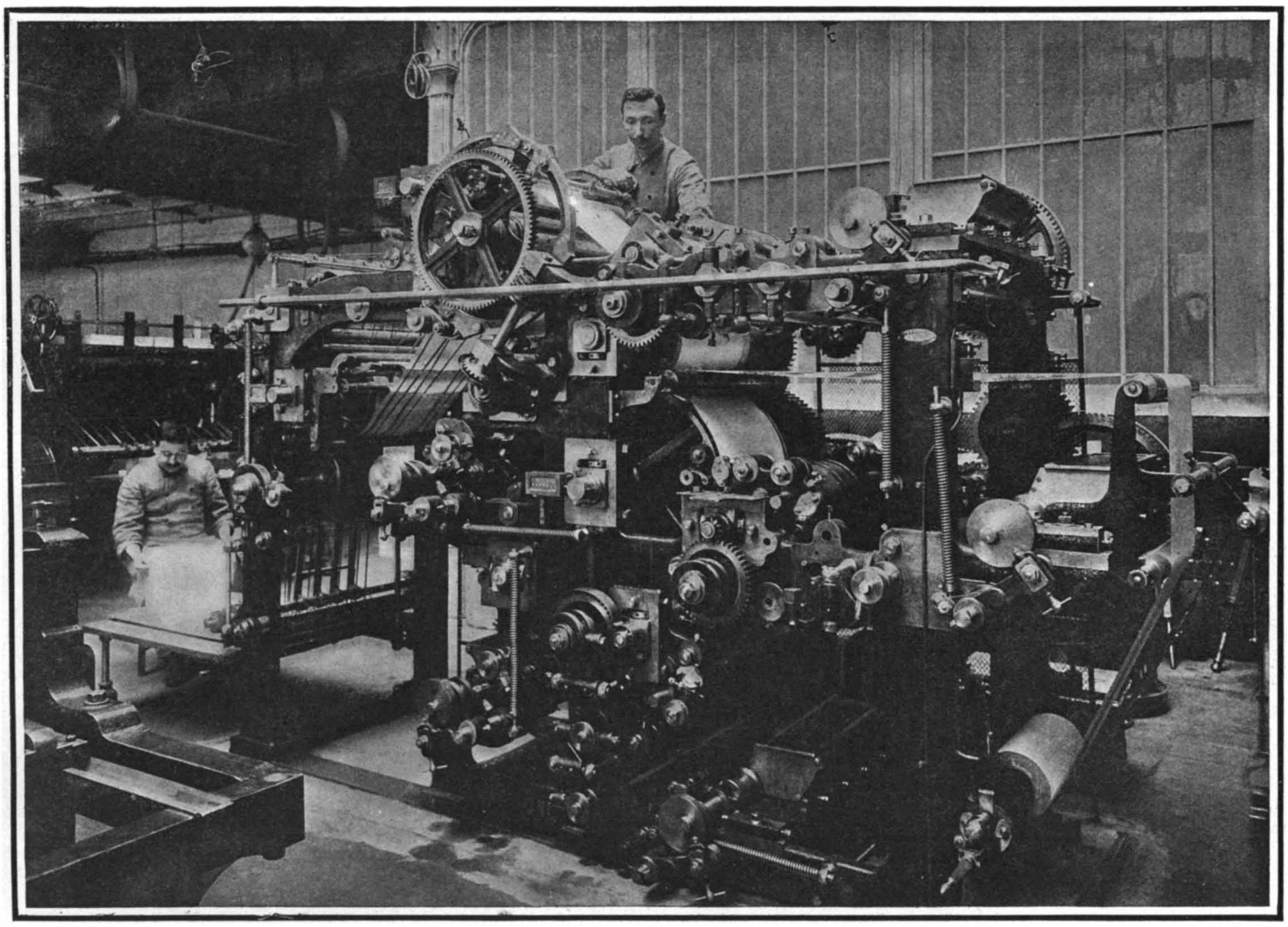
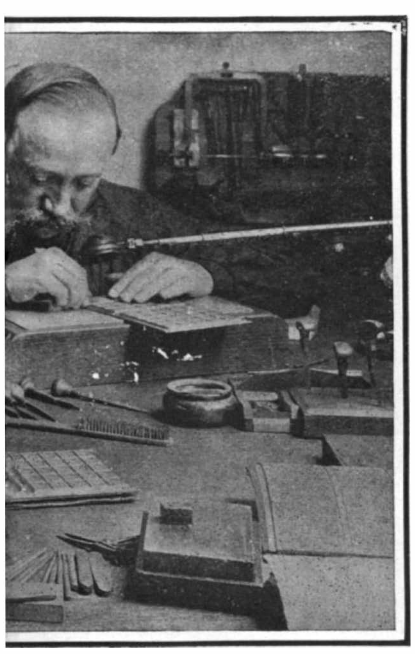


Fig. 8.—Printing money orders on the Marinoni cylinder press.

the revolving table.



re stamps are printed.

Fig. 6.—The perforating machines.

NCH POSTAGE STAMPS.

