SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1905, by Munn & Co.]

Vol. XCIII.—No. 11.
ESTABLISHED 1845.

NEW YORK, SEPTEMBER 9, 1905.

10 CENTS A COPY.
$3.00 A YEAR.

This Bridge has the Pivotal Towers and Chain Cables Advocated for the Rejected Manhattan Bridge over the East River.

THE HANDSOME NEW CHAIN SUSPENSION BRIDGE AT BUDAPEST.—[See page 197.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

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

THE SCIENTIFIC AMERICAN PUBLICATIONS.

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

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

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

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 9, 1905.

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.

THE BUDAPEST AND MANHATTAN SUSPENSION BRIDGES.

The publication in this issue of an illustrated article descriptive of the handsome chain-cable bridge across the Danube at Budapest, Hungary, possesses timely interest for two reasons: First, that this bridge represents the advanced ideas of the leading bridge builders of the world on suspension-bridge construction; and secondly, that it embodies a type of cable and a form of tower similar to those which were adopted by the bridge commissioner under the late administration for the Manhattan Bridge across the East River, the designs for which were unceremoniously rejected by his successor immediately upon taking office. The Manhattan chain-cable bridge, however, marked a distinct advance upon the Budapest bridge, in the fact that instead of providing a separate suspended stiffening truss, the chain cables themselves were stiffened by means of trusses of which the cables formed the upper chord. This arrangement had the advantages of securing a decided economy of material, a great increase in the stiffness, and a large reduction in the total cost. Although the Manhattan bridge was designed by a noted authority on long-span suspension bridges, it was thought advisable that all doubt as to the merit of the system should be removed by submitting the plans to a board of experts composed of some of the most eminent bridge engineers in this country. The board gave its unanimous approval to the plans and thereby settled once and forever, one would have thought, the question of their feasibility.

It is a matter of history that, in the face of this indorsement, the present bridge commissioner threw out the accepted plans, and substituted for them a type of bridge which is not only distinctly behind the advanced theory and practice of long-span suspension bridges, but is well known to take longer to construct and to be decidedly more costly. Of course the bridge commissioner is entitled to his individual opinion; he is entitled to credit for sincerity in his opinion; but the people of New York city would have more respect for both, if he had not maintained such profound secrecy regarding the plans for the new bridge that even at the present writing, after the bids have been turned in, it is impossible to secure access to the strain sheets for the purpose of making intelligent comparison as to weights and costs between this bridge and the one it supersedes.

Time and again the request has been made that in order to protect the interests of the city, the new plans, like the old plans, should be submitted to an independent board of experts. Failing this, it was suggested that the least that could be done was to present both sets of plans to the contractors, and secure bids upon each. If this had been done, it is confidently believed by bridge engineers in general, that the chain-cable design would have secured bids that were far below those that have been turned in for the wire-cable type. We had fully expected to be able by this time to present a comparative table of weights of material, and of costs for the two designs based upon the strain sheets. But the most extraordinary and unprecedented course followed by the bridge commissioner in not making public, even for expert investigation, the strain sheets of his wire-cable bridge, renders any such comparison quite impossible.

The fact that the city is getting an inferior bridge may be seen, however, even from a cursory comparison, based on only one or two features. Thus, in the original design the towers were designed, like those at Budapest, to rock upon pin footings at the piers—a feature that was favorably commented upon by the board of experts. In the new design the pins have been abolished, and square footings substituted. This was a distinctly retrograde step in itself; but the mischief is aggravated, when we find that the cables are to be rigidly fixed to the top of the towers; for this renders it certain that the pull of the cables will result in uneven and uncertain distribution of pressures on the piers, and this in turn will tend to produce uneven settlement. Furthermore, although the towers are to be 27 feet less in height, they will weigh no less than 4,100 tons more.

Comment on such facts is superfluous.

Again, in the rejected design the massive floorbeams, 120 feet in length, were hinged at two points to allow for unequal deflection of the two pairs of cables, and prevent injurious bending stresses in these floorbeams. These hinges are an absolute necessity, for the bridge really consists of two bridges, side by side, and at different hours of the day one side may be loaded more heavily than the other and will be depressed accordingly. As a matter of fact, observation has shown that the outside cable on one side of the Brooklyn Bridge when it is under heavier load is sometimes depressed three feet below the other. The same causes will produce the same effects in the Manhattan Bridge; and the provision of lateral flexibility in the floor system is a necessity recognized by all competent engineers. Yet in the present design the floorbeams are rigid and continuous from end to end. This means that destructive stresses, that have not been in any way provided for, will be set up; the life of the floor system shortened, and the repair bill increased proportionately.

The two cases above mentioned are sufficient to indicate that the new design is distinctly inferior to the earlier plans. It will prove to be some $2,000,000 more costly; and the city will be fortunate if it can make use in 1910 of this greatly needed structure, which, but for the manipulations of a few politicians, would have been opened in the year 1907.

NAVAL LOSSES OF THE RUSSO-JAPANESE WAR.

In the magnitude of the losses incurred history does not furnish a parallel to the great naval conflict, which has been brought to a close by the recent negotiations in this country. From time to time during the past eighteen months, we have portrayed and recorded the principal events of the struggle; and it becomes a matter of interest at the close to sum up the injuries mutually inflicted by the two combatants. At the very outset of our comparison, the matter may be summarized by stating that the whole available fighting forces of one country have been wiped out, while the fighting strength of the other has been, strange to say, greatly augmented, so that the victor comes out of the struggle decidedly stronger in ships and general war material than he was at the firing of the first gun.

In the first place, it must be recognized that both combatants concentrated at the scene of hostilities every available ship in their respective navies. For Japan, this meant every ship that she possessed; for Russia, it meant every ship that was capable of being put into commission, or that already was in commission, with the important exception of the Black Sea fleet which, by treaty, was prevented from leaving the Black Sea. Of the sixteen battleships which, first and last, Russia was able to assemble in the Far East, thirteen, of the united displacement of 153,416 tons, were sunk; two were captured by the Japanese; and one was interned, the total losses in battleships amounting to sixteen vessels, of a united displacement of 189,682 tons. Japan, on the other hand, out of six battleships lost two, of the united displacement of 27,700 tons, both of these vessels being sunk by mines. Of armored cruisers, Russia lost five, of 38,630 tons aggregate displacement. Japan lost no vessels of this type. Of protected cruisers, six Russian ships of 29,730 tons aggregate displacement were sunk, and five of 29,210 tons total displacement were interned, or eleven vessels of 58,940 tons displacement. Japan lost four protected cruisers of 12,750 tons total displacement. In coast-defense vessels Russia lost one by its being sunk in battle, and two were captured by the Japanese, representing a total loss of three vessels of this class, of 12,378 tons total displacement. One Japanese coast-defense vessel of 3,717 tons displacement was sunk during the war.

In the above enumeration we have taken account only of the more important classes of warships. There have been other losses in torpedo boats, converted cruisers, supply ships, etc., which have occurred mainly on the Russian side. The total losses in the more important ships amount, on the Russian side, to thirty-five vessels, of a total displacement of 299,630 tons; while the loss on the Japanese side amounts to seven vessels, of 44,167 tons displacement.

Now that it is agreed that the Russian ships which fled for refuge to neutral ports, and were interned, are to belong to Russia, it is possible to make a rough estimate of the present relative standing of the two navies. If, for convenience, we suppose that the interned ships could be placed at once in commission, Russia's available navy to-day in the Far East (and as we have seen, this is practically the whole of her available navy) would amount to one battleship, the "Czarevitch," now interned at Kiauchau; two armored cruisers, the "Gromoboi" and "Rossia," now at Vladivostock; and six protected cruisers, one of which is at Vladivostock, the others being interned at various neutral ports. Japan, on the other hand, has not only made good the loss of the two battleships by the capture of two of the Russian battleships; but according to reports which have come, apparently under official sanction, from the Far East, she has raised four battleships, one armored cruiser, and one protected cruiser, that were sunk at Port Arthur, and also the protected cruiser "Variag," which was sunk at Chemulpho. This will give Japan a total of ten battleships, nine armored cruisers, and about a dozen protected cruisers, which means that she has a much more powerful navy to-day than she had when the first blow was struck some eighteen months ago.

It is one of the inexplicable facts of the war that the Russians should have left four battleships, an armored cruiser, and a protected cruiser at Port Arthur in such a condition that the Japanese have been able to raise them and take at least two of them to Japan. Naval officers are asking why the Russians, when they set sail from Port Arthur on August 10, did not do so with the determination either to sink some of the enemy or be themselves sunk in the attempt. Failing this, they should at least, in sinking their own ships just before the final surrender at Port Arthur, have wrecked them so completely as to render their subsequent salvage by the Japanese impossible. As it is, the Japanese are likely to put four of these very battleships in commission under their own flag—a feat which must certainly be reckoned as one of the most brilliant of the many brilliant things done by this remarkable people.

PEACE IN THE FAR EAST.

The late Russo-Japanese war has been a war of surprises. The Japanese in particular have astonished the world by the unbroken succession of victories that has crowned their efforts. But nothing that they have done has been so truly dramatic as the sudden display of magnanimity with which, in the full flush of their victories, they suddenly, in the interests of peace, withdrew their demands for the legitimate fruits of conquest, and met the uncompromising stand taken by their beaten foe. Peace hath its victories no less than war; and in consenting to forego the $600,000,000 indemnity, which by every precedent she was entitled to demand, Japan has won a moral victory which, in its way, is as great as any she has commanded by force of arms. It is an extremely gratifying feature of the successful issue of the negotiations, that the whole world has been quick to recognize this element of magnanimity on the part of the Japanese nation. Not in a single instance has it been suggested that it was fear on the part of Japan that she could not prosecute to its bitter end the war she had begun, that led her to make the concession. Indeed, there can be little doubt that at the crisis of the negotiations, she was within an ace of returning to the arbitrament of war; and it is significant that the whole world is of one accord in attributing the present peace largely to the untiring effort and wonderful tact displayed by President Roosevelt in preventing a final rupture, and in bringing these most delicate negotiations to their present happy conclusion.

It was peculiarly fitting that, outside of the plenipotentiaries, the main instrument in bringing this colossal and bloody struggle to a close should have been the Chief Executive of a nation, one of the first of whose avowed objects is the development of the arts of peace, undisturbed by the burdens and entanglements which rest upon and involve a nation that is professedly warlike. It required no little courage and an infinite amount of tact to approach the belligerents at the very time when the attitude of both of them seemed to be firmly set against receiving the offices of any intermediary. When the first overture was made, not a government the world over believed that it would be acceptable, and up to the very hour of his final success it was predicted, even at the very town where the negotiations were in progress, that his efforts for peace would prove to be completely abortive. It may be said, without fear of contradiction, that this latest act of our President will go down into history as one of the most brilliant and beneficent acts of statesmanship achieved by any President of the United States.

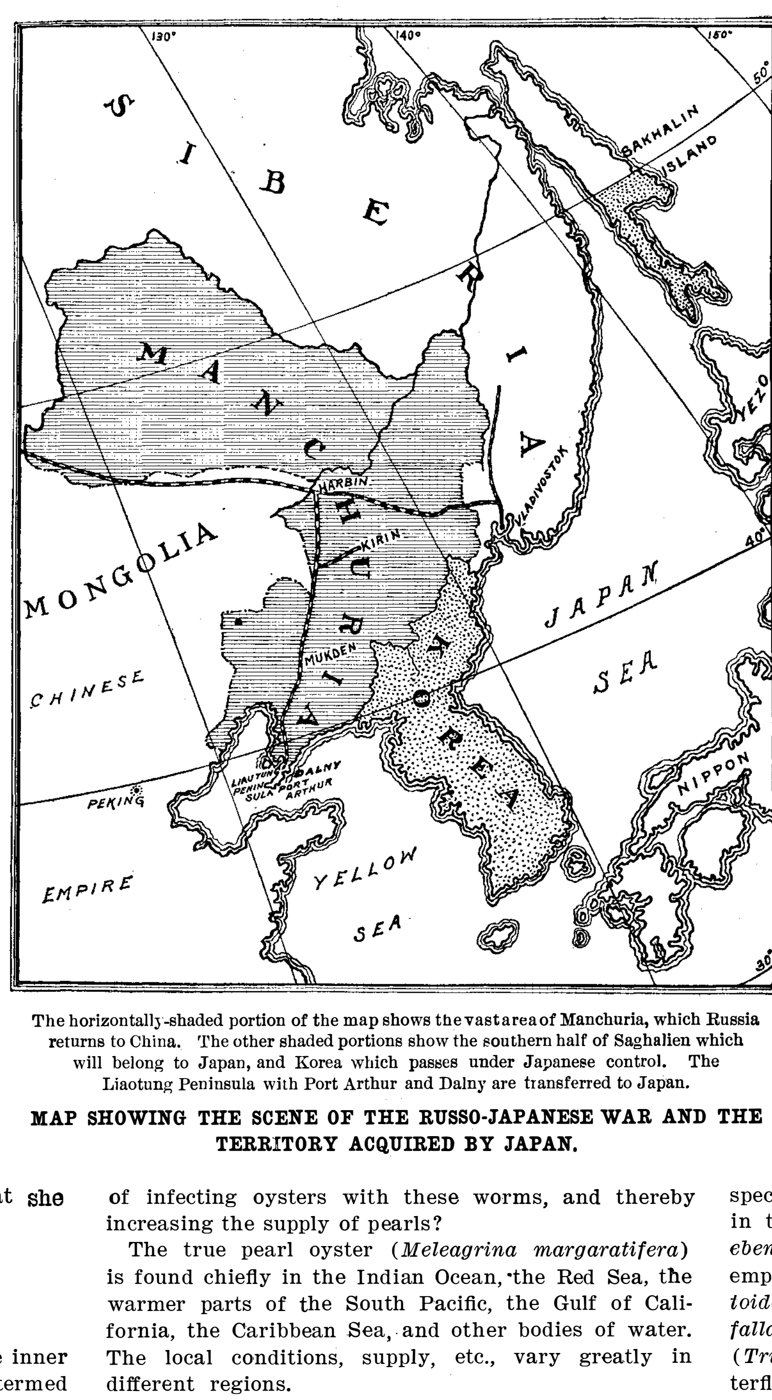
The terms of the treaty, as drawn up in its final form, will prove, all things considered, to be about the best that could be devised, not merely for Japan and Russia, but for all the complicated interests that are involved in the Far Eastern question. Japan has gained all and more than she sought at the commencement of the war. Russia, it is true, has seen her dream of military empire and domination pass absolutely out of sight. But it is quite possible that this loss will ultimately prove to be her gain; for had she continued to follow out that policy, she would ultimately have been involved in a conflict far wider in its scope and more disastrous in its results than that which has just been concluded. Moreover, the generosity of Japan in demanding less than the legitimate fruits of her victories now makes it possible for the contending countries to settle down into mutually amicable relations, each assisting in that future and wonderful development of the Far East to which the present peaceful negotiations will prove the threshold.

The attitude of Japan at the opening of the war was shown in the following statement, which she issued to the powers at the outbreak of hostilities: "It being indispensable to the welfare and safety of Japan to maintain the independence and integrity of Korea, and to safeguard her paramount interests therein, the Japanese government finds it impossible to view with indifference any action endangering the position of Korea. Russia, notwithstanding her solemn treaty with China and her repeated assurances to the powers, continues in occupation of Manchuria, and has even taken aggressive measures on Korean territory. Should Manchuria be annexed to Russia, the independence of Korea would naturally be impossible." In the negotiations immediately preceding the war, Russia declined to give any guarantees regarding Manchuria. She also demanded the establishment of a neutral zone in Korea, extending south from the Yalu River; but she declined to establish a similar neutral zone north of the river in Manchuria. It was at this point that the negotiations broke down.

In the terms of peace, as now agreed upon by the plenipotentiaries, it will be seen that Japan secures all, and more than all, that she had asked.

1. Russia recognizes the preponderating interests of Japan in Korea, which will now be under a Japanese protectorate, and will become to all intents and purposes a Japanese colony.
2. Manchuria will be evacuated both by the Russian and Japanese forces, and that great empire will be restored to China.
3. Russia transfers to Japan the leasehold of the Liaotung Peninsula.
4. Russia returns to China its civil administration of Manchuria.
5. The southern and more valuable half of the island of Saghalien is to belong to Japan, and the two countries mutually agree not to erect any military works on that island.
6. Russia transfers to Japan, without compensation, all the docks, magazines and military works at Port Arthur and Dalny.
7. Russia transfers to Japan all of the railroad through Manchuria between Port Arthur and Kunshien, retaining that portion of the line (about one-third) from Kunshien to Harbin.
8. Russia grants to Japan valuable fishing rights along the Siberian coast.

The magnitude of the changes thus brought about in the Far East will be realized by a study of the accompanying map covering the area affected by the negotiations. Russia still retains intact the Transsiberian railroad and the splendid terminal harbor at Vladivostock; she will thus be in a position to utilize these great works for their legitimate purposes of assisting in the development of Siberia by bringing its products to the Eastern Sea. By the acquisition of the southern half of the island of Saghalien, Japan once more acquires land that was originally her own, the loss of which has ever been a sore point with that proud and patriotic people. In Korea she will have ample room for her natural instincts of colonization; and the possession of Dalny and Port Arthur will place her in a strong strategic position to maintain and protect what she has won as the fruits of this costly war.



The horizontally-shaded portion of the map shows the vast area of Manchuria, which Russia returns to China. The other shaded portions show the southern half of Saghalien which will belong to Japan, and Korea which passes under Japanese control. The Liaotung Peninsula with Port Arthur and Dalny are transferred to Japan.

MAP SHOWING THE SCENE OF THE RUSSO-JAPANESE WAR AND THE TERRITORY ACQUIRED BY JAPAN.

PEARLS AND PEARL SHELLS.

BY RANDOLPH I. GEARE.

Speaking generally, the substance forming the inner layers of the shells of any nacreous mollusk is termed "pearly." In the mass it constitutes what is known as "mother-of-pearl," while in the form of a detached lustrous concretion it is a "pearl." Dr. W. A. Herdman, of the University of Liverpool, England, in reporting recently on the pearl-oyster fisheries of Ceylon, makes some very interesting statements as to the origin of pearls, from which it appears that some pearls, or pearly excrescences on the interior of the shell, are due to the irritation caused by boring sponges and burrowing worms. It would seem that minute grains of sand and other foreign particles gain access to the body inside the shell, which are popularly supposed to form the nuclei of pearls, only under very exceptional circumstances; in fact, only one pearl out of a large number which Dr. Herdman decalcified, contained in its center what proved to be beyond doubt a grain of sand. It is only when the shell is injured, as by breaking off or crushing the projecting "ears"—thereby enabling some fine sand to work in—that such inorganic particles supply the irritation which gives rise to pearl formation. Another class of pearls, found in the muscular tissue of the animal, are called "muscle-pearls." They have no organic nuclei, but seem to start as minute calcareous concretions in the tissue. The choicest pearls, to which Dr. Herdman gives the name "cyst" or "orient," occur in the thin muscular margin of the mouth, or in the thick, white, lateral part over the stomach and liver, or at times are found free in a cavity of the body; and Dr. Herdman's observations have caused him to remark that the majority of the fine pearls found in the soft tissues contain more or less recognizable remains of parasitic worms, so that the stimulation which eventually causes the formation of an "orient" pearl, is due to infection by a minute worm which becomes incased and dies; thus, as Dr. Herdman puts it, justifying in a sense Dubois's statement that "the most beautiful pearl in the world is in short nothing more than the brilliant sarcophagus of a worm."

Dr. Kelaart, another prominent authority on pearls, is credited with having been the first to connect their formations with the presence of wormy parasites, although as far back as 1852 Filippi proved that the trematode worm, known as *Distomum duplicatum*, was the cause of pearl formation in some of the fresh-water mussels. Other authorities, such as Humbert, the Swiss naturalist, agree that these worms play an important part in the formation of pearls; and, this being so, it may be asked, What is to prevent the possibility of infecting oysters with these worms, and thereby increasing the supply of pearls?

The true pearl oyster (*Meleagrina margaratifera*) is found chiefly in the Indian Ocean, the Red Sea, the warmer parts of the South Pacific, the Gulf of California, the Caribbean Sea, and other bodies of water. The local conditions, supply, etc., vary greatly in different regions.

The pearl fisheries of India have long been famous. The most important are in the Gulf of Manar. On the Ceylon side the fisheries were very profitable in 1903 and 1904. The seasons are irregular here, as elsewhere, owing to the frequent disappearance of the oysters before they reach the proper age of production, which is four to six years.

As the *modus operandi* of these fisheries is in general similar in every region, a brief description of that employed in the Ceylon fisheries will suffice for all. When conditions are favorable, a fishery is organized, and two hundred or more large boats are fitted out, manned by sturdy natives, each boat having its complement of divers. The boats, grouped in fleets of sixty or seventy each, start at night so as to reach the banks by sunrise. Each boat generally carries two divers, and is manned by ten rowers, a steersman, and a shark-charmer (*pillal karras*). He is a very important personage, for upon his mystic ceremonies the diver chiefly relies for protection from the numerous sharks; but he also arms himself with a club in case the incantations of the "charmer" should fail! As soon as the bank is reached, a signal gun is fired and diving commences. The diver has a stone of granite weighing about forty pounds attached to the cord by which he is let down in order to facilitate his descent. Divers work in pairs, one going down while the other stays on board to watch the signal cord. When this is jerked, the stone is pulled up first, then the basket of oysters, and lastly the man! Divers generally remain below about a minute, and are expected to make forty or fifty descents a day. The pearls are sorted into ten different sizes by passing them through brass sieves containing respectively 20, 30, 50, 80, 100, 200, 400, 600, 800, and 1,000 holes. The number of oysters obtained daily in these fisheries is estimated at about a million. These are auctioned off, and frequently bring $10 to $14 a thousand, while even as high a price as $24 a thousand has been reached. The present local price for selected pearls of one carat and upward is about $20 per carat. In 1903 the government realized $271,850, and in 1904, $351,564 from these fisheries.

Among other localities where pearl fisheries are carried on may be mentioned the Merguian Archipelago under the government of Burma, the lower end of the Red Sea, the Persian Gulf, the waters around the Molucca Islands, in the neighborhood of Zanzibar, and on the west coast of New Caledonia. Nearer home are the fisheries of La Paz, in Lower California, British Honduras, Panama, along the coast of Ecuador and of Peru; and in the lower Gulf of Maracaibo. There is also a flourishing pearl fishery on the northern coast of Australia, where a large fleet of vessels is employed, and another extensive industry has lately been reported in the neighborhood of Thursday Island, north of Queensland.

The gathering of pearls from fresh-water shells has been carried on for centuries on this continent. When De Soto was made governor of Cuba, it was agreed that one-fifth of all treasures won in battle, including *pearls*, should be given to the Spanish crown, and on one occasion his men are said to have obtained three hundred and fifty pounds weight of pearls from Indian graves in Cutifachiqui. The value of pearls from fresh-water shells varies greatly, depending on their size and color. One pearl from a fresh-water mussel was sold for $1,500, while a round, pink pearl from Tennessee brought $650. One of the finest pearls ever collected in the United States was the "Queen." It had a beautiful luster and weighed ninety-three grains. It was found near Paterson, New Jersey, in 1857, and was sold to the Empress Eugenie for $2,500. To-day it is probably worth $10,000.

Pearl-fishing in the United States has been carried on in many States, including Kentucky, Tennessee, Texas, Wisconsin, Illinois, Arkansas, Missouri, Georgia, and Kansas.

The manufacture of ornamental objects, such as pocket-books, hand-satchels, jewel-cases, etc., from pearl-shells, has during recent years become an important industry, and with their iridescent shades of salmon, purple, pink, and cream, very beautiful articles are made.

The pearl-button industry has increased extensively during the last eight years, and several factories, especially in towns in Iowa and Illinois bordering on the Mississippi River, are now in operation. The principal species of fresh-water mussels whose shells are used in their manufacture is the "niggerhead" (*Quadrula ebena*), while several varieties of "sand shells" are also employed, including the "yellow" (*Lampsilis anodontoides*) the "black" (*L. rectus*), and the "slough" (*L. fallaciosus*). One of the best shells is the "deerhorn" (*Tritigonia verrucosa*), and another favorite is the "butterfly" (*Plagiola securis*). The pearl-button industry in the United States began in 1891, the first factory being established at Muscatine, Iowa. The largest factories turn out as many as a thousand gross of finished buttons a day, the average price obtained being thirty-five to forty cents a gross.

Forty feet was formerly considered the maximum height at which centrifugal pumps could operate efficiently, and experiments conducted in 1874, 1875, and 1876 by William O. Webber seemed to demonstrate that the highest efficiency in the single-stage pump was found at a height of about 32 feet, and a maximum velocity of the liquid being pumped through the discharge orifice of the pump of not exceeding 12 feet per second. In Appold's experiments it was determined that the efficiency mainly depended upon the form of the blades in the impeller or vane and the shape of the volute or enveloping case, and that the best form for the blade was a curve, pointing in the opposite direction to that in which the impeller revolved, and for the case, that of a spiral tapering type or volute.

TRIAL TRIP OF THE BARTON AIRSHIP.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

After many months of waiting for propitious weather, the trial voyage of the Barton airship from the Alexandra Palace, London, was carried out on July 22 last. This vessel, which was fully described in the Scientific American several months ago, possesses many ingenious and notable features, the principal of which is the combination of aeroplanes to assist the ascent and descent of the vessel in conjunction with the ordinary gas bag.

The vessel is a mammoth structure. It comprises an elongated cigar-shaped balloon 180 feet in length by 40 feet in diameter, with a capacity of 200,000 cubic feet of gas. Slung from the balloon is a bamboo car 127 feet in length by 18 feet in height. The car is built triangular in form, the horizontal bamboo members being carried through the corners of the triangles, while by pointing the apexes of the triangles downward the lower horizontal bamboo member constitutes a keel. The deck runs the full length of the car and varies in width from 2 to 8 feet. Fore and aft are fitted two four-cylinder Buchet gasoline motors of 50 horse-power each. The motors are carried on cast-iron frames rigidly fixed to the bamboo. On either side of each engine are fitted two propellers carried on brackets. The propellers are of the two-bladed type, of 7 feet diameter with a fine pitch, and revolving at 1,000 revolutions per minute. The drive from the motors is transmitted to the propellers through belts and pulleys. At the end of the car is a large rudder 12 feet 6 inches wide by 18 feet high, giving a total area of 225 feet. In the center of the car is the aeronaut's deck, from which the control of the airship is maintained, while midway between this deck and the rear motor is the steering wheel for actuating the rudder, steering being carried out with a hand wheel similar to that of a ship. The trim of the vessel is controlled by water ballast tanks fore and aft. The movable aeroplanes, of which there are normally thirty-two, are placed in front of both the bow and stern motors, and by their inclination up or down the vessel can be made to rise or fall irrespective of the balloon itself. The total weight of the craft is 14,000 pounds. For the generation of the hydrogen for the inflation of the balloon 600 carboys of concentrated oil of vitriol were decomposed by 50 tons of iron borings.

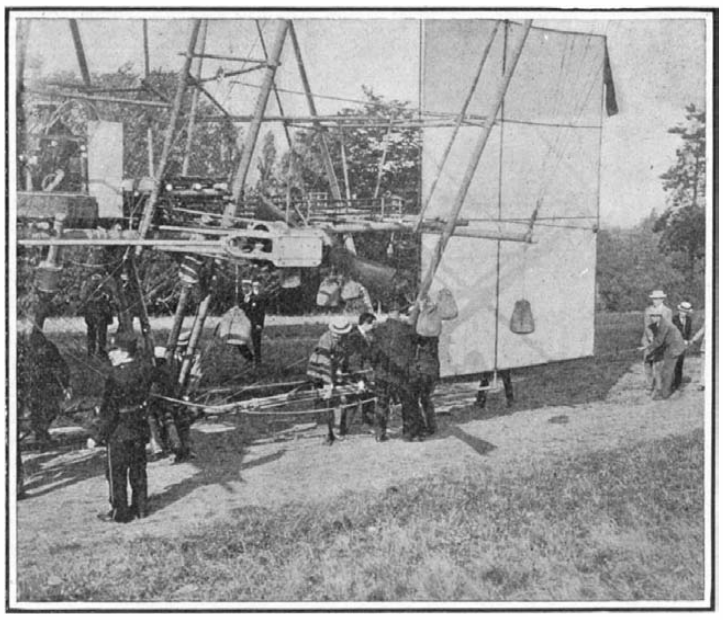
The day selected for the trial trip was not attended with the best weather conditions. Furthermore, owing to the rapid deterioration of the gas within the balloon, due to the fact that it had been standing for a few days, 300 pounds of ballast, two members of the crew, and twenty-eight aeroplanes had to be discarded. Five aeronauts ascended in the vessel, comprising Dr. Barton, the designer; Mr. A. E. Gaudron, who had charge of the aerostat; Mr. Rawson, at the helm; and Mr. Henry Spencer and Mr. Newton, in charge of the fore and aft propelling motors respectively.

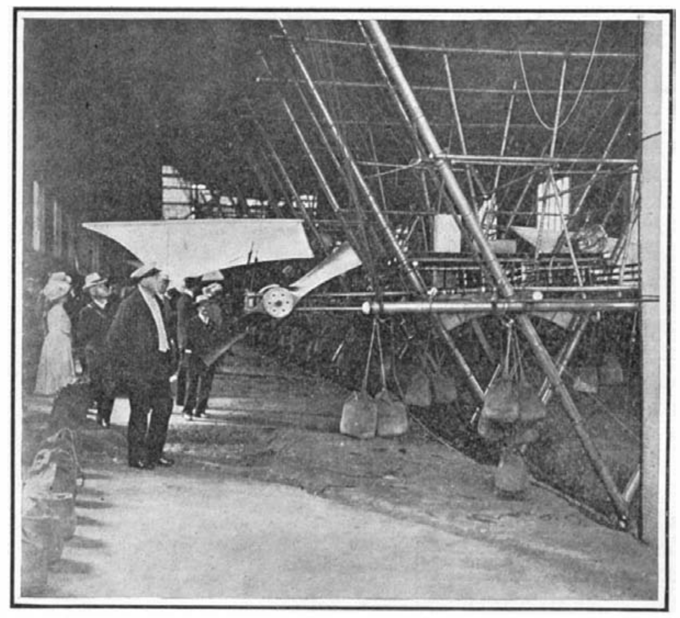
The vessel rose into the air smoothly and calmly, but when it had ascended, a wind blowing at the velocity of 30 miles an hour was encountered. The airship's head was brought round against the wind, and although it could hold its own, the tendency of the balloon to buckle caused the aeronauts to swing her round again in the wind's favor. The wind blew fitfully, the velocity varying from 20 to 35 miles an hour. Whenever the vessel's nose was brought up against the wind at the former speed it could make slight headway, but the treacherous gusts rendered it hazardous to persist in a forward course. It was therefore resolved to cut across the wind in a southeasterly direction. The dirigibility of the machine was successfully demonstrated, for she was successfully turned round on two or three occasions, the circle required being of 200 yards. With a larger prow rudder, however, the aeronauts state that it would have been possible to swing round in a much smaller circle.

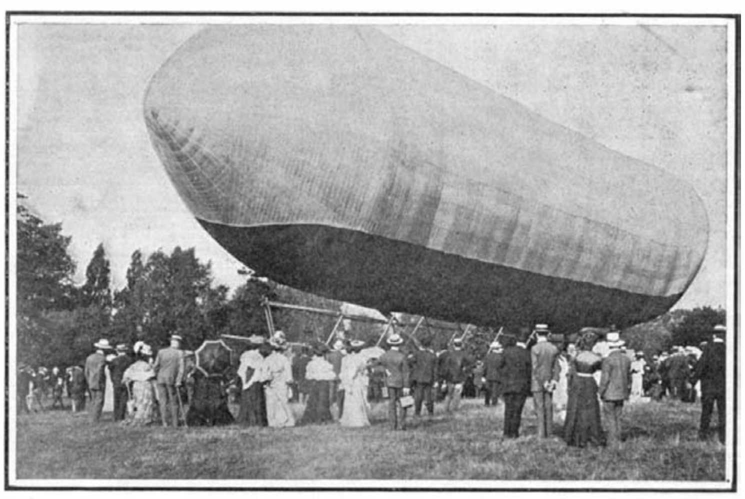
The machine traveled for several miles in a southeasterly direction with every success and was maneuvered to within a height of 200 feet of the ground. As the wind had dropped somewhat, the vessel's head was brought round toward the starting point, and for some distance she succeeded in making progress against the wind. When, however, the wind increased again, the engines were stopped, and the vessel was allowed to drift at an altitude of 2,400 feet for some eight miles, descent being finally made 16 miles from the starting point.

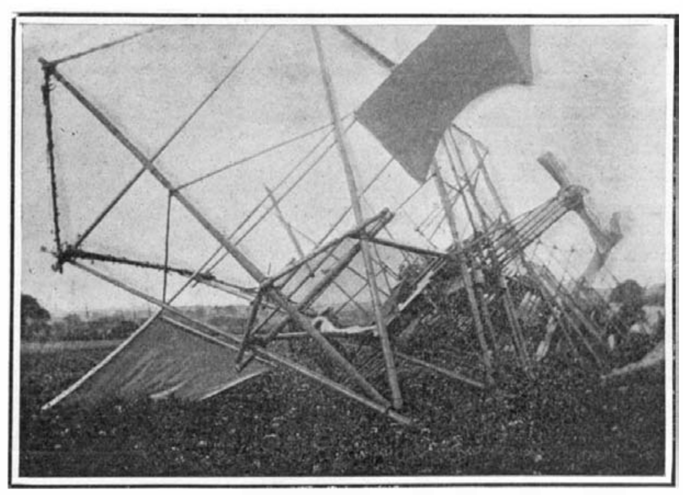
The maneuvering capacity of the vessel was clearly demonstrated during the descent. The machine was brought to the ground quite smoothly, without any signs of bumping, generally characteristic of balloon descents. A slight mishap occurred at this juncture, however. The aeronauts gathered together in the bow, with the result that the stern mounted swiftly in the air to a height of some 40 feet. One of the party immediately seized the ripping valve and a huge rent was torn in the balloon fabric, liberating the gas with a roar. The force of the escaping gas ripped the balloon completely in halves and the fabric collapsed, bringing the framework to the ground with a crash. Fortunately, no one was hurt, and owing to the elasticity of the bamboo the only damage to the car was one broken propeller.

Although the trial was but a qualified success, it emphasized one or two cardinal points. The most vital is the impossibility of attaining success with an airship which depends for its buoyancy upon a gas balloon. Dr. Barton has already decided to discard the gas bag in his new machine which is now approaching completion. This new vessel will depend for its buoyancy upon the aeroplanes, which, although only four were carried upon this initial trip, proved highly satisfactory. Another inherent danger of such a balloon is buckling when brought head against a strong wind. The motors proved sufficiently powerful, but the propellers were found to be somewhat too small and pitched at the wrong angle. Many valuable details were obtained during the trial which are to be incorporated in the new aeroplane, which is to be submitted to a trial within the next few weeks.


Preparing for the Ascent.


The Propellers and the Ballast Bags.


Just Before the Ascent.


After the Descent.

TRIAL TRIP OF THE BARTON AIRSHIP.

An Improved Submarine Signal.

Arthur J. Mundy has invented an improvement in the system of submarine signaling, described some months ago in these columns.

The invention relates to that portion of a submarine signaling system which includes the means for taking the sound-signals conducted by the water from a submerged signaling apparatus from the water and transmitting them, preferably electrically, to a telephone receiver on a vessel. This portion of the apparatus as a whole has been named a "hydrophone." The part of the hydrophone which is immersed in the water and receives sound impulses from it and transmits them is called the "hydrophone-transmitter," or, for short, the "transmitter." The part which receives the impulses from the transmitter and delivers the sound to the hearer is known as the "hydrophone-receiver," or, for short, the "receiver."

For use on vessels carrying machinery making noise—like, for instance, steamships—Mundy has discovered that it is desirable to take and transmit the sound signals conducted by the water from the water at a point away from the vessel and below the surface of the water and also while the vessel is in motion; and his present invention, or hydrophone, comprises a device the sound-transmitting portion of which is adapted to be let into the water from the stern of a moving vessel and to be towed in the water by the vessel at any desired distance therefrom and at any required depth below the surface of the water, and the receiver portion of which is adapted to be carried on the vessel and to receive from the submerged sound transmitter the sound signals conducted to it by the water and to deliver them audibly to the hearer on the vessel.

Mundy prefers to employ, as a means for holding the hydrophone transmitter submerged, a transmitter holder, which has a shape resembling that of a fish. This holder is provided with means whereby, while being towed, it is caused to assume an upright or vertical position below the surface of the water in the water and to maintain such position so long as it may be towed or be in motion. The transmitter preferably is so mounted in the holder as to present a sound-receiving diaphragm on each side of the holder, which preferably is flush with said side. The towline for towing the holder in its submerged plane also serves to provide an electric circuit between the transmitter and battery on the vessel and the receiver. The holder preferably is attached to the towline by means which may form a part of the towline, which acts to prevent sound vibrations from being delivered by the towline to the transmitter of the holder and which sound-insulating means has been termed an "antihummer." The electric relation between the transmitter and the battery on the vessel is such that the electric circuit from the transmitter to the battery and receiver is automatically established upon the submerging of the holder, remains established while it is submerged, is automatically broken upon the removal of the holder from the water, and remains broken while it is so removed from the water and inactive. A means for accomplishing this result is the employment as a part of the circuit of the water itself when the holder is submerged.

THE ELIZABETH BRIDGE AT BUDAPEST.

The handsome Budapest bridge which forms the subject of the accompanying illustrations is of especial interest to New Yorkers, because it is almost identical in design with that proposed by ex-Commissioner of Bridges Lindenthal for the new East River bridge. This "eyebar" design, though strongly recommended by the Municipal Art Commission, was rejected because of several more or less fanciful objections. In the Budapest bridge this construction was found to give the greatest strength and efficiency in proportion to the weight of material used, and at the same time it provides a structure of undoubted artistic beauty.