THE HEAVENS IN JUNE.

BY HENRY NORRIS RUSSELL, PH.D.

IN the month of June the most interesting events for the amateur astronomer are two eclipses, both of which are visible in the eastern United States.

The first is a total eclipse of the moon, which occurs on the evening of the 3rd. The earlier phases of the eclipse take place before the moon rises; which, since she is exactly opposite the sun, happens as the latter sets. By this time she will be fully half immersed in the earth's shadow, and at 7:58 P. M. eastern standard time the last ray of direct sunlight will leave her disk, and she will be totally eclipsed.

In the strong twilight that will still be present she will be invisible; but as the darkness increases, her full disk may be faintly seen, shining with a dull and reddish light, which is due to sunlight refracted through the earth's atmosphere (as through a lens). How bright this will be depends on the weather in the part of the earth where the light must pass (in this case above Norway, Greenland, and Hudson's Bay). If the air is full of clouds there, the moon will be very faint; if it is clear, she will look brighter.

Totality lasts a little more than an hour. At 9 P. M. the moon's edge begins to come out of the shadow. The illuminated portion rapidly grows, and at 10:14 the whole moon is visible, though the western edge will still be darker than the rest, because it is still partly shaded by the earth.

It is not very often that a lunar eclipse happens at such a convenient hour in the evening, and in so genial a season, so that this is a very good chance to see one, especially for the youthful amateur.

It may be remarked in passing that an intelligent interest in eclipses need by no means be confined to adults; with no more apparatus than a tennis ball, a golf ball, and any sort of lamp the affair can be explained and illustrated by the aid of a working model to anybody.

At the new moon following this eclipse there is another—this time of the sun, of course—on the 17th.

As seen from the Eastern States this is a rather small partial eclipse, just before sunset, the sun setting before the greatest phase is reached. It will be somewhat better visible in the northwestern part of the country, where the lunar eclipse can hardly be seen at all.

This eclipse is total, with very short duration, along a track which passes from Siberia to Greenland, and is practically inaccessible; passing right across the unexplored polar region and within a hundred miles of the North Pole itself.

THE HEAVENS.

Turning from these passing shadows to the unchanging stars, we find due south and very high up, at our accustomed hour in the evening, a great red star that must attract even the most careless eye. This is Arcturus, the brightest star in the northern hemisphere of the sky, and also one of the most remarkable.

Though to the naked eye it seems quite fixed—among its neighbor stars—modern telescopic observations would show within a few months that it was moving southward. Since the days of Ptolemy it has moved over a distance equal to fully twice the moon's apparent diameter, and, even to the naked eye, it no longer fits the alignments with other stars which Ptolemy described.

Its real motion is very rapid—about 100 miles per second, according to the latest measures of its distance, which put it rather nearer than the previous determinations, and show that its light takes forty or fifty years to reach us. On the same data, it is about 150 times as bright as our sun; so that it is altogether a very imposing luminary.

The other stars of Boötes are shown on the map, and also in our initial, which shows the figure of the Herdsman, who, with the Hunting Dogs before him, is carelessly pursuing the Great Bear round and round the Pole. The stars ϵ and π (shown on the map) are fine doubles, separable with a three-inch telescope. Below these is Virgo, with the bright star Spica; and lower still, to the right, are Corvus and Crater, resting on the back of Hydra.