The Elizabeth bridge crosses the Danube in a single span. The main span from center to center of the piers is 957 feet in length. The approaches, from the center of the pier to the face of the abutment, are each 139 feet long. The total length between the faces of the abutments is 1,235.5 feet.

The bridge roadway consists of a driveway 36.3 feet wide and of two footways, one on each side. These are 11.5 feet wide on the main span, and 12.2 feet on the approaches.

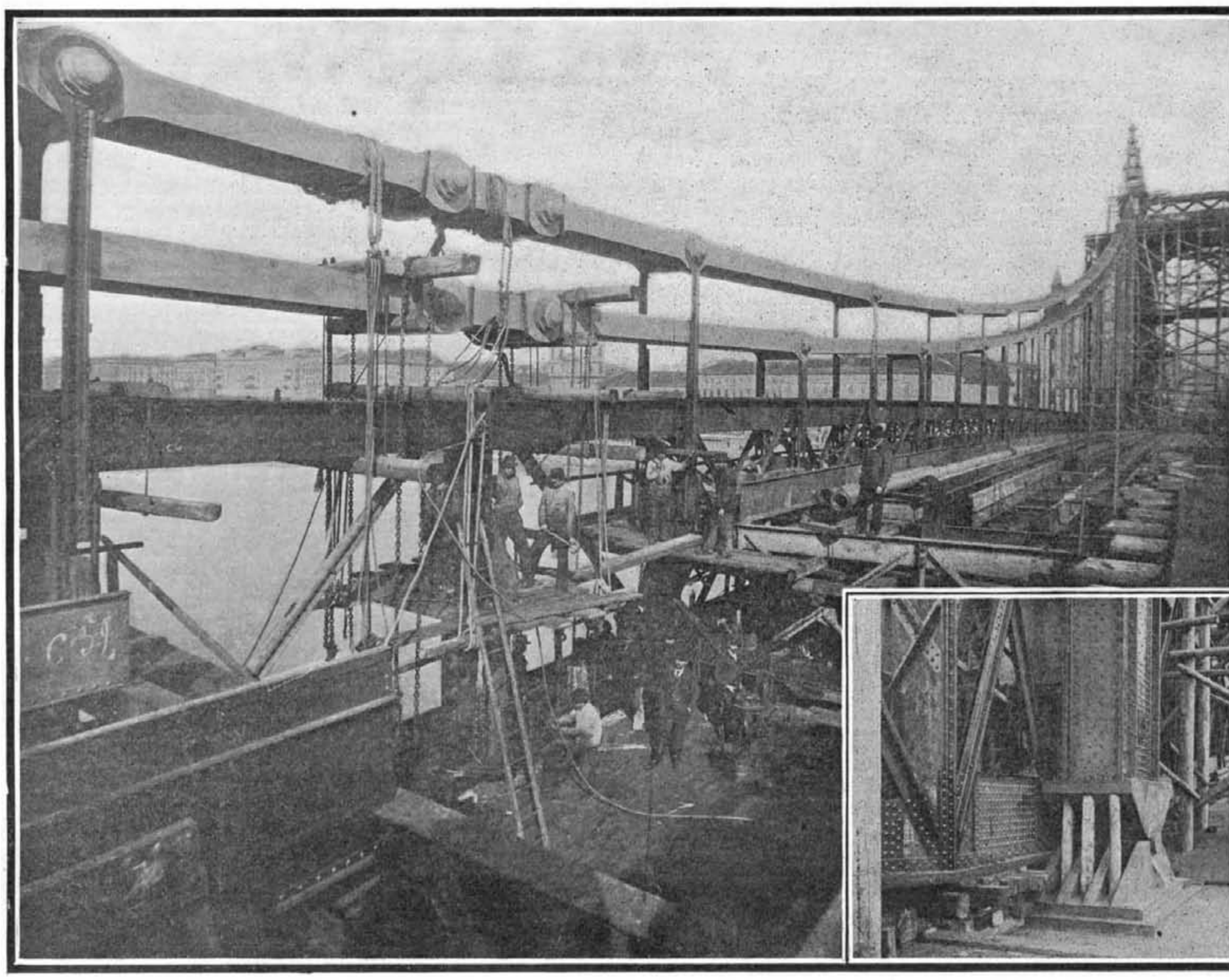
The suspension chains are arranged in two pairs, the pairs being 66 feet apart. The chains of each pair are located one above the other, and, of these, the lower ones have fixed points in the tower heads, while all four are anchored in the abutments. The towers are pivoted at their bases.

The skeletons of the towers from which the chains are suspended consist in each case of two massive posts of box section, 72.8 fet apart from center to center. These towers rest on two steel pivots, which are located on cast-iron plates, one on each side of the stiffening truss. To counteract the horizontal swinging of the chains, the suspenders are stiffened in a plane transverse to the axis of the bridge. This transmits the wind pressure acting against the chains to the stiffening trusses, and particularly to the wind-bracing.

The lateral bracing of the stiffening truss, which is continuous throughout the structure, consists in the channel span of four trussed cross girders and one counter bracing to each panel of 20-foot length, and at the intersection with each cross girder the main trusses are suspended to the chains.

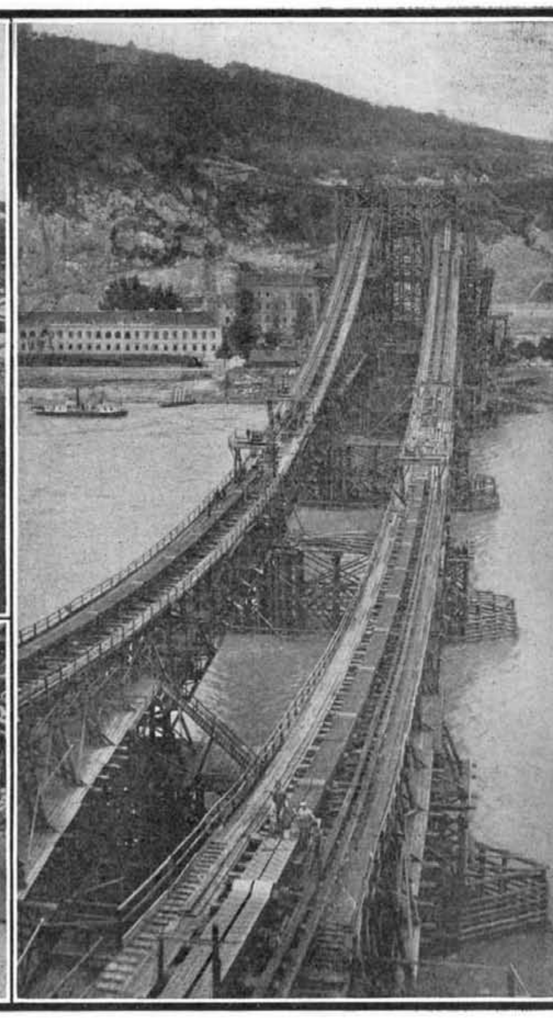
All the 66-foot trussed cross girders are attached to the verticals in the web of the stiffening trusses save at the line of the towers, and are webbed vertically between their posts by a double series of symmetrical latticing, united at the points of intersection with intersection plates.

Upon the upper chords of the cross girders and immediately above each of the truss verticals is a row of seven stringers of rolled I-section. To the central part of their webs is attached a system of secondary cross girders, which in turn carry longitudinal floor beams, supporting, together with the stringers men-

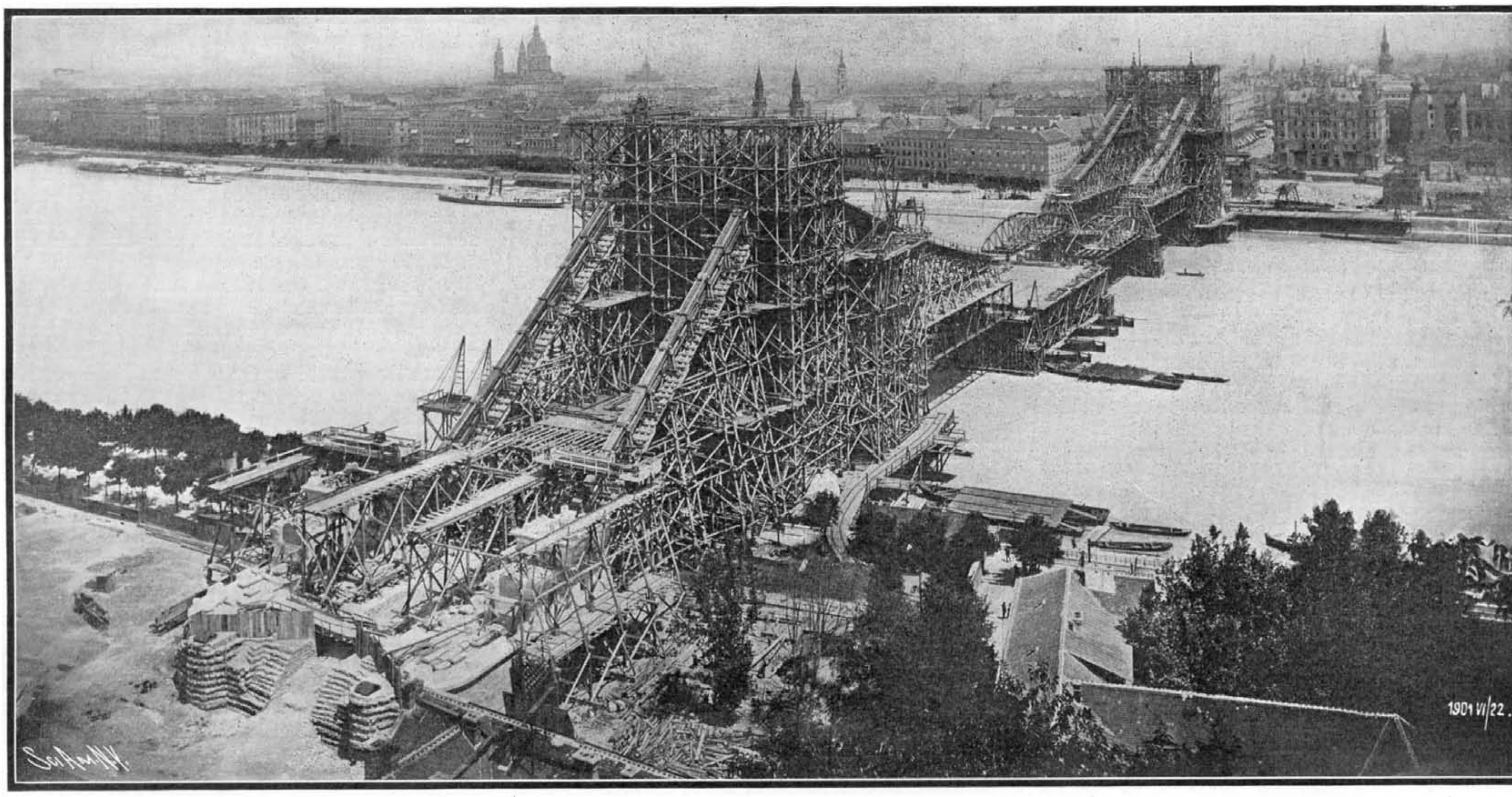


The Erection of the Center Panels of the Stiffening Trusses.

One of the Pivots at the Tower Base, and the Stiffening Truss.



View of Completed Chains Taken from Top of Tower.



The Elizabeth Bridge under Construction, Showing the Elaborate Fixed and Floating Falsework in the Channel of the Danube.

THE HANDSOME NEW CHAIN SUSPENSION BRIDGE AT BUDAPEST.

tioned, the buckled plate decking of Zorès section.

The longitudinal bearers are placed between each of the middle stringers, and are fixed to the secondary girder with angle struts, one on either side, forming chairs; but outside of the third stringer only one longitudinal bearer is laid, since the conduit for the electric street railway itself stiffens the floorwork between the main cross girder and the wood paving.

The whole of the bridge structural work, including the towers, is of Siemens-Martin mild steel, and its total weight is 3,801 tons, besides 2,082 tons for the superstructure of the towers. The steel has a minimum ultimate tensile strength of 7,700 pounds, and a maximum of 9,900 pounds a square centimeter, or 0.155 square inch. The test specimens 8 inches long, with a maximum sectional area of 0.62 square inch, and at the limits named, yielded minimum elongations of 28 per cent and 22 per cent. Perpendicular to the rolled direction, the material yielded elongations of 26 and 20 per cent respectively. All rivets are of the same material, and have a tenacity of 7,700 to 8,800 pounds, with elongations of 32 and 26 per cent respectively.

The maximum unit stresses allowed per square centimeter of sectional area are 2,420 pounds in the main girders, and 2,640 pounds in the towers, the wind bracings, the floor members, and the suspension bars, or hangers, and a shear on the rivets of 1,870 pounds. The stress calculated upon the bearing diameter of the rivets and bolts was 3,960 pounds.

THE MANUFACTURE OF THE EYEBARS.

In the manufacture of the chains, and in fact of other steel parts, the following conditions were imposed: In the preparation of the plates neither punching nor shearing was allowed, and the treatment of the plates in their machining appears to have been such as to render annealing superfluous.

The eyes were required to be geometrically central in the head and on the center line of the plate, and the maximum deviation from templates permitted in the distance between eye centers was 0.12 inch at a temperature of 10 deg. C., 0.02 inch in the eyes themselves, or a total of 1.6 inches in the half-span of the suspended chain.

The plates were assembled, and the complete members for each eyebar were temporarily bolted together at one end, and rigidly clamped up throughout the rest of their length, with their center lines in exact correspondence. The eye at the free end was then reamed accurately at one operation, and as nearly as possible at the same temperature, this process being followed subsequently by the similar boring of the opposite head.

THE ERECTION.

The work of erection was naturally so arranged that it could proceed simultaneously from both shores toward the middle of the bridge.

Following immediately upon the fixture of the anchor thrust blocks or shoes, the lowest links in the lower anchor chains—chain eyes Nos. 1 and 2—were erected upon timber stoolings, with the anchor stop plates threaded between every alternate link, and onto these were screwed the angular filling plates, which, along with the stop plates, take the thrust against the forged steel double anchor beams. The corresponding links of the upper chain were next erected, and this permitted the completion of all the principal work in the anchor chamber.

At least three openings were necessary for the river traffic during the entire period of erection, and consequently more than three fixed falsework bridges could not be erected because of lack of time, but the constructors were obliged to avail themselves of floating scaffoldings.

The operation of mounting the chains was as follows: The single plates, protected against buckling by wooden beams, were placed upon cars by cranes. The cars ran on tracks upon the falsework at a height of 9 meters. That the work might proceed simultaneously at four points, electric cranes of 5.2 horse-power were placed between the panel points 14 and 15. By this means the chain plates were raised to a height of 120 feet and placed on tracks running at right angles to the plates. They were then allowed to slide to the point at which they were to be used, and were built into the structure by means of small hand cranes.

One of our illustrations shows the mounting of the lower chain, the floating falsework being located in the third channel opening, and the erection of the two falsework bridges having not yet begun. We can here clearly see the vast amount of expensive wooden falsework that was used in erecting this bridge. In the proposed Manhattan bridge across the East River, the erection was to have been carried on from a temporary suspended erection platform, similar to that used for the construction of the new suspension bridge.

After the falsework over the channels and the falsework bridges had been removed, the mounting of the channel span was begun by means of the previously-used floating falsework. By this means, the cross girders together with the verticals of the stiffening trusses, the lower chords of the latter, the wind bracing, and the three middle rows of longitudinal girders from joint 18 to the center, were mounted in the following manner:

The falsework, built upon four floats, was first divided into two sections, each of which rested upon two floats. One of each pair had its mounting surface 2 meters lower than the other, so that it could pass under the already erected iron construction. The cross girders were completely riveted and joined to the proper verticals of the stiffening truss before being placed upon the floats. These were so arranged that the above-mentioned cross girders could be drawn up under the hangers. The parts of the cross girders and the verticals of the stiffening truss were placed on a mounting scaffold on the shore and there riveted together. After the cross girders had been hung on the hangers, by means of great screws, the three middle longitudinal girders were built into the structure, and then the cross girders were joined to these longitudinal ones.

The painting of the ironwork proceeded simultaneously with the erection of the same. The magnitude of this operation is evidenced by the fact that the paint used at the working place and in the factory weighed some 216,000 pounds, and was valued at over $11,000.

Correspondence.

An Earthquake Observation.

To the Editor of the Scientific American:

Having just read in the Scientific American of August 26 an account of the seismic disturbance recorded at Birmingham, England, July 15 last, it occurred to me that it might be of the same origin as the earthquake felt here at 5.08 A. M. on the same date.

The features of the shock here were two tremendous reports about one second apart, louder than the heaviest crash of thunder I ever heard, followed by a rumbling sound of perhaps 15 seconds' duration. The reports were not instantaneous, like the discharge of a gun, but resembled the grinding roar of the fall of an immense pile of bowlders, and lasted rather more than a second. These loud noises, which seemed like explosions, came without any noticeable warning, and the movement of the earth was slight as far as my personal observation went. The only damage done in this vicinity was the shaking of a few loose bricks from chimneys, but the noise was the most terrific I ever experienced. I had been up about ten minutes and was sitting by an open window, so was in a favorable position to observe these phenomena.

The difference in longitude—68 degrees—between Birmingham and Augusta, Me., would account for four and one-half hours of the difference in time, and the remainder, I presume, would be required for the earth tremors to traverse the intervening distance.

Warren W. Seavey.

Gardiner, Me., August 28, 1905.

A Suggestion for Aeroplane Designers.

To the Editor of the Scientific American:

I wish to call attention to one fault in all, or nearly all of the aeroplanes and areoplane-supported flying machines thus far described in the Scientific American. The center of gravity is too near the wing surface. When one sees such a machine with a wing expansion of 20 feet and with the seat or platform and operator and machinery only a foot or two below the center of the wing surface, one may know that it is only a question of time—generally a very short time—till a disaster occurs. The reason is this: while the air at some times and places is calm or has a smooth and regular movement, at other times and places it has as many waves, cross-currents, and eddies as the rapids at Niagara. Now, while in the former case an aeroplane may be so designed as to be practically without ballast and yet maintain a horizontal position, in the latter it is sure to roll and pitch and plunge. To see the difference, take a thistledown, with seed attached, and set it afloat in the air. It will move off evenly and steadily. Now take another exactly like it, detach the seed, and set it afloat. It will dive, plunge, roll over and over, and perform all kinds of antics. It is thus that practically all the aeroplane accidents to date have been caused, including that to Langley's machine and those which caused the deaths of Lilienthal and Maloney (Montgomery's machine). Neither rudders, wings, nor skill of operator is any match for the eccentricities of the wind, and when anything goes wrong with the apparatus a greater accident is sure to occur.

The parachute is the most unscientific of aeroplanes; yet accidents are rare, practically never occurring after the parachute has once opened and the aeroplane principle has come into play, except what may be due to landing in unfavorable places. That this is so is due exclusively to the fact that the ballast and center of gravity are far below the supporting surface, thus always preserving the apparatus in an upright position.

What the writer suggests is this: Place the platform, the engine, the operator, etc., at a distance below the wing surface at least equal to the expansion of said wings—if the wings extend 20 feet from tip to tip, then place the platform, etc., 20 feet below; if 30 feet, then 30 feet below, etc. If what goes to make up the ballast is light in proportion to the wings, the distance should be greater. The propellers, rudders, etc., can be placed at or near the wing surface, as at present, and operated by piano wire or light chain. This will add somewhat to the weight and complication, of course, but will make dives and plunges with their accompanying accidents impossible.

Charles S. Adams.

Warren, Ohio, August 17, 1905.

The Lunar Rainbow.

To the Editor of the Scientific American:

As you gave place to articles on lunar rainbows in several issues of late, and in that of the 26th instant, now before me, I infer they are infrequent, and may continue to interest your readers. Charleston, S. C., my home, is so near the Gulf Stream that we have ascribed our notably beautiful sunsets to the atmosphere thereby produced. The same cause may account for the frequency of the solar rainbows, and the not infrequent, but seldom noticed, lunar rainbows. Although my home looked into the Atlantic Ocean, across the fifteen square miles of water forming Charleston's beautiful harbor, therefore I seldom had the western skies under observation at the lunar rainbow (full moon) period of the day, yet I recall many lunar rainbows during the half century since I was an observant boy, and, if memory serves me, one double lunar rainbow. But the most perfect of these bows that I recall I saw on the edge of Darlington, S. C.—a beautiful town in east-middle South Carolina—in 1891. I was in a road leading north, with extensive fields east and west, and hence my opportunity. The full moon had just risen above the tops of the distant woods, and the bow in the west was perfect. The span of the bow was materially less than the span of a sun rainbow, but its depth, or thickness, was proportionally much greater. The rainbow colors were distinct but pale, as if the arch were built of pale mother-of-pearl, and they changed and faded less rapidly than the sun rainbows I have seen. In 1863, when in camp on John's Island, S. C., I saw a brilliant sun rainbow with one foot of the arch so near we could stand on it, or pass behind and in front of it, but we did not "dig for gold."

James G. Holmes.

Macon, Ga., August 28, 1905.

The Current Supplement.

The current Supplement, No. 1549, opens with an article on the laboratory for the testing of materials of the Charlottenburg Polytechnic School, which article is supplementary to that on the same subject appearing in this issue of the Scientific American. Last spring Mr. Dugald Clerk delivered a series of lectures, in which he summarized his views on the value of various kinds of gas for power purposes. His remarks are published in the current Supplement. A. S. Mann discusses the subject "Can a Steam Turbine be Started More Quickly than a Reciprocating Engine?" Messrs. R. S. Hutton and J. E. Petavel very thoroughly review the preparation and compression of pure gases for experimental work. "Diamonds and the Diamond Industry" is the title of a contribution which gives many a valuable bit of information. Miss Adele M. Fielde, in a striking article on the sense of smell in ants, summarizes the results of investigations which she has carried out, and which throw a flood of light on the function which the sense of smell plays in ants. Prof. A. Berget discusses the rhythmic movement of the sea from a mechanical standpoint, and arrives at conclusions somewhat at variance with those commonly accepted, conclusions which are based mainly on the mathematical investigations of Laplace. Dr. Conant writes on the beginnings of counting.

Simon Lake to Settle in Berlin.

Simon Lake, the submarine torpedo boat inventor, announces that he will settle permanently in Berlin, although he will still maintain an American office.

The reason for his decision to leave the United States, he said, was because he is unable to get the recognition on this side of the water that is his in Europe.

Mr. Lake said that in the tests made with his type of submarine on the other side of the Atlantic the boat had sunk 138 feet, the greatest depth ever reached by a submarine.

A volcano throwing off molten lava has been discovered in Nevada by McClure, Wheeler, and Somers, cattlemen of Lovelock. The volcano is in Rye Patch, Humboldt County. Although that section has been traversed for years, the crater has just been found. The men were in search of cattle when they came on the stream of lava, and tracing it to its source found the volcano.

THE LABORATORY FOR THE TESTING OF MATERIALS OF THE CHARLOTTENBURG POLYTECHNIC SCHOOL OF BERLIN.

BY L. RAMAKERS.

During the course of the year 1903 the laboratory for the testing of materials of the Charlottenburg Polytechnic School was transferred from the city of Berlin to one of its suburbs, Gross-Lichterfelde, and there combined with the chemical laboratory of the Berlin Academy of Mines. The resulting institution, under the title of "Königliches Materialprüfungsamt," embraces the experimental study, in all its branches, of the materials utilized in the industries; and for this purpose, the most complete and improved modern testing machinery and instruments were installed in its buildings.

The idea of testing materials is, so to speak, as old as civilization itself. Even in primitive times, the making of a tool or a weapon must have been immediately followed by a testing of the same; and while modern science has, of course, vastly changed the *modus operandi* of these tests, the fundamental purpose of the investigations is the same to-day as it was in the bygone ages. The development, however, of this branch of engineering did not assume anything like its present proportions till toward the middle of the last century, and during this period the first great strides forward were made.

The completeness of the Gross-Lichterfelde establishment, a partial description of which follows, demonstrates the great importance that is at present attached to the question of material testing. The origin of the Charlottenburg laboratory dates back to 1863, when Wöhler conducted a number of tests at Frankfort-on-the-Oder. In 1870 it was moved to Berlin, where a series of tests by Spangenberg were made, and in 1884, when it was joined to the Polytechnic School, its staff consisted of but fourteen persons. At the time of the establishment at Gross-Lichterfelde the number of employes had been increased to one hundred and seven, and at present the services of one hundred and thirty-eight individuals are required to conduct the investigations carried on within its walls.

The purpose of the new institution is the testing of materials for scientific or general uses, as well as the carrying out of investigations upon the orders of civic administrations or private individuals. The members of its staff are employed in various ways; they investigate the properties of materials, determine the degree of safety of constructions of manifold kinds, fix the value of the coefficients to be used in calculations, scientific and otherwise, improve upon existing methods of testing, and the apparatus for the same, advise industrial manufacturers in many ways, and similarly assist administrations and boards throughout the German empire.

The work of the laboratory is carried on in six main divisions, that is: 1, metals; 2, building materials; 3, paper; 4, metallography; 5, general chemistry, and 6, oils. The institution covers an area of about 10½ acres, situated between the railway and the road from Berlin to Potsdam. The principal one of the various buildings, which are all connected by a railway, is horseshoe shaped, the machinery building and workshops being situated in the center. It surrounds two large courtyards, which are closed at the rear end by a group of secondary buildings. The arrangement and distribution of the rooms is such that the heaviest apparatus occupy positions on the ground floors, where they are all connected by railways. These railways are also used for the weigh-bridge, the coal depot, and the boilers. The two large courts mentioned above, as well as the remaining unoccupied ground, are utilized for open-air tests. Below ground all the buildings are connected by a gallery, which carries the steam, water, gas, and electric mains as well as the drains. The main building, the ground floor of which is occupied by the management, contains on the second floor the laboratory of general chemistry (fifth division); on the third, those of metallography (fourth division); and on the fourth, the photographic studio. The building forming the right wing is devoted to the testing of metals (first division) on the ground floor, and to the testing of paper (third division) on the second floor. The building forming the left wing contains on the ground floor the laboratory for building materials (second division), and those for oils (sixth division) on the second floor. These various buildings are all provided with extensive platforms, which are utilized for certain of the open-air tests.

The total surface covered by the buildings is 56,615 square feet. The surface utilized by the laboratories and offices is 40,420 square feet, while the total floor space inclusive of the upper stories is 64,930 square feet. In the construction of the laboratories and administration buildings, nothing has been neglected that could add to the hygienic condition and comfort of the employes.

The steam necessary for the heating of the rooms and for the various apparatus of the central power station is furnished by boilers located in a suitable building on the north side of the grounds. In the central power station are located two 60-horse-power steam engines, which drive two dynamos; these give 220-volt continuous current, which is used for running various motors and for lighting the establishment. Furthermore, the laboratories are supplied with water power from two separate hydraulic mains, which are under a pressure of 200 and 400 atmospheres respectively. That the various buildings are plentifully provided with measuring apparatus designed for scientific observations goes without saying.

The division for the testing of metals comprises, essentially, two large halls, 115 and 130 feet in length by 26 feet in width. In one of these halls is located the great 500-ton testing machine that was employed in the old laboratory at Berlin, and for which it was built by Hoppe in 1891. Fig. 1 of the illustrations accompanying this article shows this great mechanism, which is designed to test materials both by tension and by compression. It has effective lengths of 55.75 and 49 feet respectively, for each of these two cases. Another machine, built according to the Becker system, is used for torsional tests up to 72,500 foot-pounds, and by means of it pieces 33 feet in length may be tested. The other hall contains a machine designed according to the Borsig system for testing pipes by means of internally and externally exerted pressure. The pipes may have a length of 13 feet and a diameter of 4¼ feet. The same machine can be employed for testing blocks of masonry and concrete, and for this purpose can exert a pressure attaining 600 tons. Besides this, the hall contains a new 100-ton Werder apparatus, for the purpose of testing by tension chains and cables with a possible length of 55 feet, and at the same time for compressive tests of columns up to 50 feet in length. This machine was constructed by the Société de Nuremberg, which likewise supplied the laboratory with two 50-ton Martens machines, shown in Fig. 2 of the illustrations. These rather complicated mechanisms are designed to test materials of various kinds while they are being subjected to the action of heat or cold of various degrees.

In the same hall there are, furthermore, three Pohlmeyer machines, built by the Ehrhardt Works, of Düsseldorf. One of these has a capacity of 100 tons, and the two remaining ones each of 50 tons. They are for the purpose of studying the resistance of bodies to pressures, acting simultaneously upon all of their faces, and it is possible by means of these apparatus to submit small-sized test pieces, located in the interior of hollow steel cylinders, to hydraulic pressure reaching 4,000 atmospheres.

The apparatus described above are all supplemented by manifold measuring instruments, for the purpose of observing all possible distortions of the bodies while undergoing the various tests. Aside from the two main halls described above, the metal division comprises various laboratories for the detailed study of the resistance of materials, especially under the effect of heat or cold. In these laboratories materials are also tested by means of repeated stresses, prolonged or alternating. A special building arranged for experiments under shock contains several dropping machines, among them an apparatus which employs the fall of a 2,200-pound ram from a height of 33 feet. In the part of the installation reserved for open-air tests, there is a small hydraulic press for the testing of structural building materials of larger size and the measurement of the elastic distortions of staircases, roofs, vaults, etc. Figs. 3 and 4 show this mechanism prior to and after testing a portion of an iron staircase. The appliances for measuring the distortion of the structure while undergoing the test can be clearly seen on the photograph. The metal-testing division also includes a large and complete mechanical workshop for the preparation of test pieces, as well as for the repair of machines and instruments.

The division for the testing of building materials consists primarily of a shop in which masonry stones are cut and shaped to the dimensions necessary for submitting them to the tests. A room that is devoted to tests under low temperature contains two refrigerating apparatus, each of which is capable of holding ninety bricks or a corresponding number of stones, which in the space of five hours can be brought to a temperature of minus 4 deg., measured internally. The same room contains the machines employed for testing material by wear, especially by the action of a sand blast. In the molding shop there are mortar and concrete pugmills, as well as an apparatus used for hammering test briquettes. The former is shown in Fig. 5 of the illustrations.

Materials for conglomeration are first sent into the crushing room, where they are reduced to powder and sifted; another room is set aside for storing the briquettes during the period of setting. This, with its tanks and shelves, is shown in Fig. 6. The next hall is the large one, where the tests of resistance are made. It contains first a 10-ton hydraulic press covering a floor space of 20 x 10 feet. Another press, the capacity of which is 20 tons, is designed for the testing of concrete or stoneware pipes. Both of these machines were constructed by the Borsig Works. The apparatus supplied for this division of the establishment by the Nuremberg Company consists of a 150-ton machine for compressive tests of brick; a 400-ton machine for testing blocks of concrete in the same manner; a 40-ton machine for similarly testing cements; and finally, a 1,300-pound machine for testing the tensile strength of cements. The 400-ton press for concrete blocks is shown in Fig. 7. In addition to the new apparatus described above, the hall contains various other machines of the ordinary types.

The division devoted to the testing of building materials is completed by three laboratories intended for chemical, mineralogical, and physical investigations. Besides these, however, large open-air spaces are reserved for its use for the testing of flooring of larger size, experiments in the resistance to fire, and the study of the influence of atmospheric conditions. Figs. 8 and 9 show the beginning and the end of an experiment on fireproof building material.

The division for the testing of paper comprises two chemical laboratories, two halls devoted to microscopy and micro-photography, and a room devoted to tests of resistance. The last contains various Schopper machines, and among others one with a maximum power capacity of 2 1-5 pounds for the testing of hair, fibers, and threads; a machine developing a maximum power of 22 pounds for the testing of ordinary papers; another of 220 pounds' capacity for the testing of cardboard; and finally, one of 1,100 pounds' capacity for the testing of stronger materials, such as coarse cloths. In the same hall are installed machines for rumpling paper and an automatic resistance gage of the Martens type. This delicate instrument is shown in Fig. 10. The motive power used in this department is either electricity or hydraulic pressure.

The division of metallography consists of a polishing shop, for the preparation of the specimens to be examined microscopically; of a chamber of microscopy, including among others a splendid micro-photographic apparatus of the Martens type; of a laboratory for analytical chemical studies; and of a hall for heating by incandescence. The room for microscopic investigation is shown in Fig. 11, while that for heating by incandescence is shown in Fig. 12. This last is provided with measuring apparatus of the most highly improved and modern types. There is, furthermore, a room for measurements of the most precise kinds for the determination of small differences of potential between metallic electrodes encountered in different phases of the manipulation. Finally, there are a foundry and a forge for necessary repairs, preparation of specimens, etc.

The divisions of general chemistry and oils include different laboratories for organic and inorganic chemical research, the laboratory for electrolysis, in which are installed two accumulators and a dynamo, a special room indirectly illuminated for determining the flashing point of oils, a complete installation for the distillation of crude petroleum, lubricating oil, and residues, a laboratory for experiments in refining and for testing by low temperatures, and finally a laboratory devoted to experimental physics. The last is provided with the most highly improved instruments, such as the Vogel spectroscope, a polarizing apparatus, a photometer and refractometer, a Beekman apparatus for the determination of molecular weights, and an Oswald thermostat. These two divisions, also, have at their disposal for open-air experiments ground space and platforms connected with the majority of the buildings.

The establishment of this model institution at Gross-Lichterfelde, now without a rival in Europe, required the large sum of $664,000, and covered a period of four years. Of the sum mentioned, $516,000 was expended by the administration in charge of the construction of the buildings, while the remainder of the appropriation, $148,000, was used to provide new apparatus and instruments.

In the current number of the Scientific American Supplement will be found an article with six engravings, further to illustrate the above account of this interesting laboratory. We refer the reader for additional information to the Supplement.

New World's Kilometer Motor-Cycle Record.

A new world's motor-cycling record was established by the well-known rider, Cissac, for the flying kilometer at the recent automobile meeting at Brighton, England. There were four entries, comprising Cissac and Rignold, each mounted upon a 12-horse-power twin-cylinder Peugeot motor cycle; G. A. Barnes, on a 10-horse-power twin-cylinder Barnes, and C. R. Collier, on a twin-cylinder 7-horse-power Matchless machine. Cissac in his heat covered the flying kilometer in 27 2-5 seconds, which is a speed of 81½ miles per hour, with Rignold 4 1-5 seconds behind. Cissac's time in this heat was only one-fifth of a second behind the record time for this distance established by Guipponne a short time ago at Ostend. In the final Cissac covered the short mile in 49 3-5 seconds, and the flying kilometer in 25 seconds dead, equal to a speed of 86 miles an hour.

THE OYSTER INDUSTRY.

BY I. B. OWENS.

A visit to the smaller cities and towns bordering salt or brackish waters, where oysters are cultivated, and another to the great fish markets, such as are found in Boston, New York, Philadelphia, and Baltimore, or even in New Orleans, Chicago, and San Francisco, where oysters are sold, will give some idea of the extent and importance of the oyster industry. Thousands are employed. Even in these days of billion-dollar enterprises, a large capital is invested. It is incorrect to suppose that the oysters are merely caught in their natural state and brought untreated to the market. They must be carefully cultivated from inception to maturity, and skill and experience go far in the make-up of the successful oysterman.

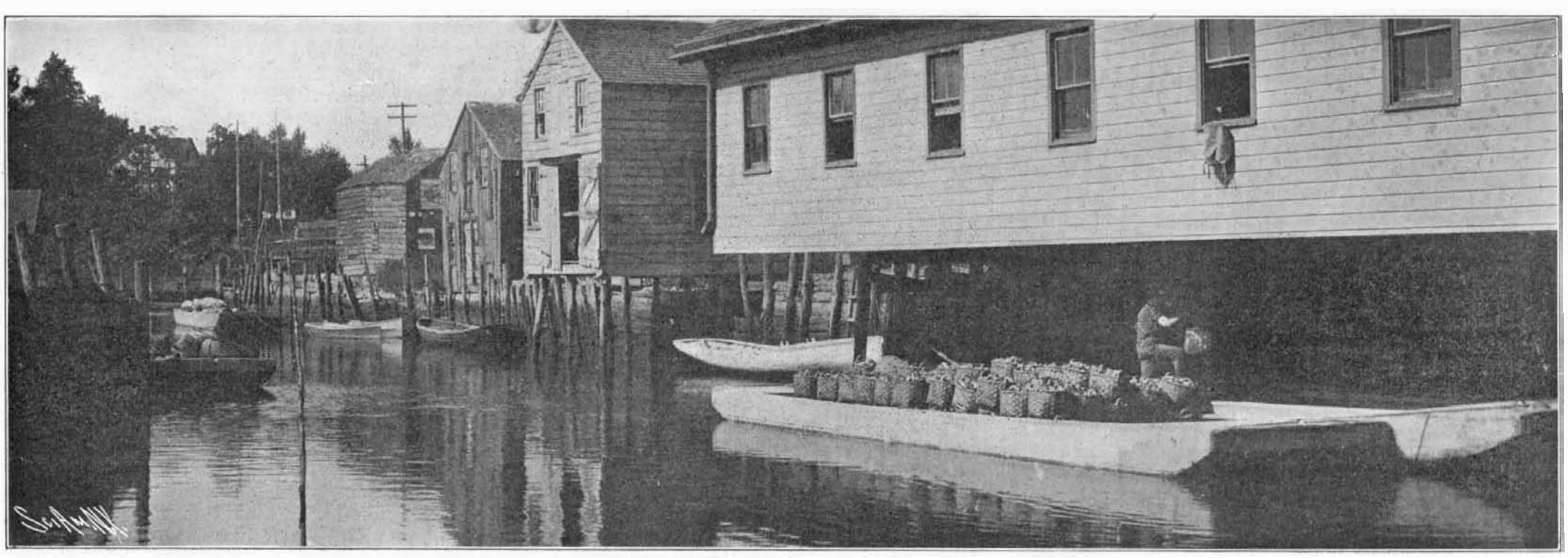
The young or "seed" oyster results from the spawn, much the same as with fish, and this seed is the one essential thing to the oyster planter. At present the waters adjacent to New York and New Jersey supply the seed not only for the New York industry, but for localities so far away as San Francisco. In the early days of the New York oyster business, however, the seed was brought from the Chesapeake Bay, and more than a little romance is woven into what was known as the "Virginia oyster trade." The seed oysters were freighted to New York in small sailboats which, in order that the seed could be planted in season, were raced up and down the Atlantic coast with a skill and desperate daring known only to the American boatman of forty years ago. Famous among these boats was the sloop "Admiral," of only 29 tons gross burden, owned by the late Joseph Ellsworth. This boat, to use the expression of her skipper—now a grizzled veteran of seventy years—"ran the beach loaded decks-to in the dead of winter," making on each trip thousands of dollars for her owner.