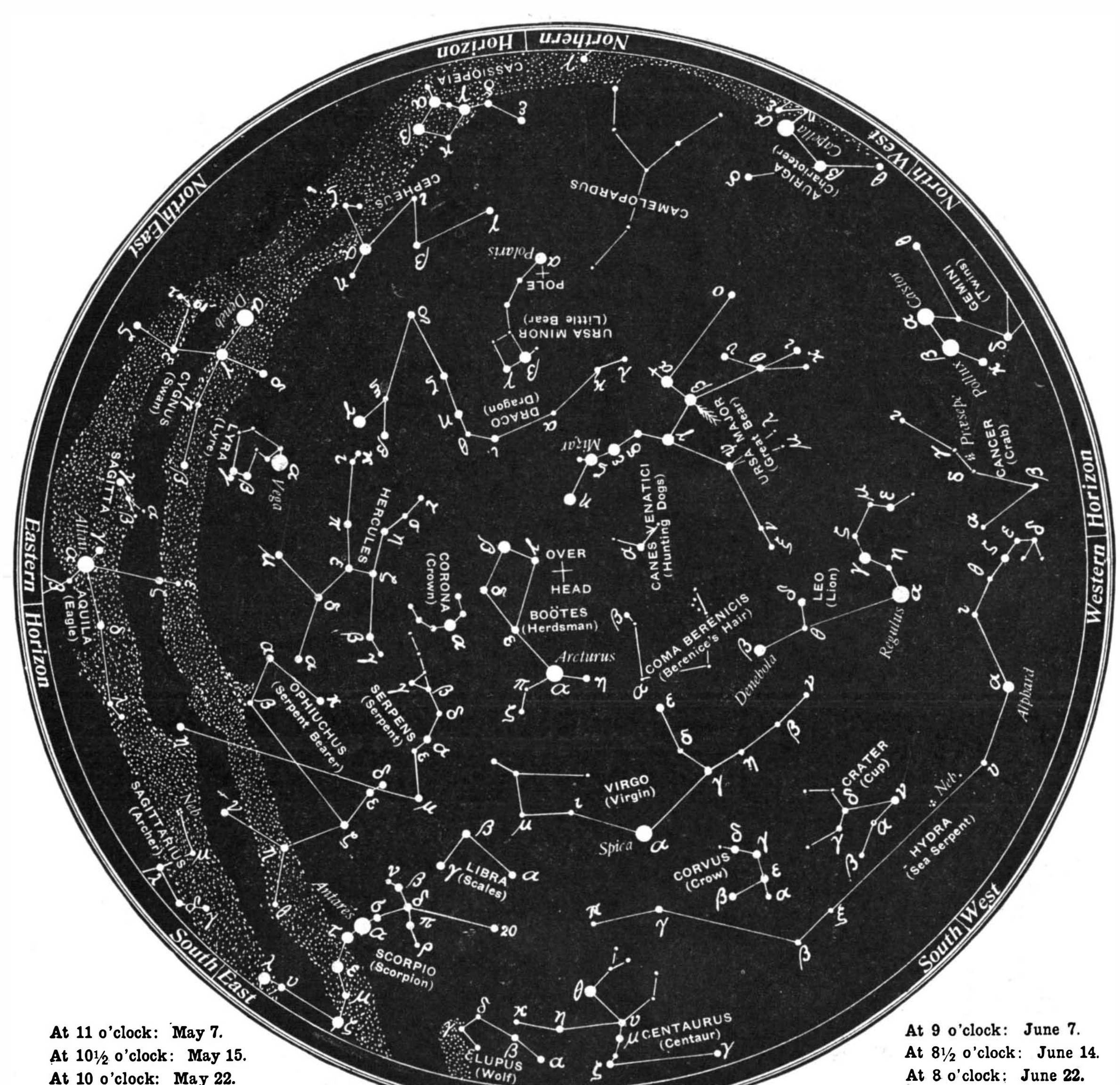
Due south, very low down, is the upper part of Centaurus. The two brightest stars of this constellation, which lie to the eastward of the Southern Cross, and whose line points toward it, are only well visible from points south of 25 deg. north latitude.

Scorpio is well up in the southeast, and the tangled mass of Ophiuchus and Serpens is above and to the left.

Altair has just risen, almost due east, and Cygnus is low in the northeast. Higher up is Lyra, with the great blue star Vega. Between this and Arcturus are Hercules and the semicircle of the Northern Crown.

The Great Bear is almost overhead, northwest of the zenith. Draco and Ursa Minor are above the Pole, and Cassiopeia and Cepheus below it.

Auriga and Gemini are setting in the northwest, and Leo is due west, still pretty well up.



At 11 o'clock: May 7.
At 10½ o'clock: May 15.
At 10 o'clock: May 22.

At 9 o'clock: June 7.
At 8½ o'clock: June 14.
At 8 o'clock: June 22.

At 9½ o'clock: May 30.

NIGHT SKY: MAY AND JUNE

THE PLANETS.

Mercury is evening star until the 14th, and after that morning star. He may be seen just after sunset during the first few days of the month and just before sunrise at its end, but for the most of the time he is invisible.

Venus is evening star, best visible at the end of the month (when she sets at about 8:40 P. M.) but not yet conspicuous.

Mars is in Aquarius, and rises about midnight in the middle of the month. He is steadily growing brighter, but is twice as far away as he will be in September, and only one-quarter as bright.

Jupiter is evening star in Leo, and sets at 11:30 P. M. on the 15th. He is by far the brightest object in the western sky.

Saturn is morning star in Pisces, rising about 1 A. M. toward the end of the month.

Uranus is in Sagittarius, and comes to the meridian at 2 A. M. on the 12th. He will be more conveniently observable after opposition next month.

Neptune is unobservable, setting but two hours after sunset.

THE MOON.

The moon is full on the 3d at the middle of the eclipse, in her last quarter at 10 P. M. on the 10th, new during the solar eclipse of the 17th, and in the first quarter at 2 A. M. on the 25th. She is nearest us on the 12th, and remotest on the 25th.

She passes near Uranus on the 6th, Mars on the 10th, Saturn on the 13th, Mercury on the 17th, Venus on the 18th, Neptune on the 19th, and Jupiter on the 23rd. The conjunction with Venus is close, but moon and planet are too near the sun to be easily seen.

At 9 A. M. on June 21st the sun reaches his greatest northern declination. This will therefore be the longest day of the year—how long depends on the observer's latitude.

At New York the day, from sunrise to sunset, is almost exactly fifteen hours long.

Princeton University Observatory.

Effect of Silicon in Iron.