When the seed acquires in its natural bed or "reef" a growth of from one to three inches in length, it is gathered from the water and carefully culled or sorted. The perfect seed are then replanted in other localities where their growth can be carefully watched. From then on the crop must have ceaseless attention for from two to three years, in which time the growth is complete and the marketable product results. During this time the oysters must be kept from the attacks of the starfish and other destructive parasites; they must be kept spread out thinly on the bottom so that their growth will not be hampered, and they must be protected from the many other things (not excepting thieves), on the absence of which the life of the oyster depends. To prevent theft of the oysters, men are stationed in watch-boats which are anchored over the beds. The watch-boat shown in one of the illustrations is owned and maintained by a community of oystermen whose beds lie off Keyport, N. J. When the growth of the oysters is complete they must be taken up for market. In some cases the beds run dry at low tide and then the oysters are raked into heaps and taken off the beds. In most instances, however, the beds are always under water and the oysters are then taken up either by hand-tongs or dredges. The tongs have long wooden handles terminating in groups of iron fingers in which the oysters are caught. Tonging is slow and extremely laborious work and is fast being supplemented by the dredge. This instrument is formed of a large and heavy iron rake, to which is attached a bag, partly of iron links and partly of heavy cotton mesh. The dredge is dragged along the bottom and will catch, according to its size, from one to ten bushels at each haul. In the early days the dredges were hauled by sailboats and pulled aboard either by hand or by hand-operated winches on the decks of the boats. Now steam and gasoline-driven dredge boats are almost exclusively employed and these are fitted with power operated hoisters, by means of which the dredges with their loads are raised on deck. Usually the dredge boats have the engines in their after-ends and are provided with shafts driven from the engine and running forward to the hoisting drums, which are placed in the bows between decks, the chains, to which the dredges are fastened, being passed up through the deck and over sheaves hung from a mast or stanchion. These boats range from five to two hundred tons burden. The boats shown in the illustrations are about fifteen tons burden and under favorable conditions are capable of dredging up five hundred bushels of oysters in ten hours' work.

Unloading the Oysters from a Dredge Boat into a Scow for Transportation to Fresh Water.

As the contents of the dredges are thrown on the decks of the boats, the shells, dead oysters, debris and the like are carefully culled from the marketable oysters. As a rule, when the mature oysters are gathered from the beds, they are poor or shrunken, and oysters from some localities, when fresh from the beds, have a bitter, coppery taste. To swell or "fatten" the oysters under these conditions they are put through the process of "drinking;" that is to say, they are sunk for a short time in fresh or only slightly brackish water. Usually this is done when the oysters are still in the shell, they being unloaded from the dredge or other boat in which they are first gathered and transported to fresh-water creeks or springs, where they are thrown overboard and allowed to lie for from six to ten or twelve hours. They are then taken up and are ready for the market. In some cases the oysters are not "drunk" until opened. Then the oysters, removed from the shells, are placed in troughs or vats and covered with fresh water. In either case, the oysters throw off their natural bitter or coppery taste and, absorbing the fresh water, swell out or "fatten," as the oystermen term it, taking the plump, rounding form which they usually bear when sold to the consumer. The oysters are transported to the market or opening houses in various ways, depending upon the locality and traffic conditions. Most of the oysters reach New York market in bulk by boats, as will be appreciated when one inspects the large fleet of oyster boats always to be seen at Gansevoort and Fulton markets, New York city, during the oyster

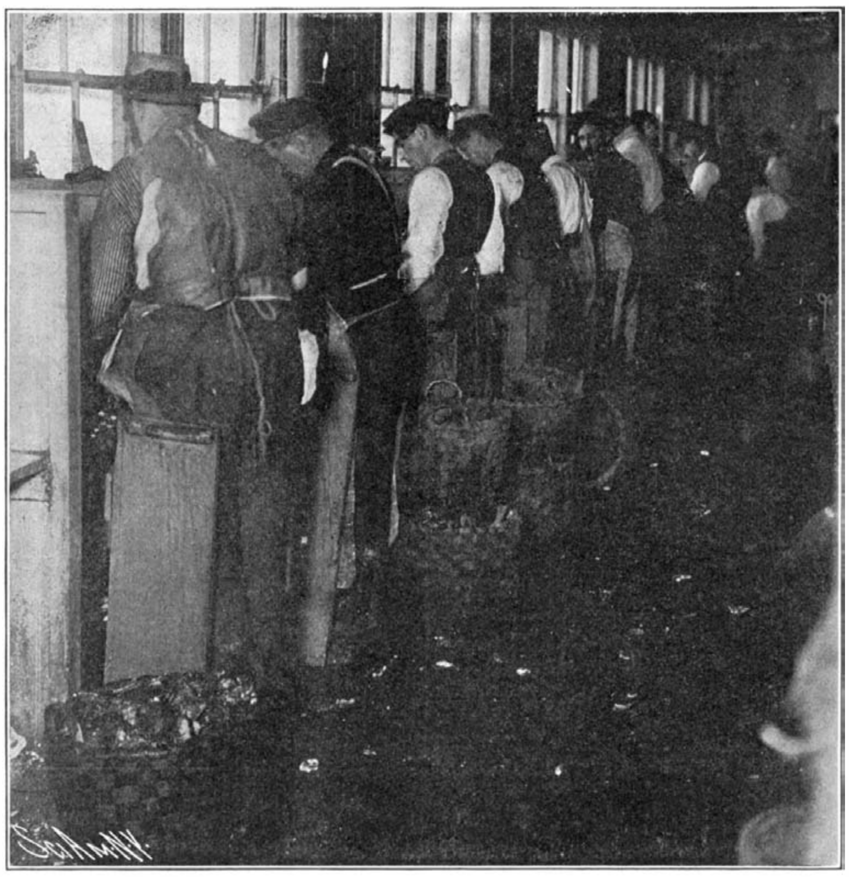
After Having Been in Fresh Water, the Oysters are Transferred to Baskets and Carried to the Oyster House.



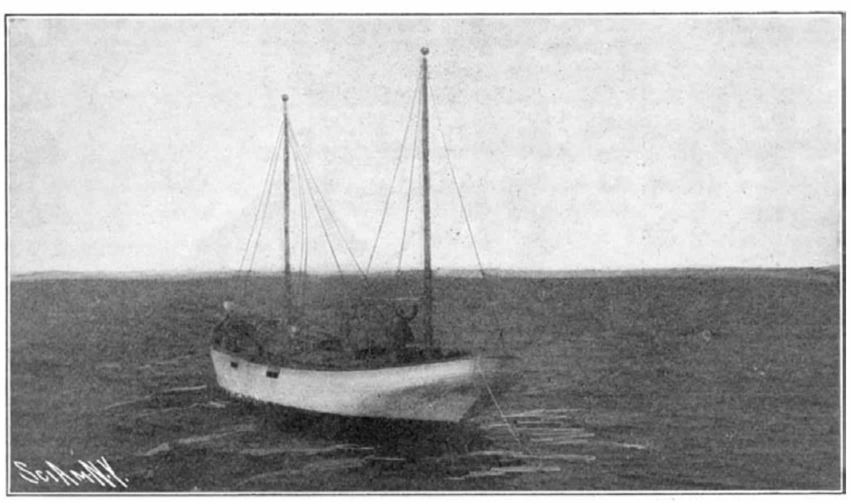
After the Oysters Have Lain in Fresh Water for Six Hours, They are Removed to the Oyster House.

THE OYSTER INDUSTRY.

season. Some of the product is, however, shipped in barrels by rail and steamboat transportation lines. Market oysters are divided into three grades, known by the oystermen as box, cullings, and cullintines, the largest being called the box oysters, the medium-sized cullings and the smallest cullintines. According to the practice usually followed in the New York market, the oysters are not "culled" or sorted until reaching the market or opening house. Here they are separated into their proper grades and those intended for local consumption are usually delivered in their shells to the buyer. A vast part of the product is, however, shipped far inland to be consumed either fresh or to be preserved or canned, as may be desired. In shipping the oysters inland, it is customary to open them and place them with their liquor and a cake of ice in cans or tubes. In this form they may be safely transported long distances. The thoroughness with which this part of the business is understood is attested by the fact that the writer has been served in Omaha, Nebraska, with raw oysters on the half-shell, although the restaurateur, when pressed hard on the point, admitted that the shells were as much a part of his equipment and were used by one customer and then another with the same frequency as his cups and saucers. These oysters for the inland trade are opened in the oyster houses which are usually erected on the shores adjacent to the oyster grounds or beds. One of the engravings shows the men at work opening or "shucking" the oysters. In the Chesapeake Bay this part of the trade has been highly developed, thousands of men and even women being given employment by it and the "shucking houses," so called in that locality, being located at almost every point along the bay shores convenient to the railroad and steamship lines.



Opening the Oysters for Market.



Guard Boat Watching for Oyster-Poachers.

Storing of Sun Heat in Liquids.

A storing of sun heat in some of the small salt lakes of Hungary was observed as far back as in 1901 by Kalecsinsky, who recorded the results of his investigations in a paper before the Hungarian Academy of Sciences. He showed the warm layer of the Szovata salt lakes, which lies at a certain depth below the surface between two colder layers and which is several meters in depth, to have necessarily derived its heat from the sun. Both natural and artificial salt lakes, he further showed, can be heated to any higher extent only in case their surface is covered with a layer of fresh or diluted salt water. Such salt lakes accumulating the heat of the sun up to 70 deg. C. for rather a long time, are to be considered as heat accumulators.

According to information in the German press, Kalecsinsky has since been engaged in continuing his own researches in this direction, in conjunction with the work of other authors. His latest results are recorded in a memoir, likewise presented to the Hungarian Academy of Sciences.

In this interesting paper it is stated that the phenomena in question, so far from being confined to the salt lakes of the Szovata district, are shared both by Roumanian, Norwegian, Siberian, and other salt lakes and can be reproduced artificially in artificial salt water. In fact, concentrated solutions of Glauber salt, sal ammoniac, soda, etc., on being exposed to the sun, will become heated in the same way as a salt lake, provided their surface be covered with a layer of either fresh water or diluted salt water. Even fresh water, however, can be heated in the same way if it be covered with a layer of either petroleum or oil.

These phenomena are accounted for by the physical properties of the liquids and depend mainly on their arrangement. In the case of salt water covered with fresh water, the maximum heat will mostly be stored at the contact points of the two layers. If the fresh-water layer be evaporated without being heated, the temperature will be compensated for. Since oil and water do not diffuse into one another, as is the case of fresh and salt water, the maximum temperature in oil-covered water will mostly be found immediately below the oil layer.

The heating undergone by such water can be raised so far as to kill any animal and vegetable life below the layer, if the lower water be not renewed. In the Ostravik Lake, in Norway, the oysters thus died in 1885, until the salt water was put in connection with the open sea. As soon as this connection had been produced, the oysters thrived very well. Many temperature phenomena observed in large continental seas, such as the Baltic and Mediterranean, are explained in this way. Strong currents of cold, fresh water will, for instance, flow in the northern Mediterranean from Italy into the hot salt-water basin. So far from producing any cooling, the light and cold fresh water will, however, maintain the heat in the salt water, so that at a certain depth the water in the northern Mediterranean is warmer than in the southern part where this protective fresh-water supply is missing.

Some greatly interesting conclusions may be drawn as to conditions prevailing in primitive ages. It is likely that salt lakes existed then as they do now, as there would otherwise be no such salt deposits as that of Stassfurt. These salt deposits mostly consist of alternative layers of different salts. The researches of Van't Hoff and others have shown the elements contained in water to combine to quite different salts depending on the temperature, each salt having a formation temperature of its own. Now, as in the evaporation of the primitive lakes, such salts as corresponded to the actual temperature of the strata are likely to have been deposited, there might have been a similar accumulation of sun-heat by covering layers, the different salts produced by the variations in temperature constituting, so to say, a geological thermometer.

The French physician, Dr. Marage, has experimented on the perception of vowels, the note of emission, and the distance at which the perception occurs. His experiments were made by means of the "vowel siren," for in the human chant the output of air cannot be measured. According to his observations, every vowel is perceived at a certain distance for a minimum of energy employed on a determined note. In consequence, the ear hears better certain vowels, when they are emitted on certain notes. This explains why singers are led to slur certain words in singing. The *e* and *i* need the sharp notes; the *o* and *a* carry the voice. The education of the ear is of no consequence in these experiments. Tests of audition have been made on a professional singer, and on a countryman destitute of all knowledge of music. By these means the auditive acuteness of a patient may be measured. The acumeter ought to be able to render, like the "vowel siren," sounds of which the tone and height are constant, the intensity alone varying. Dr. Marage concludes that there is probable occasion for modifying the note emitted by the sirens of the lighthouses, a note which is at present *re;* there are other notes which would carry farther with less expenditure of energy.

Deck of a Dredge Boat, Showing Crew Repairing a Break in the Dredge.

Culled Oysters Ready for Market.

THE OYSTER INDUSTRY.

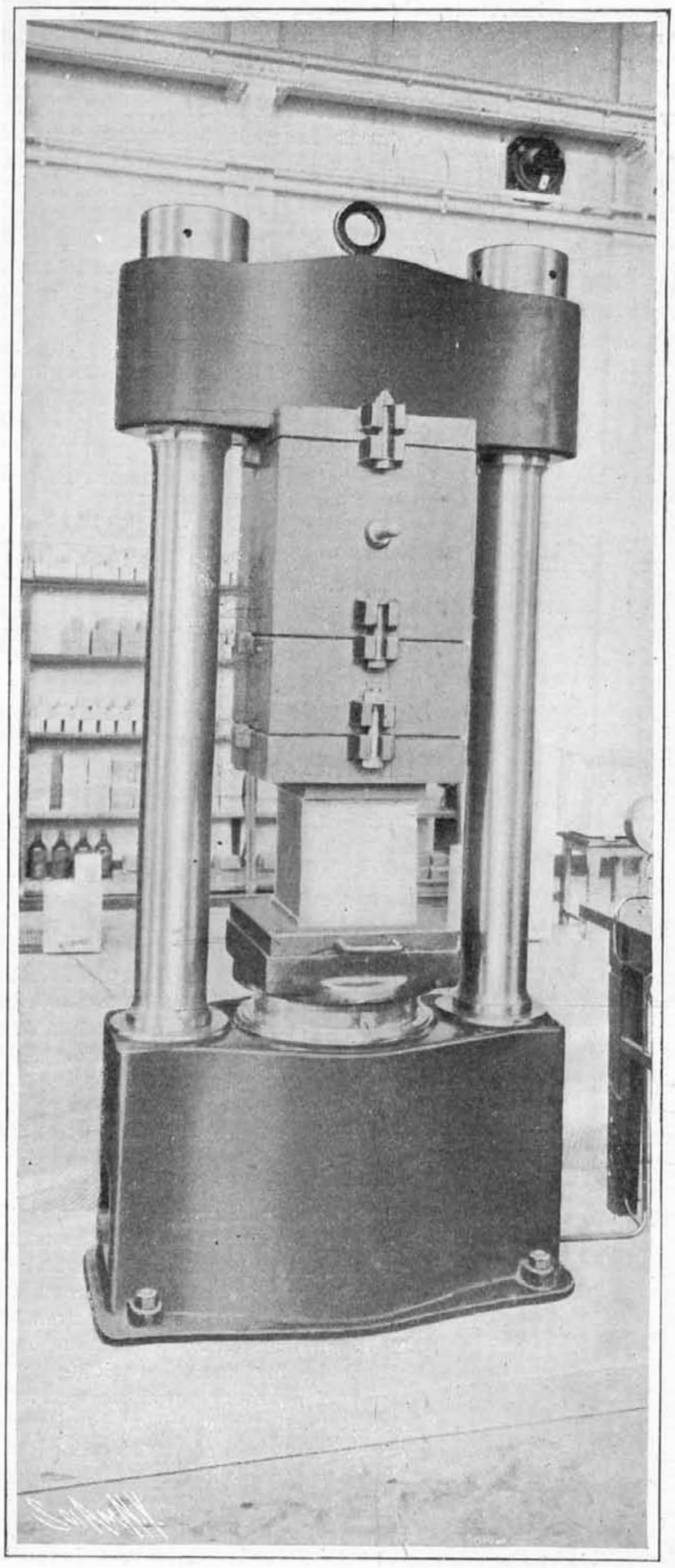


Fig. 7.—A 400-Ton Hydraulic Press for Testing Concrete Blocks Under Compression. This Forms Part of an Elaborate Equipment for Testing Conglomerates and Materials to be Used in the Form of Briquettes.

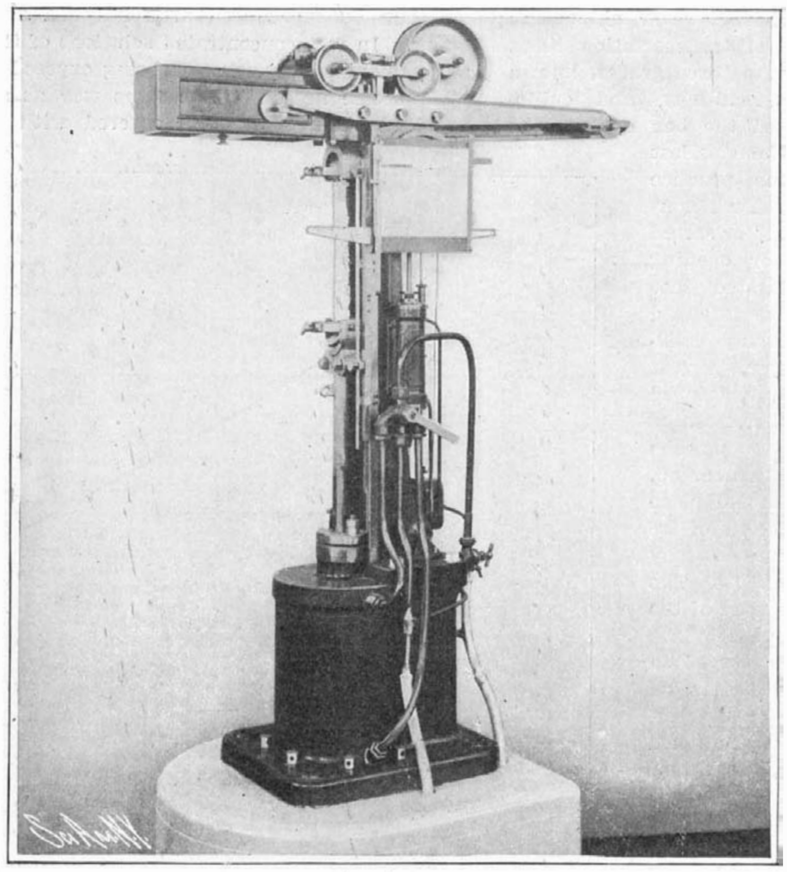


Fig. 10.—Martens Automatic Resistance Gage.

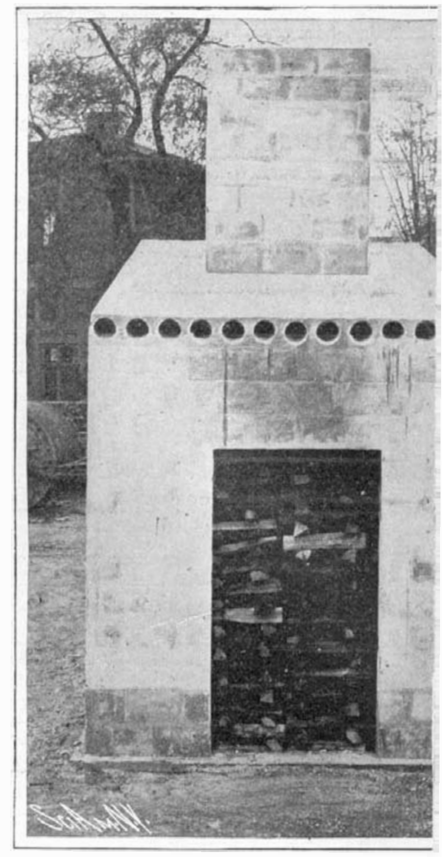


Fig. 8.—A Test of Fireproof Material Pr

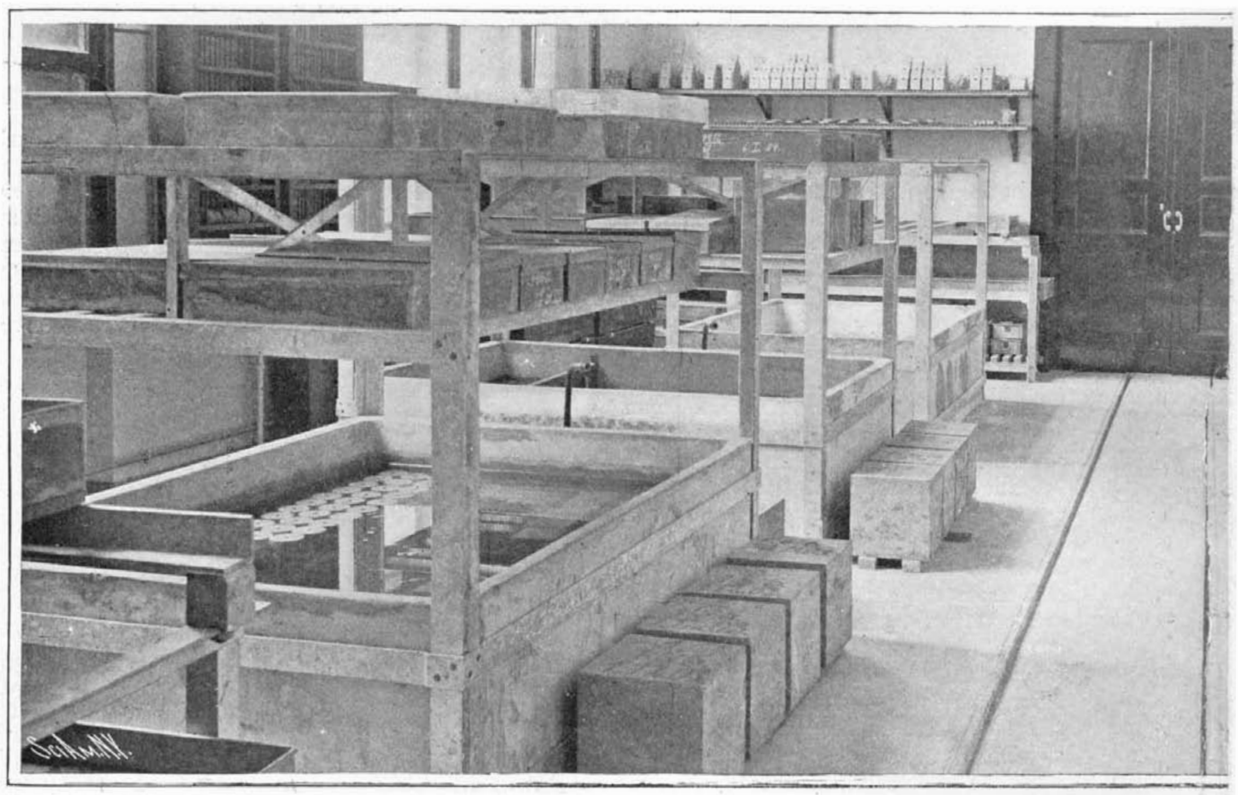


Fig. 6.—Room for the Setting of Briquettes of Hydraulic and Ordinary Cements.

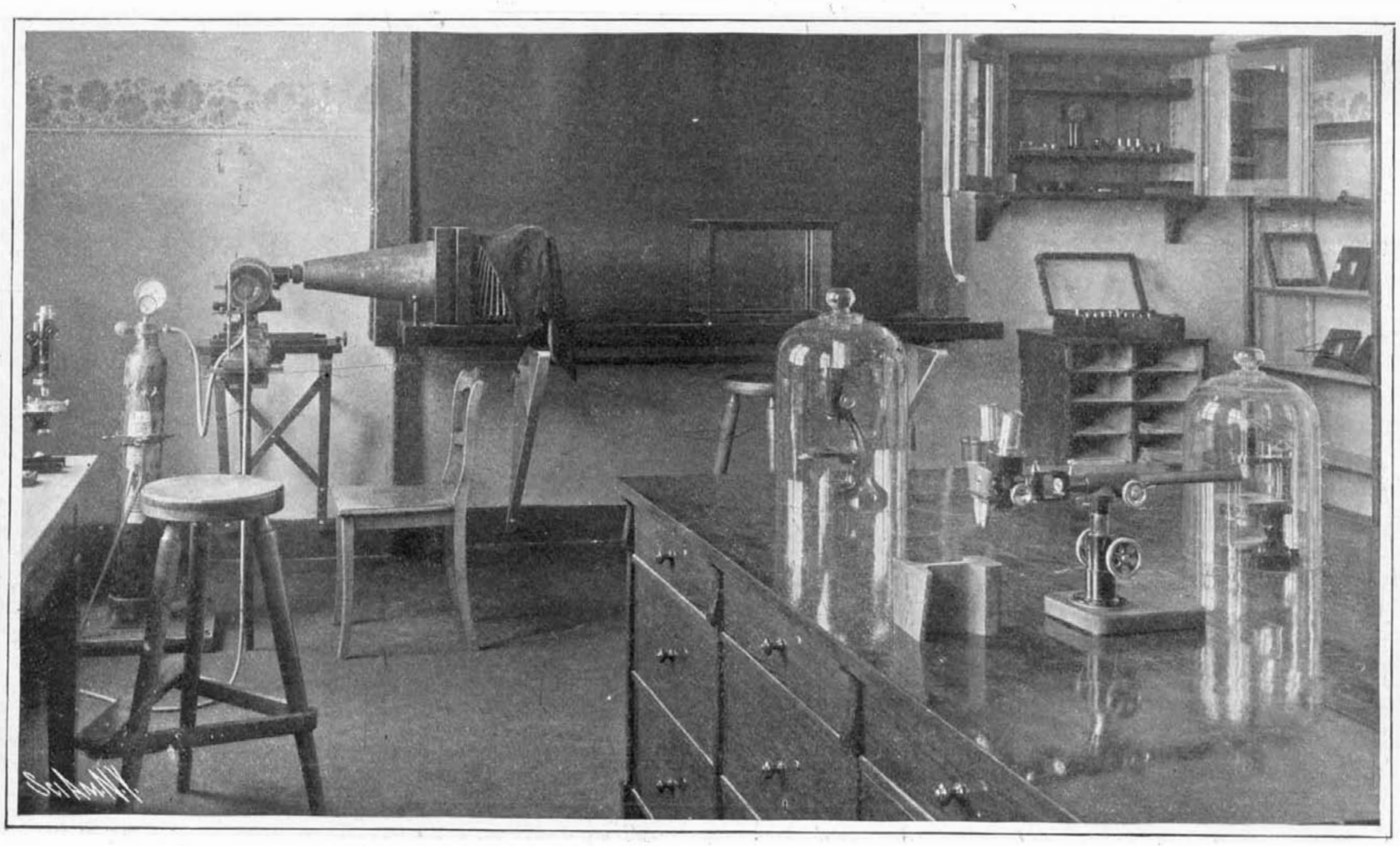


Fig. 11.—Room for Microscopic and Micro-photographic Investigations.

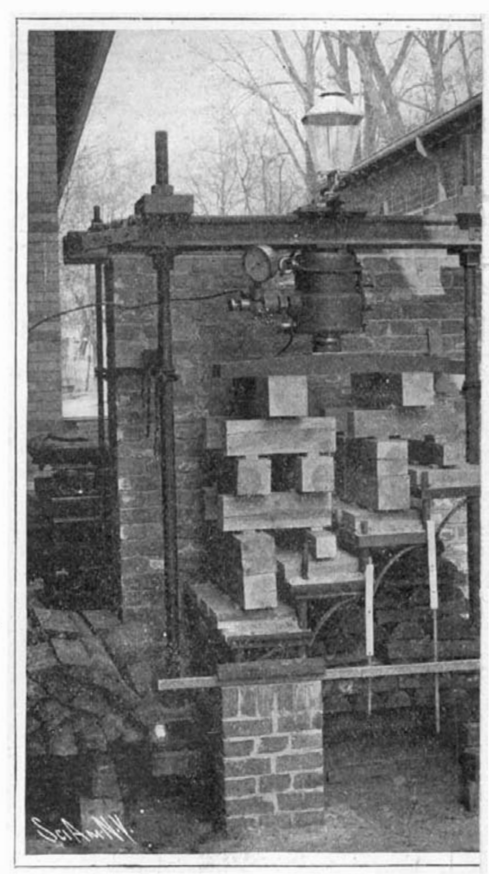


Fig. 3.—Ready to Test an Iron Stairca

SOME OF THE TESTING APPARATUS OF THE ROYAL POLYT

ior to Ignition.

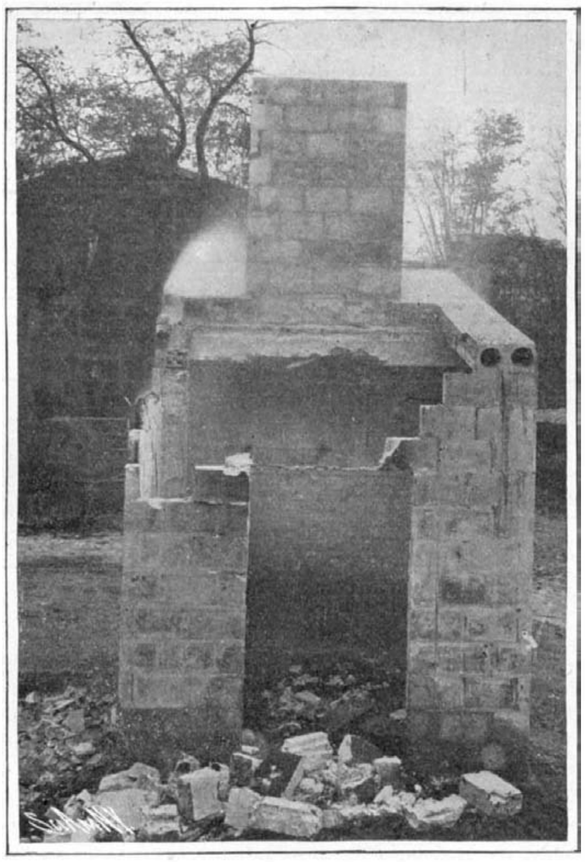


Fig. 9.—Conclusion of the Test.

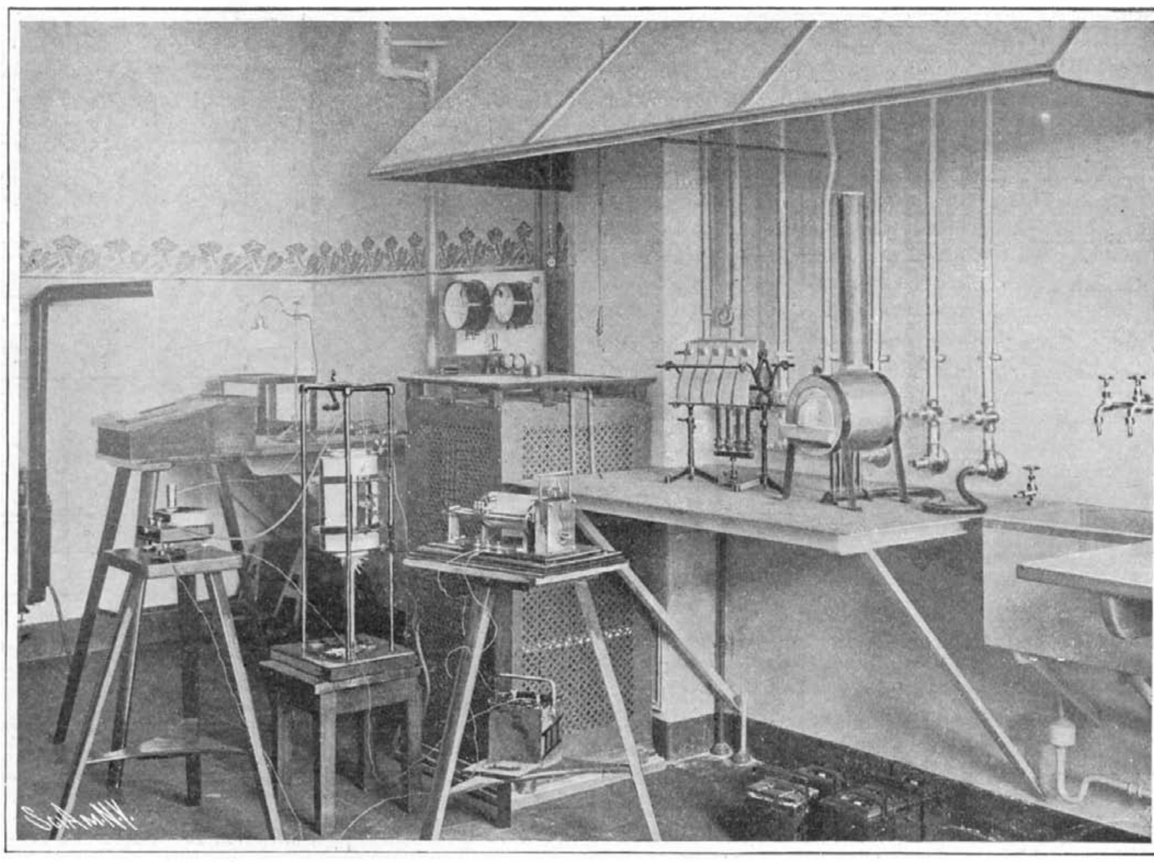


Fig. 12.—Room for Conducting Tests on Incandescent Heating.

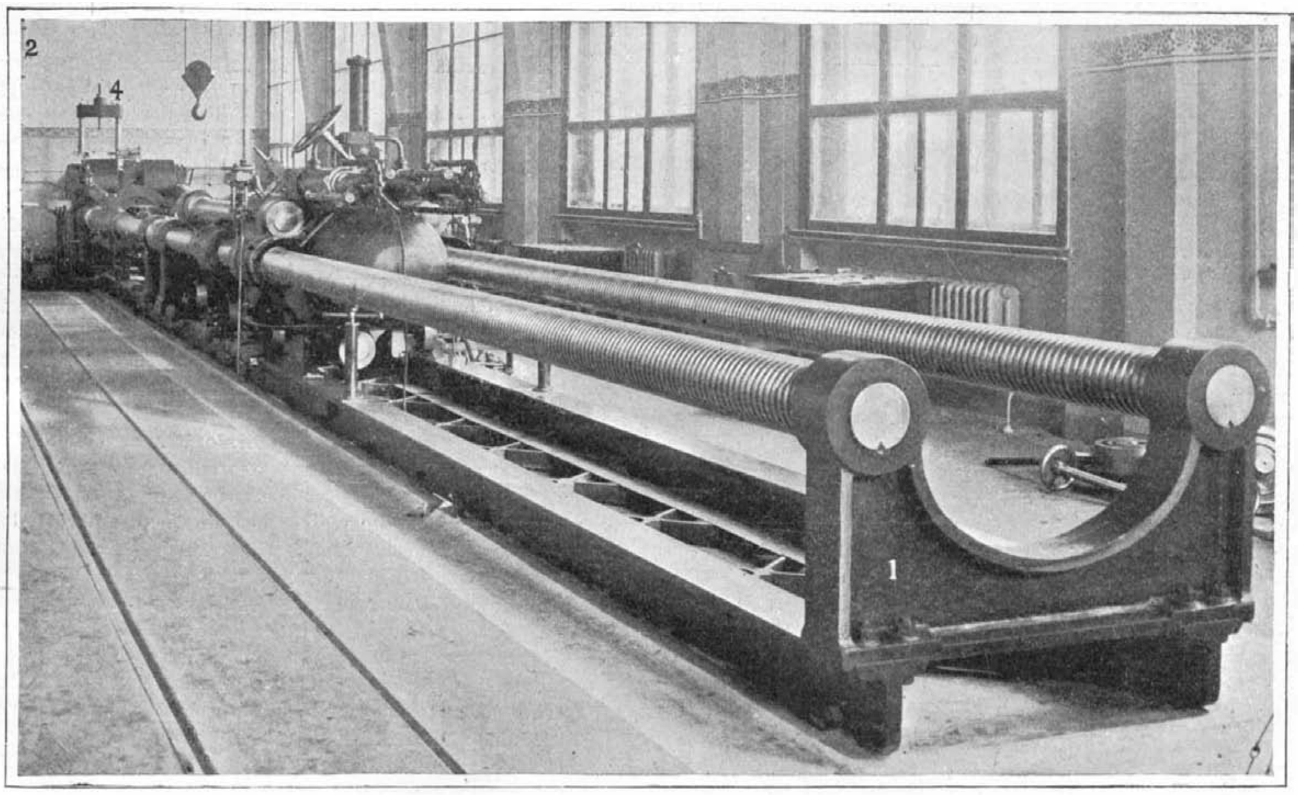


Fig. 1.—Giant Hoppe Testing Machine (1); Controlling Apparatus (4).

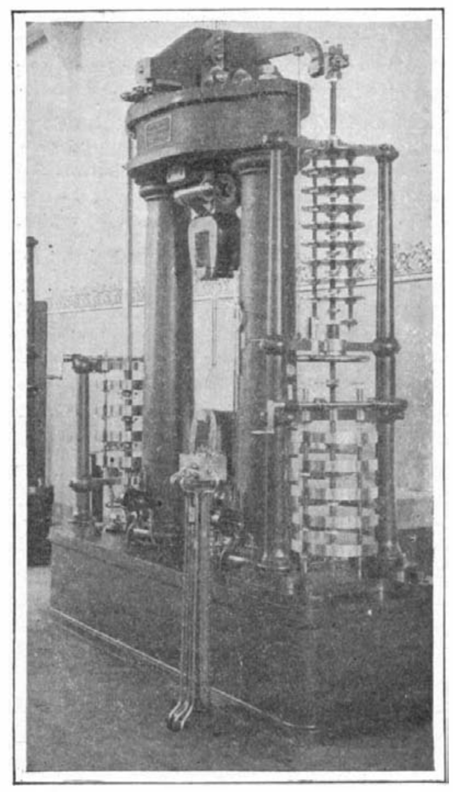


Fig. 2.—A Machine for Heat Tests.

se.