The effects of silicon upon the physical and chemical properties of iron include the following:

1. Magnetic Properties.—The magnetic permeability decreases as the proportion of silicon increases. In addition to the gradual diminution sudden falls of permeability decrease when the weight of silicon amounts to 1/5, 1/3, and 1/2 of the mixture. These proportions correspond to the formulæ Fe_2Si, $FeSi$, and $FeSi_2$, and the peculiar phenomena observed indicate that these three are the only possible definite compounds of iron and silicon. These results were obtained with iron free from carbon. The combined effect of carbon and silicon on the magnetic properties remains to be studied.

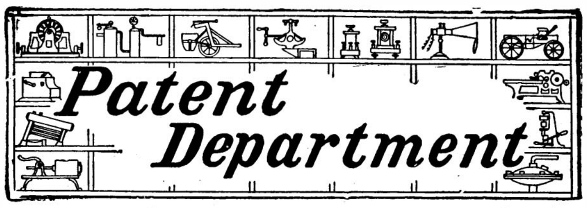
2. Chemical Properties.—The more silicon the iron contains, the smaller is the proportion of carbon which the metal can combine with or dissolve. In presence of silicon, the carbon separates as graphite in the act of solidification.

The characteristic chemical effect of silicon is a greatly diminished susceptibility to attack by acids. The alloys which are best attacked are those which contain more than 1 part of silicon to 2 parts of iron, and which are produced in the electric furnace.

Sulphuric acid can be concentrated to 66 deg. Baumé in vessels made of such an alloy without producing the slightest corrosion. An alloy containing 21 per cent of silicon, immersed for two months in hot sulphuric acid of 22 deg. Baumé, lost less than 1/16 per cent in weight, while ordinary cast iron lost 46 per cent in two hours. A larger proportion of silicon is required to resist nitric acid, which can be concentrated, in vessels of a suitable alloy, to 48½ deg. Baumé.

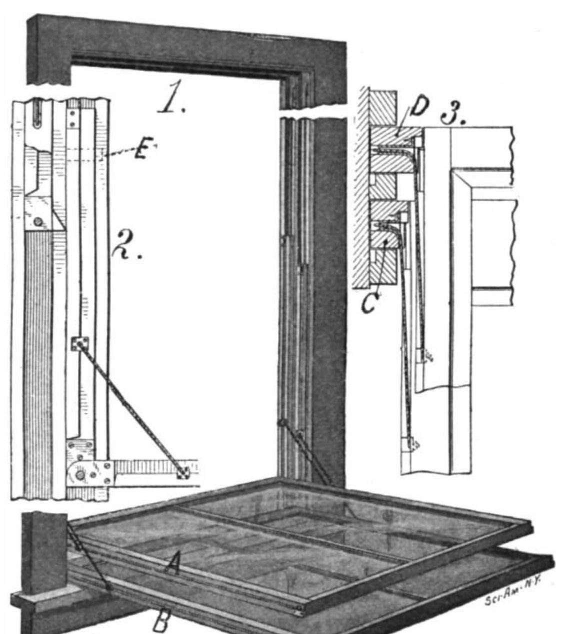
Less satisfactory results were obtained with hydrochloric acid. Ferro-silicon is less affected by acetic acid than any common metal alloy, except tin.

The perfection which has been reached in the manufacture and adjustment of automobiles is well shown by the exhaustive examination of all the working and other parts, in the laboratory of the Massachusetts Institute of Technology, of the Maxwell car, which has recently completed a 10,000-mile non-stop run. After the engine had been officially stopped at the end of twenty-five days' continuous running the car was driven for ten miles for the observation of its general running condition, starting and stopping on the steepest grades in the neighborhood, and showing perfect control by both brake and clutch. The engine was then taken apart, all bolts and nuts with one minor exception were found set up tight, as well as the radiator and water connections; piston rings and cylinders were bright and smooth, and inlet valves and seats clean; the main crankshaft bearings, connecting-rod boxes, and wristpins were measured with micrometer calipers and no wear detected; the push rods, valve stems, and guides were round and smooth, showing no sign of wear, and even on the gear teeth wear was hardly noticeable.



IMPROVED WINDOW CONSTRUCTION.

The window which is illustrated in the accompanying engraving, is so arranged that the sashes may be raised or lowered in the usual manner or, when desired, may be swung inward into a horizontal position for cleaning or repairing purposes. The window frame is provided at the sides with the usual guideways for the sashes *A* and *B* to slide in in a vertical direction. The sashes are provided at each side with fixed stiles, forming an integral part of the sash, and sliding stiles *C* and *D*, complementary to the fixed stiles and hinged thereto at their lower ends, so as to permit the sashes to swing. The sash cords pass in the usual manner over pulleys at the upper end of the frame, and thence run down in grooves back of the sliding stiles, and through grommets therein to the fixed stiles of the sashes. When the sashes are swung up into vertical position, the fixed and sliding stiles may be fastened together by means of a pair of latches. The sashes will then operate vertically, after the manner of the ordinary window sash. If it be desired to clean the window, the latches may be released, permitting the sashes to be swung inward to an approximately horizontal position, as indicated in the illustration. It will be observed that the stiles *C* are somewhat narrower than the stiles *D*, to permit the upper sash to swing freely inward. The stiles are preferably rabbeted, to permit outward swinging of the sashes, and at the same time render

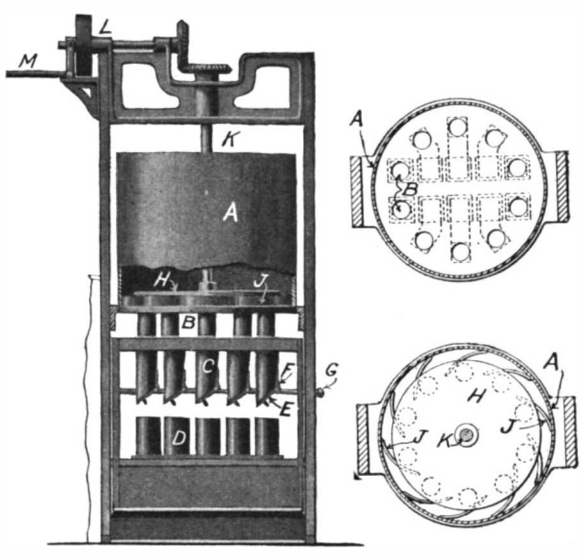


IMPROVED WINDOW CONSTRUCTION.

the sashes air and moisture proof at the joints. The sliding stiles are fitted with guide plates *E*, which extend into a recess formed in the parting strip. It will be observed that in swinging the sashes into the room, they do not interfere in the least with iron guards or fly screens placed outside of the window. A patent on this improved window has been secured by Messrs. L. W. Penzer and J. A. Kain, of Richmond, Va.

CAN-FILLING MACHINE.

Pictured in the accompanying illustration is a machine which is adapted to fill cans or similar receptacles with material such as ground or whole coffee, breakfast cereals, and the like. The machine is provided with a weighing attachment, which will weigh accurately a predetermined amount and deposit this in packages with no waste of material, and without noise or dust. The machine comprises a hopper *A* provided at its lower ends with a circle of spouts *B* which are adapted to feed the material from the hopper into a set of pockets *C*. Below these pockets is a shelf on which a tray may be placed carrying the receiving cans or receptacles *D*. The lower end of each pocket is provided with a door *E*, which is normally kept in closed position by means of a spring *F*. A horizontal slide rod *G* connects with each door *E* and it may be operated whenever desired to open the doors and permit the material in the pockets to drop into the receptacles below. In order to prevent the material from choking the spouts *B*, an agitator is provided in the hopper *A*. This consists of a plate *F* to the lower side of which a series of curved blades *J* are affixed. The plate *H* is secured to a vertical shaft *K*, which by means of suitable gearing is driven by a pulley *L*. A clutch is provided by which the mechanism may be coupled to the pulley *L* and this clutch is operated by an arm *M*. The latter may be connected with any suitable weighing apparatus operated by the shelf which supports the cans. The plate *H* is of smaller diameter than the interior of the hopper, leaving an annular space through which the material that is to be fed into the cans may pass. As the agitator revolves, the blades *J* will scrape the material into the openings *B*. It will be observed from the upper sec-

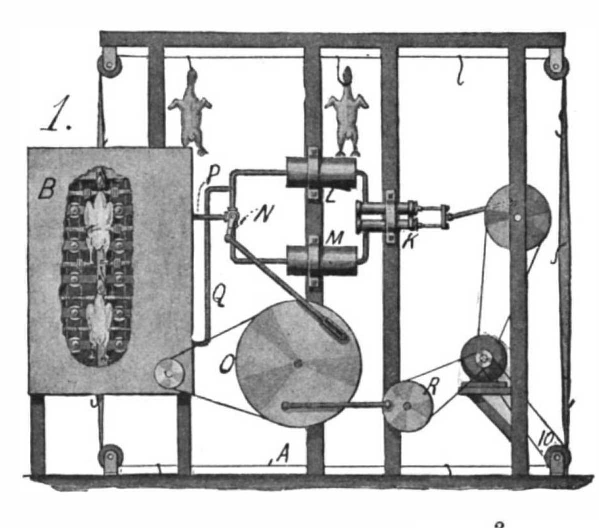


CAN-FILLING MACHINE.

tional view that the spouts *B* are arranged in a circle, but that their lower ends are bent inward so as to deliver the material into the pockets *C* which are arranged in parallel rows. From time to time as the pockets become filled with material the operator throws the lever *G*, which permits them to discharge into the receptacles *D*. The inventor of this can-filling machine is Mr. George H. Mallett, of Copake, Columbia County, New York.

POULTRY-PICKING MACHINE.