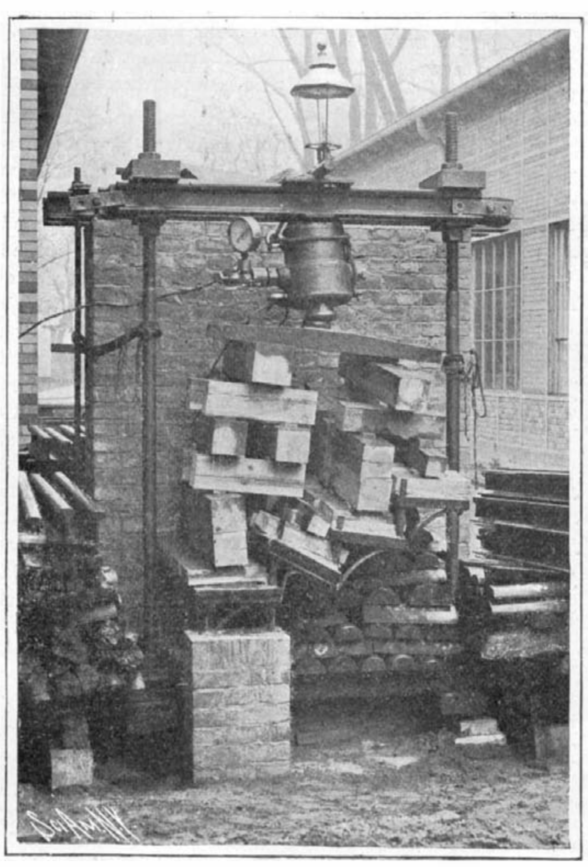


Fig. 4.—The End of the Test.

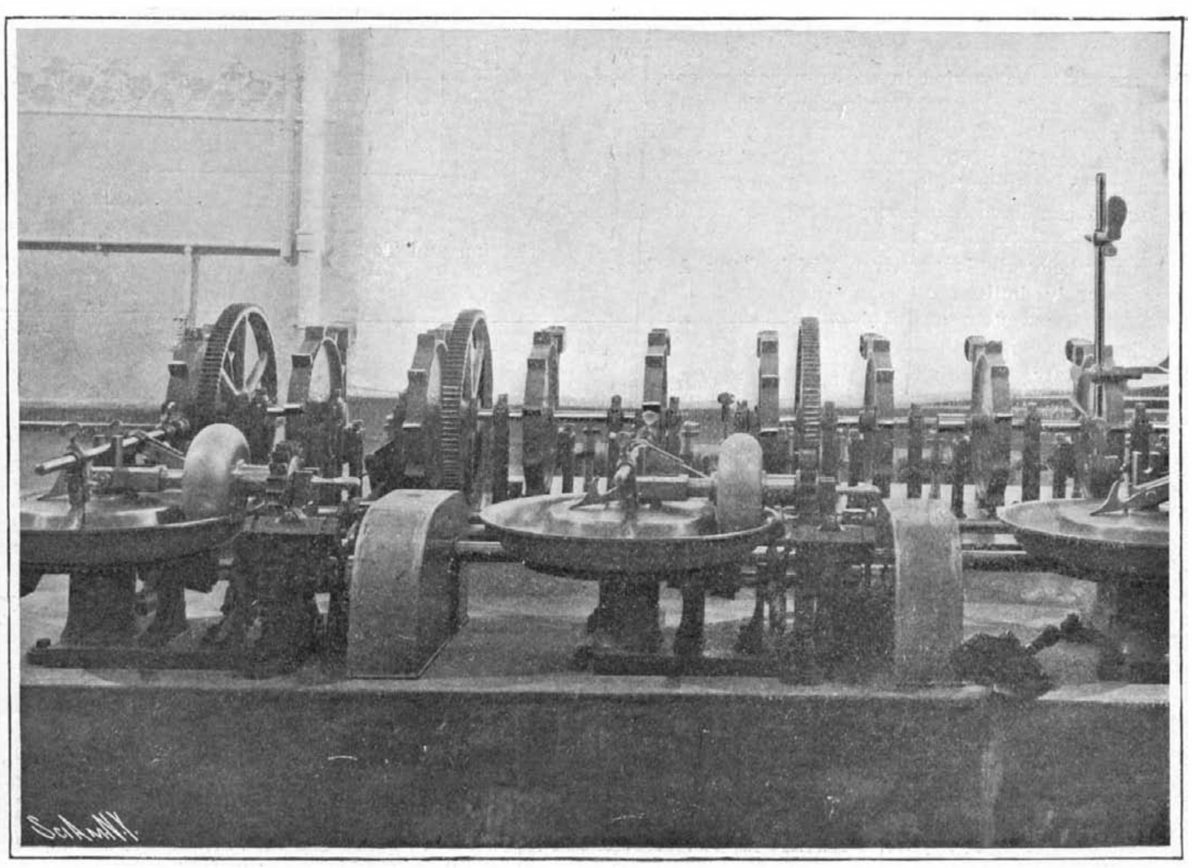


Fig. 5.—Mortar and Concrete Pug-mills for Preparing Test Specimens.

ECHNIC SCHOOL AT CHARLOTTENBURG, BERLIN.—[See page 199.]

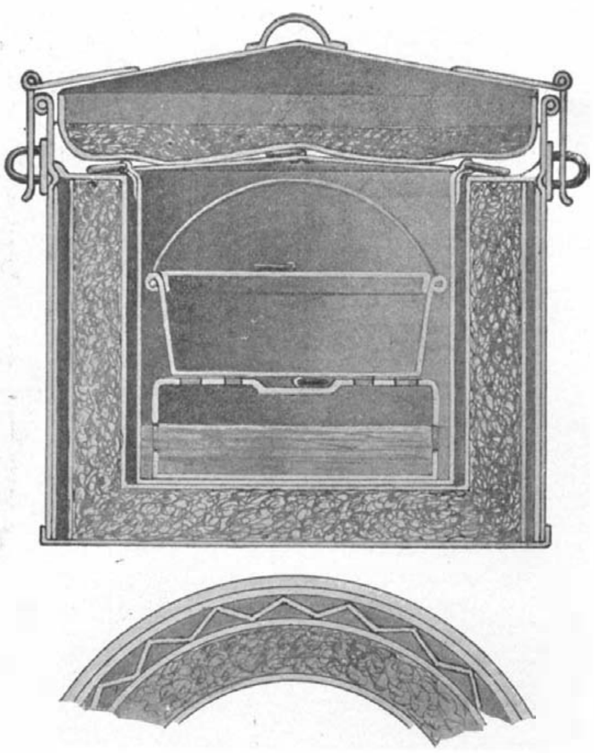
A FIRELESS COOKER.

A new method for cooking by retained heat has been invented by Mr. Felix Kahn, of New York city, who has assigned the patents covering his invention to Mr. James S. MacCoy, of 1122 Broadway, New York city. In the cooking of foods as ordinarily practised there is a great waste of heat, care, and attention, an unnecessary amount of wear and tear on the cooking utensils, a large loss of food material, and too frequently an inferior quality of food, due to the drying and burning and the loss of the juices which give wholesome, nutritious, and palatable qualities to the food. This is due to the fact that the cooking is usually done by continuous application of the heat, which wastes 70 to 80 per cent of the heat, occupies the stove with utensils for a needless length of time, and subjects the utensils to just that much more wear and destructive influence of the heat, as well as consuming an unnecessarily large amount of fuel.

The invention is an improvement over a former one, wherein the food which had been previously stewed or boiled was kept in a hot condition. By subsequent experiment it was found that after having first permeated food with heat at a cooking temperature, it was possible to stew or boil the same to perfection by the heat as conserved against loss by radiation, but that it was physically impossible to steam or dry-cook in that device by heat without the addition of a body of water. In the improved form of the device this is accomplished by placing a body of water in the bottom of the cooking receptacle, and providing a perforated rest which is placed over the water and which supports the pan or secondary cooking receptacle containing food. Substantially, the apparatus consists of an outer casing of metal and an inner casing of heavy tin. Between these are the non-conductors—paper, cylinders of dead air, and a body of fibrous material. The tight-fitting lid is similarly constructed. This ..fects a perfect retention of heat. As said above, in the bottom of the cooking receptacle is placed a quantity of water and a perforated support for the vessel containing the food. The manner of using the apparatus is very simple. An article of food prepared in the usual manner, and placed in the granite-ware cooking receptacle, is put on the fire until the contents are thoroughly permeated with the heat at a cooking temperature. The receptacle is then set into the heat-retaining part of the fireless cooker. This is closed and set aside for a period of time depending on the character of the food, and the same will then be found to be cooked to perfection. The fireless cooker has been exhaustively tested, about one hundred recipes having been put through this method by the Greater New York Cooking School with highly satisfactory results. For two summers it has been used practically with great success by Mrs. Lemcke, proprietress of said school, at her summer hotel.

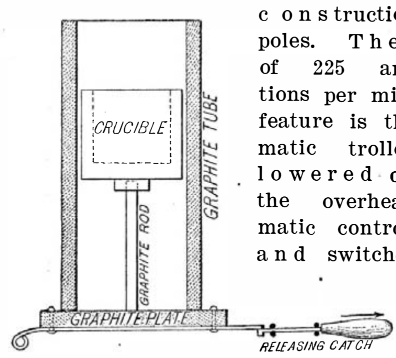
The War Department made recently at the Army Building in this city an exhaustive test of the merits of the apparatus for army use. There were present Commissary-General Weston, Capt. Murray, the cooking expert of the army from Fort Riley, Kan., Capt. Franklin, commissary at West Point, Col. Brainard and Capt. Cole, commissaries at New York, and others. The test was so satisfactory that initial orders have already been placed for its use at West Point and Fort Riley. Capt. Murray designed a case to contain six cookers of special shape, adequate to feed a troop. This case is to be carried in the transport wagon.

The cooker is adapted for general domestic use, also for use in buffet and dining cars, steamships, yachts, automobiles, etc. One of its most interesting forms is the workman's dinner pail. It cooks while he works; he can have a hot meal wherever required.



A FIRELESS COOKER.

The new electric locomotives which Ganz & Company recently built for the Valtelline system of electric railroads in the north of Italy, show a number of novel points. They employ high-tension three-phase current at 3,000 volts directly upon the motors. The main feature to be remarked is the disposition of the motors. The locomotive carries three driving wheels, and the two motors are placed in the spaces between the wheels and somewhat above the centers. The two motors are coupled across by a crank-bar which is connected to a crank on each of the motors, so that the bar takes a to-and-fro movement. The crank-bar is coupled to the middle driving wheel and thus operates it. From the middle wheel there is a horizontal driving bar which runs to each of the other driving wheels on the sides. Counterweights on the motor shafts balance the system. The inclosed motors are of a special double construction and have eight poles. They run at speeds of 225 and 112.5 revolutions per minute. A new feature is the use of a pneumatic trolley which can be lowered or raised against the overhead line. Pneumatic controller apparatus and switches are among the points to be noticed, and the motorman operates all the devices on the car by working a few valve handles which are placed together in the end cabin. The new locomotives are able to take a 250-ton load up a twenty per cent grade. They can draw a 400-ton load on a one-per cent grade and bring the speed in 55 seconds from zero up to twenty miles an hour.



Trap for Dropping Crucible.

ARTIFICIAL PRODUCTION OF REAL DIAMONDS.

BY A. FREDERICK COLLINS.

Diamonds as beautiful as those found in the celebrated Kimberly Mines, in South Africa, are now made in the electric furnace; and the only difference between those taken from the extinct craters of volcanoes abroad and those formed by applying heat and pressure at home is the consequential one of size.

Many have been the attempts to produce artificial diamonds that could not be detected from those of genuine origin, but there is not an instance on record where such imitations approximated anywhere nearly the hardness, the specific gravity, and refractive powers of the real gems and which gives to them their extraordinary brilliancy.

It has been a matter of common knowledge for a very long time that diamonds were nothing more nor less than a form of carbon, and that Nature in her workshop produced these precious stones by a subtle process from another form of carbon called graphite, but while the latter is a widely-distributed element there are very few places indeed where the crystallized forms are found, and the output from all the mines in the world is effectually controlled by what the broker in gems calls the "Diamond Trust."

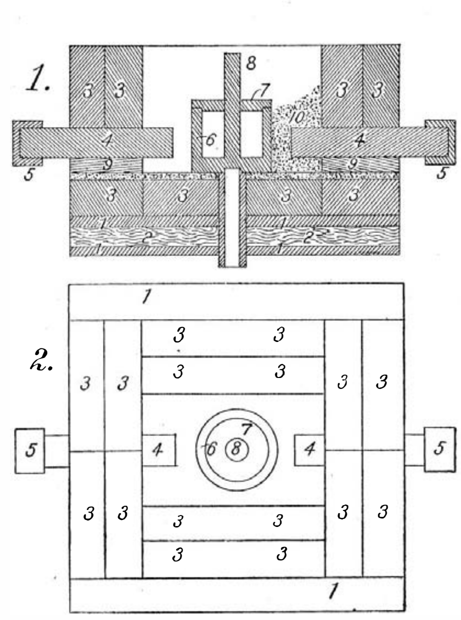
To produce real diamonds by artificial means seemed theoretically possible to those who had studied the subject profoundly, for the chief requirements were first, an intense heat, and second, an exceeding pressure directed on the material to be converted into crystals. To work out these conditions so that they might adequately prevail in practice was a vastly different phase of the problem, and for this reason, if none other, the results obtained are highly interesting and even encouraging.

The deductions relating to the formation of diamonds under natural circumstances have been based largely upon observation; of course analysis shows what the stone consists of, but of its manufacture nothing. When a gem is recovered from the "blue-stuff" or diamond-bearing clay it is found incased in an opaque layer or matrix and isolated from others of its kind.

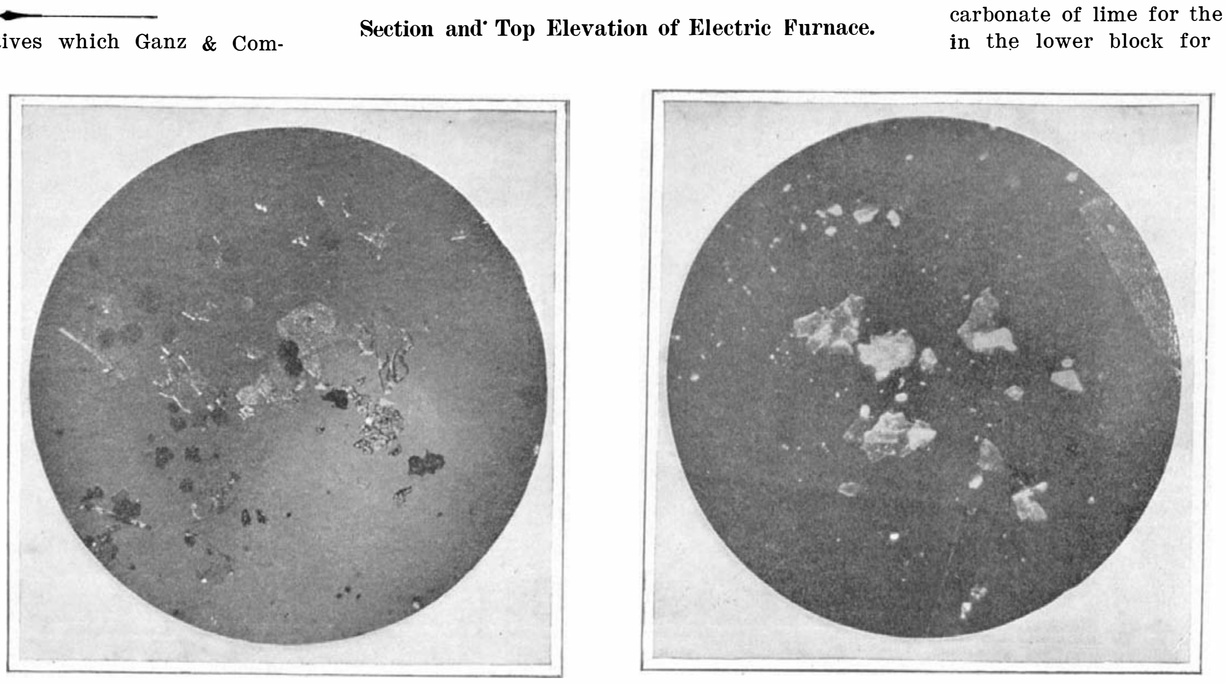
This being the case, mineralogists concluded that ordinary carbon had been treated to a degree where it was fused and then suddenly cooled, when it crystallized, for when the matrix is removed the diamond in its rough state is found inside. In order to bring out its beautiful iridescent properties that make it so well beloved, the rough gem must be carefully cut and polished.

Occasionally diamonds have been discovered in meteorites formed of masses of iron that have fallen from space to the earth and in which the heat generated by the aerial passage and pressure due to the change of temperature were sufficient to crystallize the graphite and thus form the diamond. It is from these limits that men came to believe in the possibility of imitating the process and so to legitimately produce real diamonds.

The electric furnace offers the means for obtaining heat at an exceedingly high temperature, and several different methods have been evolved for procuring the requisite pressure. In the earlier experiments of Prof. Henri Moissan in the art of diamond making he employed the following methods: His electric furnace comprised an iron casing having a lower block of carbonate of lime for the body. A cavity was formed in the lower block for a crucible made of molded carbon. The carbon electrodes between which the electric arc was formed, were placed horizontally through the furnace over the mouth of the crucible. Into the crucible a fourth of a pound of Swedish iron was placed together with the graphite which was to be converted into diamonds, and the mixture was then covered carefully with powdered charcoal. The arc was produced by a current of 1,000 amperes at 500 volts, and when the heat became intense enough the graphite was practically fused with the iron. The next step was to subject the fluid mass to great pressure, and this was done by grasp-



Section and Top Elevation of Electric Furnace.



Artificial Diamonds Viewed by Reflected and Transmitted Light.

MAKING DIAMONDS BY ELECTRICITY.

ing the crucible with a pair of tongs and plunging it into cold water, a process not without danger to the operator.

The effect of this sudden change in temperature was to cause the iron, which was heated to incandescence, to instantly contract and with such force that the particles of carbon held in suspension in the liquid mass were greatly increased in density, and having the brilliancy and other attributes of real diamonds.

Mr. Henry W. Fisher, chief engineer of the Standard Underground Cable Company, of New York city, has improved upon Moissan's method in many respects but especially in the manner in which the contents of the crucible are immersed in the cooling bath. Other improvements relate to the construction of the furnace and the means employed for obtaining a more intense and uniform heat, the details of which will be made clear by referring to the diagrams.