A machine for picking poultry has recently been invented which possesses many admirable features, chief of which is that it does not require an operator to hold the fowl against the pickers. The fowls are attached to a belt which travels through the machine, and the picking is done automatically. The endless belt on which the fowls are hung is indicated at *A* in the engraving and it passes upward through the picking chamber *B*. Within the latter are two types of pickers. The lower pickers are of the form indicated in Fig. 2. They consist of a tubular member *C* flexibly connected with a tubular spindle which passes through a frame arranged within the picking chamber. The picker may be moved out of its normal position in any direction required by the passage of the fowl through the chamber. The member *C* is provided with a comb *D* and a slot *E* adjacent thereto. Air may be fed from pipe *F* through the spindle and the slot *E*. The spindle carries a double grooved pulley *G* by which it is connected to an oscillating mechanism. The upper series of pickers are of the form indicated in Figs. 3 and 4. They are also flexibly connected to spindles whereby they may be oscillated and at the same time be moved in any desired direction. The tip of each picker *H* is of annular corrugated form, this form being produced by means of rings *J* which encircle the

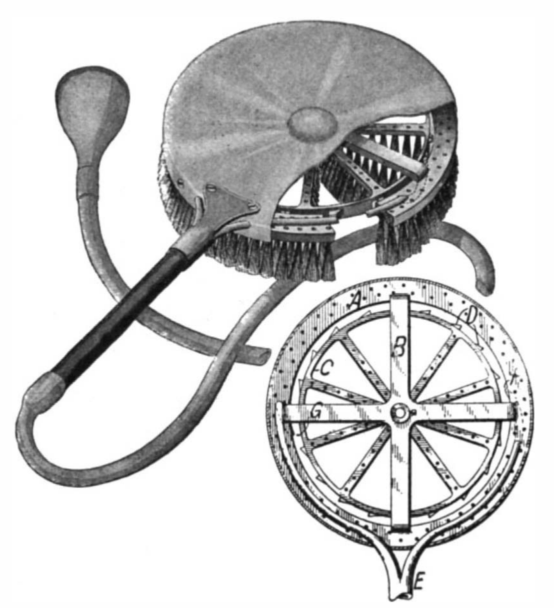


POULTRY PICKING MACHINE.

flexible tips and rings *I* of larger diameter which are situated within the flexible tips. The pickers *H* communicate with an air supply and an alternate compression and vacuum is produced in them, causing them to expand and contract like a cylindrical bellows. The feathers and down on the fowl are grasped between the folds of the bellows and pulled off as the fowl is fed upward by the belt. In order that all parts of the fowl may be brought into contact with the pickers, the belt is given a half turn as it passes through the picking chamber. A small compressor *K* is used in connection with this machine and supplies a compressing chamber *L* and exhausts the air from a vacuum chamber *M*. A three-way valve *N* serves to connect pipe *P* first with one chamber and then with the other. This valve is operated by a pitman which connects with a wheel *O*. The latter is oscillated by means of a continuously revolving wheel *R* with which it is connected by a pitman. The pipe *P* communicates with the pickers and operates the bellows *H* in the manner just described. The pickers *C* are arranged to seize the feathers by means of the combs *D* and at the same time the suction through the slot *E* serves to hold the feathers fast to the pickers and causes them to be torn from the fowl. Immediately thereafter a supply of compressed air passes through the picker, causing it to release the feathers, which are then blown out of the top of the chamber by means of a continuous draft of compressed air from the supply pipe *Q*. The pickers are all belted together and are rocked back and forth by means of belt connection with the oscillating wheel *O*. Mr. Theodore G. Griggs, of 101 North 15th Street, East Orange, N. J., has just secured a patent on this poultry-picking machine.

SELF-CLEANING BRUSH.

The device which is illustrated in the accompanying engraving is particularly adapted for use as a bath brush, although with slight modifications it may be used as a scrubbing brush for floors, windows, and similar articles. The brush is provided with an inner revoluble part arranged, like a water wheel, to be revolved by a stream of water which is supplied from a faucet, through the brush handle. The water serves



SELF-CLEANING BRUSH.

to keep the bristles clean. The outer ring *A* of the brush is formed with a spider *B* in which the inner ring or wheel *C* is journaled. The ring *A* is fitted with two rows of bristles arranged to form a continuous brush surface. The spokes of the inner wheel also carry bristles, the ends of which are at the same level as those of the outer ring. Formed on the periphery of the wheel are a series of buckets *D* which open through the rim. The hollow handle of the brush communicates by means of a branched pipe *E* with two nozzles *F* and *G* which are arranged to direct streams of water against the buckets and thus rotate the wheel *C*. The water passes through the buckets to the inner side of the wheel and is dashed against the radial rows of bristles. The bristles are thus kept continually wet, and the water flowing over them serves to keep them clean. The top of the brush is covered by a casing which prevents the water from splashing upward. A patent on this improved brush has been secured by Mr. M. A. Dickison, of Phœnix, Ariz. (Box 275).

Alkaline Silicates.

The alkaline silicates are usually made by fusing silica with the caustic alkali or its carbonate. The product dissolves in water with difficulty and it must be treated with water at a high temperature and pressure in order to convert it into a salable article. The solution thus obtained requires tight packing for shipment, and the expense of carriage is further increased by the large quantity of water which must be transported with the silicate. By a recently devised process silicates of the alkalies are produced in the dry state and are easily soluble in boiling water. This result is obtained by forcing steam or air through the fused mass and thereby converting it into a fibrous form similar to that of cotton wool. This operation is much cheaper than treatment with hot water under pressure.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

DISPLAY APPARATUS.—E. F. CANNON, Portland, Ore. The object of the invention is to provide a simple and inexpensive apparatus which has shelves for carrying and exhibiting wares and merchandise, which are movable in different directions and in different ways, to display the exhibited articles in a plurality of fashions. Mr. Cannon has invented another display apparatus by means of which merchandise and other articles can be advantageously exhibited and can be mounted upon traveling shelves moving in a plurality of directions, and which is portable so that it can be moved from place to place as desired.

BARREL-SHELF. — A. HUGHES, Houston, Texas. The purpose here is to provide a portable barrel shelf which can be conveniently applied on a barrel to bear the weight of a sack and its contents in filling the sack, and which can be conveniently folded into compact form and stored in a small space when not in use.

ENLARGING ATTACHMENT FOR CAMERAS.—C. F. ADLON, Las Vegas, New Mexico. One purpose of the invention is to provide an attachment whereby large prints may be made upon sensitized paper from small negatives, and to so construct the attachment for the enlarging camera that it can be expeditiously and conveniently set up and applied to an ordinary camera, and as readily and quickly removed therefrom.

Hardware.

CONVERTIBLE LADDER.—S. S. GROVES, Loraine, Ill. This invention is an improvement in ladders and especially in ladders which may be extended or may be converted into step ladders as desired. A hinge joint is movable to a point below the guides on the main section when the parts are adjusted, so that when the ladder is extended the extension is firmly secured and braced by the guides on the main section.

ADJUSTABLE CASTER.—J. SHARON, Canaseraga, N. Y. The invention has for its object to provide a stove leg to which is pivoted an arm having a wedge-shaped flange which is adapted for engaging snugly converging sides of the stove leg, there being a caster pivoted to the fl. ge and means being provided for holding the arm off the floor.

ADJUSTABLE WRENCH.—O. C. CALDWELL, Klamath Falls, Ore. The wrench is of the sliding jaw type, and consists of but two sections, each cut from plate metal as flat blanks into proper form and completed by lapfolding members of each section upon other portions thereof, the two sections when completed being adapted for slidable engagement and locking adjustment at desired points of separation of the jaws.

NUT-LOCK.—H. W. WORTHINGTON, Richfield, Kan. The nut lock devices forming the subject of this patent include a washer of a special iorm. The washer is provided with a tooth which is bent out of the plane of the washer and is adapted to engage a ratchet piece in the nut to be locked. The washer is distinguished by an elliptical opening which permits the washer to be driven in the direction of the major axis of the opening and out of engagement with the nut.

MITER-BOX.—J. F. WINKLER, Marquette, Mich. This box comprises a rocking trough for securing the work, means for indicating the angle of its inclination, a saw guide arranged transversely of the trough, and mounted for swinging movement in a horizontal plane, and means for indicating the angle of inclination of the guide with respect to the trough.

Household Utilities.

FLAT-IRON STOVE.—E. L. HEGARTY and H. L. MOODY, Waterville, Maine. The invention belongs to that class of stoves or heaters in which an inverted flat-iron, generally electrically heated, constitutes the heating element, and has for its purpose a holder which will firmly support any ordinary shaped iron in an inverted position, and a member for protecting the pressing face of the iron, extending beyond the edges thereof.

AWNING.—W. SULLIVAN, New York, N. Y. The more particular purpose of this improvement is the production of a type of awning suitable for stores, dwellings, and the like, such awning being provided with means whereby it may be connected at one of its ends with one of the sashes, and at its other end with a frame pivotally supported upon the window jamb.

Machines and Mechanical Devices.

HAMMER.—H. J. AUGUSTINE, Mooreland, Okla. The construction accomplishes an increase in the mobility of the hammer so that it may be shifted in a number of independent directions for the purpose of applying it to different portions of work, or readily placing it out of the way a moment after it has been used; and to more evenly distribute the weight of the hammer and mechanism immediately connected therewith relatively to its support.

METALLIC BELT.—H. L. CANNE, Dingman Township, Pa. The object of the present invention is to provide a belt for use in power transmission or for use as an over-shoe for vehicle wheels and for other purposes, the belt being strong, durable and exceedingly flexible in every direction. It relates to metallic belts such as shown and described in the application for Letters Patent of the U. S., formerly filed by Mr. Canne.

BUNDLE-FORMING MACHINE.—A. J. CHESSON, Suffolk, Va. The machine facilitates the forming of bundles or packages of boards of short lengths, or similar articles. It facilitates the forming by providing a bed upon which the articles are laid, and the device includes means for bringing the different articles or members which form the bundle into alinement longitudinally and transversely.

CHAIR.—A. H. CLARK, Denver, Col. The invention relates more particularly to chairs or seats for theaters and the like. An object is to have a movable seat held by resilient controlling mechanism in an elevated position and which can be depressed, locked in a partially depressed position and released from this by a further movement of the seat.

BURGLAR-ALARM. — H. SPENCER, Ridgefield Park, N. J. More specifically the invention pertains to that type of alarm which employs a bell which rings automatically when its plunger is pressed, and the improvement concerns itself especially with the construction of means for pressing the plunger of the bell and for disengaging the operating mechanism when desired.

AUTOMATIC REGULATING-VALVE.—J. C. SMITH, Louisville Ky. The subject of the invention is intended for controlling the flow of weak liquor to an absorber. This liquor leaves the generator under a pressure of approximately 150 pounds, while the gas admitted to the absorber is under a pressure of from 5 to 15 pounds. The returning fluid absorbs 27 to 29 per cent. of its weight of ammonia gas, and for this absorption to take place it is necessary that the pressure of the incoming fluid be equal to that of the incoming gas.

PHOTOGRAPHIC-PAPER-PRINTING MACHINE.—E. N. KERR, Rock Island, Ill. One purpose here is to provide a construction of machine for printing photographic paper, especially designed for use in connection with the so-called gas-light paper, wherein the time of exposure is under the complete control of the operator and may be made to vary as desired from a second or seconds to a minute or many minutes.

Prime Movers and Their Accessories.

ROTARY EXPLOSION-ENGINE.—W. A. SMITH, Los Angeles, Cal. There is provision in this invention of an improved rotary explosion or gas engine, arranged to utilize the force of the explosive mixture to the fullest advantage by giving a plurality of impulses to the rotor at each revolution thereof, thus insuring an easy and steady running of the engine.

REVERSING-VALVE.—J. W. BELL, Shenandoah, Pa. When this valve is closed it completely shuts off all communication between the pressure chamber, back of the valve and the cylinder, with the exhaust ports leading from the chambers at the ends of the side valve, thus preventing a loss of power from the cylinder through a reverse valve chamber, which stops all interference with the operation of the slide valve and auxiliary plunger therefor when used by reason of counter pressure leaking from the back of the reverse valve.

Railways and Their Accessories.

RAILROAD CASH-FARE RECEIPT.—G. McN. ROSE, JR., Nashville, Tenn. The invention comprises more particularly an arrangement of lines inclined relatively to each other and to the sides of the ticket or receipt, and bearing numerals and other indications of different amounts in dollars, dimes, and cents. When the receipt is used, a portion is torn off corresponding to the amount paid by the passenger for fare, and the inclined lines indicate the steps of division between the stub and the portion given to the passenger.

RAIL-BASE AND METAL CROSS-TIE FOR RAILWAY TRACKS.—M. A. TEMPLE, Berlin Heights, and H. C. TEMPLE, Cleveland, Ohio. The invention provides a resilient, continuous rail base for the rails of a railroad track and angle iron tee bars therefor, dispensing with wooden cross ties and affording longitudinal and transverse supports beneath the rails that are very durable, adapted to hold the rails from spreading or creeping, and prevent a derailed car from leaving the road bed, thus obviating accidents.

Pertaining to Recreation.

TOY-PISTOL.—M. D. GREENWOOD, Hoosick Falls, N. Y. More particularly the invention relates to that type of pistol in which a resilient band is so arranged that when released a projectile, such as a marble, stone, or bean, may be thrown. It holds the projectile in the barrel and adjacent the plunger while the pistol is being aimed and to release the projectile simultaneously with the release of the plunger.

AMUSEMENT DEVICE.—W. P. HAYES, New Haven, Conn. In a bowl-shaped body the inventor provides a central circular seat at the bottom, and a circumferential seat at the side, arranged at or near the top at approximately right angles to the bottom seat. Passengers enter the bowl through an opening, and when this is closed the bowl is revolved on its vertical axis, and by centrifugal action moves the passengers from the bottom seat to the side seat, where they remain suspended at right angles to the natural seating posture.

SNELLED-HOOK BOX.—M. M. SCHANEY, Dubois, Pa. In order to carry out the invention a cylindrical box is provided, having therein a spring-actuated reel, on the periphery of which is arranged a moistening pad. The reel is provided with grooves whereby the hooks may be protected, together with devices for keeping the snells taut and always accessible and in a condition to be used immediately.

Pertaining to Vehicles.

DUMPING-WAGON. — T. WRIGHT, Jersey City, N. J. The object of the invention is to produce a construction in which the body of the wagon or cart may be raised and inclined, but in which the center of gravity of the body and its load will remain in substantially the same plane as when the body is in its normal position on the track.

ROTARY WHEEL-GUARD.—F. E. HUTCHINGS, New York, N. Y. The special object of the invention is to so construct and mount the guard that it will be at the minimum distance from the wheel, and the possibility of any person or object falling behind the guard and in front of the wheel will be eliminated. It relates to improvements shown in a prior application filed by Mr. Hutchings.

VEHICLE-WHEEL.—G. R. WILLIAMS, Little Rock, Ark. One purpose of the invention is to provide a wheel for carriages, automobiles, and like vehicles, that will possess efficient resilience without detracting from its supporting qualities, and to provide a construction wherein a resilient tire is combined with compensating spokes.

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.

Legal Notices

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