The furnace was made by attaching sheets of asbestos, 1, 1, above and below the table, 2; on top of the asbestos, fire brick, 3, 3, 3, 3, were placed and a lining of magnesite, 4, 4, formed the inner surface of the furnace. The crucible, 5, was made of Acheson graphite and so designed that a portion of it extended through the hood of the furnace and on through the table; 6 is a valve stem arranged so that it can be lifted and the incandescent mass in the crucible permitted to fall into a cooling bath immediately below. Graphite electrodes, 7, 7, are capped with brass conductors over the ends to facilitate the flow of the current; crushed coke is packed around the crucible and electrodes, this serving to retain a large percentage of heat that would otherwise be wasted.

In the diagram showing a top elevation of the furnace, where like figures are used to designate similar points, extending to either side of the powdered coke, 8, is the lining of finely-divided magnesite, 9, 9, which in this form does not conduct and dissipate much of the current when the furnace becomes excessively heated. This furnace is the outcome of several prior ones that Mr. Fisher had designed and built. The first one was of lime and similar to the one used by Moissan, and then furnaces of asbestos board were constructed and these were lined with blocks of magnesia, but not until he set up the one described above was a really satisfactory furnace obtained.

Since there were large heat losses due to the reduction of temperature from the instant the crucible was removed from the furnace until the contents were thrown into the cooling bath, the experimentalist devised several methods in which the matrix could be instantly dropped from the furnace into the cooling vessel below.

His first plan was to employ a cylinder of hollow graphite for a crucible and have the lower end of this rest on a graphite slab large enough to project beyond the furnace; when it was desired to discharge the mass in the crucible into the cooling bath the flat slab was pulled away and gravity did the rest.

The danger due to explosion by the sudden change of temperature when the matrix was cooled in water led the investigator to test the efficiency of other mediums as cooling agencies; in one a large lead casting having a hole of appropriate size drilled in the center formed the receptacle for the fluid mass; then a bath of solder was tried, but finally it was found that water gave the best results.

In one of the early trials at making diamonds when the pivoted drop door of asbestos was used to plunge the molten mass into the bath, the crucible holding it did not fall in a straight line, as had been intended, but precipitated the seething matrix into the bath in such a manner that it came in contact with the iron vessel containing it; instantly a bluish-white flame shot up like a heavy disruptive discharge, due, it is thought, to the rapid decomposition of the water, and the matrix then passed through the bottom of the iron pot, melting a large hole in it.

This accident led to further improvements so that the crucible could not depart from its predetermined course. It was subsequently found that the more rapidly the contents of the crucible were cooled, the greater the diamond-making qualities of the matrix, and when the cooling process took place very quickly little pieces that were broken off in the water from the principal mass contained diamonds, which was not the case with the large lump remaining in the crucible and which was partly insulated by it.

In one of the accompanying photographs is shown a reproduction of a microphotograph of the first diamonds produced by Mr. Fisher; as the illustrations indicate, the photograph was taken by reflected light from the top and shows well the transparency of the miniature crystals. Our cut shows a specimen containing several perfectly transparent crystals which were evidently chips split from a larger crystal and the largest of these measured one-half millimeter in diameter; this was burned on platinum foil and when consumed left only a trace of ash. The long, sharp crystal was exceedingly brilliant and its sharp edges showed very clearly that it was fractured. This photograph was likewise made by a direct light from the top.

Attempts were made to obtain photographs by transmitted light, but where this was tried the reflected light thrown off by the diamonds cast a kind of a halo and this fogged the plate.

To create these beautiful little gems Mr. Fisher employed a current that reached as high as 1,200 amperes and the maximum power required was about 50 kilowatts. The arc produced by this great expenditure of energy caused the temperature of the furnace to speedily reach the limits of the pyrometer used to determine its value, which was 1,950 deg. C. The work of the arc had, however, only begun, and before the matrix was ready for the water bath it was estimated that its temperature had risen to a point near 2,500 deg. C., and it is quite probable that in some places within the crucible this reached as high a value as 3,500 to 4,000 deg. C.

While the stones thus formed are not large enough to be of commercial importance, it is of more than passing interest, for it points out a way for the manufacture of diamond powder for polishing and grinding purposes, and Mr. Fisher is confident that his future investigations will result in a process by which he will be enabled to produce diamonds of fairly good proportions.

It is stated that the Austrian administration put in service not long ago in the central telephone office of Vienna an automatic section constructed according to the American Strowger system. This section supplies 200 subscribers at present, but it can be extended to take in as many as 10,000 subscribers. The expense of the outfit, as regards the special devices for automatic connection, reach $6,000 for the 200 subscribers above mentioned, not counting the mounting of the apparatus, the wires, etc. This apparatus has been purchased from the German concessionaires of the Strowger patents. Should the trial prove satisfactory, there is no doubt that arrangements will be made to manufacture the apparatus in Austria in order to apply it in Vienna on a large scale.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

CULTIVATOR.—C. E. A. STICKEL and H. C. ROGERS, Battlecreek, Iowa. The invention relates particularly to the construction of disk-cultivator. One purpose is to provide a cultivator constructed in two sections, so connected that they have independent action and when in action a rocking movement, so that when one section moves upward the other generally moves downward, whereby the cultivator is not liable to clog or choke in damp and trashy soil. The implement will leave the soil in an even condition, well turned over, and with the grain or trash thoroughly covered.

COTTON CHOPPER AND CULTIVATOR.—W. G. SUGG and J. V. SUGG, Searcy, Ark. While this machine is designated as a "cotton chopper" it may be used for chopping out corn or similar crops. The object of the invention is to provide a machine by means of which scraping, dirting, and chopping may be done practically in one operation, thus causing a great saving of time and labor in the cultivation of cotton.

Of General Interest.

PAVEMENT.—G. W. CRICHFIELD, Jersey City, N. J., and W. T. S. CRICHFIELD, New York, N. Y. The object in this case is to provide an improved sheet or so-called "monolithic" pavement; and the invention relates to that general class in which the pavement is formed of bituminous or asphaltic mixtures. Such pavements as usually constructed are formed of a base or binder laid in a continuous sheet and having above it a wearing-surface formed of a mixture having greater elasticity than the base or binder. These pavements have disadvantages and difficulties which are overcome by the provision of an improved pavement formed of a number of separate blocks of convenient size and peculiar composition. The blocks form a continuous, unbroken, and practically monolithic or sheet pavement.

COUPLING FOR DRILL-TOOLS.—F. EDER, Thayer, Mo. This coupling is capable of use in any construction requiring a rigid connection unaffected by rotation. One of the principal advantages of the improved coupling is the absolute security against detachment by reverse rotation. To disengage the parts, access must be had to the chamber. This is an important feature in well-drilling as it is frequently necessary or desirable to reversely rotate the drill.

CONFECTIONER'S CANDY-STIRRER.—M. RAUBOLD, Hopkinsville, Ky. It is customary in making candy to make frequent tests of the liquid candy by means of cold water. These are necessarily inaccurate, because the water is often of different temperatures, and the making of each test ordinarily occasions a stoppage of the stirring operations. The invention prevents the necessity for taking these frequent tests. Mr. Raubold's object is to facilitate observations of temperature of the liquid candy as it cooks.

RECLINING-CHAIR.—C. CONN, Bremerton, Wash. This is a form of chair usable as an ordinary chair or instantly and conveniently converted into a reclining-chair simply by the movement of the body of the occupant. The occupant may assume a full or partially reclining position at will and the parts will remain in their adjusted position as long as desired and will so remain when the chair is vacated until the adjusted parts are purposely disturbed. It is flatly foldable without disconnecting any of the parts.

AIR-SHIP.—W. C. BRANCH, Minneapolis, Minn. This invention relates particularly to improvements in the balloon or body portion of air-ships, the object being to provide an air-ship body portion so constructed that it will move through the air on a practically even keel or without undue rocking or tipping sidewise and that should a leak of gas occur will descend slowly, thus making the ship practically safe for passengers.

CREASING AND FOLDING DEVICE.—E. C. NAYLOR, Gloversville, N. Y. The intention of the inventor is to provide a new and improved creasing and folding device more especially designed for conveniently and quickly creasing and folding fabrics—such, for instance, as shade-cloth—with a view to form a pocket for the reception of a stick, but the device may be used for other purposes, such as folding fabrics for the formation of neckties and the like.

ICE-CREAM CUTTER.—C. A. KULENKAMPFF, New York, N. Y. The purpose of the improvement is to provide a device for cutting at one operation a block or brick of cream in slabs or cakes of equal or varying thickness and to so construct the device that the knives can be quickly and conveniently placed and adjusted in the body-section and secured in adjusted position and wherein the knives may be as expeditiously and readily removed and each part of the device rendered accessible for cleaning.

WATCH-GUARD.—A. FISHMANN, New York, N. Y. The objects in this improvement are to provide means for preventing the removal of a watch or similar object from the wearer's pocket, at the same time permitting the watch to be removed sufficiently for the use of the wearer without the necessity of manipulating any fastening devices or disengaging any hooks or the like.

SOLAR APPARATUS FOR PRODUCING HIGH TEMPERATURES.—M. A. G. HIMALAYA, 13 Rue de Buzenval, Boulogne-sur-Seine, Seine, France. This invention refers to an apparatus for producing high temperatures, particularly in the metallurgical and chemical researches which necessitate the use of temperatures higher than those of ordinary furnaces, including the electrical furnace. It converges solar rays upon a confined focus placed in the center of a furnace, crucible, or other receiver, this furnace, etc., being, if desired, placed completely outside the reflecting system. Means adjust or set the apparatus so as to maintain convergence of rays upon the focus selected whatever the height of the sun above the horizon.

APPARATUS FOR SHARPENING MOWERS.—E. C. SPRINGER, Mason City, Iowa. In the use of this apparatus, the mower to be sharpened having been secured in place and the crank member clamped upon one of its driving-wheels, some fine abrasive material such as flour of emery, is mixed with oil and applied to the ledger-blade, whereupon by rotating the working blades in the opposite direction to that in which they rotate in use, by means of the crank member, their edges will be sharpened. It is particularly applicable to "lawn-mowers."

FIRE-ESCAPE.—E. A. MEADERS, JR., Grenada, Miss. The device may be secured to a window-sill or any convenient object within the room from which the person desires to escape. The operator carried by the sling from the casing may exert any desired tension upon the line in the reel in order to assist in controlling the descent. It is intended to be made of such size that it can be easily carried in a satchel or trunk and can be immediately brought into use when needed in a hotel or elsewhere. Ordinarily the main section of the casing will be about five or six inches in diameter and about two and a half inches thick or in the direction from end to end along its axis.

Hardware.

WRENCH.—E. F. ATKINSON, Battlecreek, Mich. This wrench belongs to that class having a fixed jaw and a movable jaw. The inventor's object is to provide novel details of construction for a wrench which adapt it for convenient adjustment to engage cylindrical or angular objects between its jaws and afford means for reliably holding the movable jaw at a desired distance from the fixed jaw.

SAW.—C. DILKS, Alloway, N. J. In this instance the invention is an improvement in saws, capable of application to band or circular saws, as desired. In practice the application of the bits and keys, will not interfere in any appreciable degree with the tension of the saw at the rim thereof; nor will it detract to any material extent from the ring of the saw-blade in operation.

PIPE-WRENCH.—W. H. BROCK, Seaford, N. Y. This improvement relates to the manner of mounting the lugs. Means are provided to replace the plates when broken or worn out and to greatly cheapen the construction of the wrench. The plates may be made of fine and hard metal, whereas the handle may be constructed of comparatively cheap material. Means enable the pivot-point and channels to be formed by drop-forging. By forming the channels this way the surface is made of comparatively hard metal, whereas if channels were made by milling or by filing the metal left and constituting the bottom and sides of the channel would be comparatively soft.

Household Utilities.

THREAD-CUTTING THIMBLE.—W. H. GAY, Richmond, Va. This form of thread-cutter is a very convenient means for severing the thread from the work without use of scissors and without biting off the thread and is always on the hand when sewing and is conveniently available. It is cheaply made and is not liable to cut the work nor the fingers and presents no unsightly projection from the thimble.

Machines and Mechanical Devices.

TABLET-MOLDING PRESS.—J. F. BUCKLEY, 26 Meath road, Ilford, Essex, England. Mr. Buckley's invention relates to molding-presses, preferably of the hand-operated type, and has for its object the production of a press whereby tablets varying in thickness from the thinnest wafer to a comparatively thick lozenge may be compressed into any given uniform thickness and density at the will of the operator in a very efficient manner.

Prime Movers and Their Accessories.

ROTARY ENGINE.—W. SCOTT, Sheridan, Wyo. The invention relates to improvements in double-cylinder rotary engines using steam, air, or gas as the motive agent, the object being to provide an engine of novel and simple construction in which there will be an economical use of steam or other motive agent. Another object is to provide an engine with speed-reducing mechanism thus adapting it for use in drilling or boring.

Railways and Their Accessories.

CAR-PLATFORM.—A. MELGAREJO, Harrison, N. Y. The general purposes of this invention is to avoid accidents to passengers in getting on or off at stations and to expedite traffic. In railway operation gaps sometimes occur between the car and station-platform at the doorways through which passengers must pass. This defect becomes exaggerated on curves. Such circumstances as those suggested have caused many accidents to occur by persons falling into the space, and the object is to produce a platform adapted to overcome these defects.

SWITCHING DEVICE.—C. J. Carlson, Spokane, Wash. The purpose here is to provide a switch mechanism whereby the engineer, motorman, driver, or operator of a car or train of cars without leaving his station can direct the rolling-stock from the main line to a siding or from the siding to the main line, the movement of the switch being automatically accomplished through the medium of a device carried by the car and which is under complete control of the operator and may be brought instantly into operation.

DUST-PROOF JOINT.—G. W. Tidrick, Dillonvale, Ohio. In the present patent, the inventor's object is to provide a new and improved dust-proof joint more especially designed for use in mine-cars and similar cars and arranged to protect the bearing of the axles from injury by the coal-dust or other fine particles of the load passing to the bearing-surfaces.

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.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9754) C. H. C. writes: I would like to ask the following questions relative to cement walks: How thick should they be? How much top and how much bottom? What proportion sand, gravel, and cement in bottom? What of the same for top? What thickness of cinders for foundation? The above walk to be in residence district. A. The usual specification for a cement walk is as follows: First, lay 4 or 5 inches of clean, sharp cinders. On top of this ram thoroughly in place from 4 to 6 inches of good concrete, and continue the ramming until the water appears at every point on the surface of the concrete. As soon as the concrete is set, spread very evenly a finishing coat about one inch thick of either neat cement or cement mortar made of equal parts of cement and sharp sand. This foundation coat should be thoroughly troweled to a polished surface. The best proportions for the concrete are as follows: Five parts of sharp broken stone, three parts of clean, sharp sand, one part of best Portland cement.

(9755) W. L. Du B. asks: How long a spark ought an induction coil to give which has a 7-inch core 1 inch in diameter, primary five layers No. 16 insulated copper wire, secondary 5 ounces of No. 36 double cotton-covered wire? Does too much insulation between the core and primary and also between primary and secondary affect the length of the spark to any marked extent? Does the secondary need any more insulation between layers of double cotton-covered wire? A. Your coil may give a spark something less than a quarter of an inch long. The primary wire has too many layers. No. 12 or 14 wire wound in two layers is better. Then you will get a strong current from your battery. Much insulation is not required between the primary and the core, but the secondary must be well insulated from the primary coil. It is not well to use double cotton-covered wire in the secondary. It takes up too much room. Single silk is the proper thing. Get the turns as near the primary as possible. Insulate with shellac or paraffine the layers of the secondary coil. All such details can be learned from Norrie's "Induction Coils," which we send for $1.

(9756) M. B. writes: 1. In answer to question 9697, you say that a ball of lead will fall faster to the ground than one of cork of the same size. Now this answer, which seems according to reason, is in direct contradiction to the article on gravitation in the Britannica, Vol. 11, page 66, in the latter part of the second column, on that page. As you are not likely to give a wrong answer, will you explain the contradiction? A. The usual statement that all bodies fall under gravity with an equal velocity, since each body is acted upon by gravity in proportion to the quantity of matter in it, is true when all resistance to motion is removed, outside of the matter of the body itself. In a vacuum this is literally true, a mote and a cannon ball would fall equally fast; but not so in the air, which resists the fall of small motes so that they are hours in falling a few feet, as any one can see by watching them float in a sunbeam. The actual velocity of fall is dependent upon the ratio of the weight of the body to that of the air it displaces. When a body displaces a weight of air less than its own weight it falls toward the earth; if its weight is the same as that of the air it displaces, it floats in the air, and would never fall; when its weight is less than that of the displaced air, it rises in the air as does a balloon. We do not understand that this is in contradiction to any known law of motion. 2. I was much interested in reading of a rainbow by moonlight, and also the article on the apparent reason of animals, such as cats. An action which seems almost reason, came under my notice. A cat was constantly in a cellar, which was kept closed; on complaining to the servant about it, she told me that the cat opened the door herself; this I did not believe, thinking it an excuse for carelessness; but being in the kitchen one day I saw the cat jump up, put one paw through the handle of the old-fashioned latch, the other on the latch, while with one of her hind legs she pushed against the door frame, thus opening the door. Of course this was only imitation, but it looked very like reason. A. If a cat or other animal performs an act which we should say involved reason when performed by a man, why not say that it is reason in the cat? We see no reason why we should not do so. We have known several cats which could open doors in the manner you describe, and have seen dogs and other animals act in a reasonable manner, under circumstances in which some men would not have done any better.

(9757) C. E. T. asks: I should like to find out which leg is the longer, or if both legs of an ordinary person differ in length. The reason I ask is this: While skating and moving in a circle with the right leg on the outside of the circle, the balance is easily obtained; but on moving in the opposite direction with the left leg on the outside, balance is harder to obtain. As the ears differ from each other, the idea struck me that probably the legs were affected in the same way. A. The two legs of nearly every one differ in strength; thus people are right-legged or left-legged, just as they are right-handed or left-handed. This is taken as the explanation of the fact that people tend to walk in a circle when they are not guided by eye sight. Persons lost in forests usually come around to the place from which they started in their wanderings. There is no difference in the length of legs in a person of normal condition. If there is any difference a person limps.

(9758) E. P. inquires: How many square feet of heating surface of a hot-water radiator is required to heat a room measuring 16½x14 feet with a 10-foot ceiling? A. A common rule for calculating the heating surface of a radiator is as follows: Add together the square feet of glass in the windows, the number of cubic feet of air required to be changed per minute and 1-20 of the surface of the external wall and roof; then multiply this sum by the difference between the required temperature of the room and that of the external air in the coldest weather; and lastly, divide this product by the difference in temperature between the hot water in the radiator and the required temperature of the room. The result equals the required radiating surface in square feet. The cubic feet of space in a room has little to do with the amount of radiating surface required, but is often convenient for rough calculations. Under average conditions, one square foot of radiating surface at 212 deg. will heat from 100 to 150 cubic feet in brick dwellings exposed on all sides, and from 70 to 100 cubic feet in modern dwellings exposed on all sides. From the above information you can readily calculate the heating surface you will require.

(9759) J. H. R. writes: Some laymen in our town have been discussing whether hot water would burst from a frozen water-pipe, while cold water would thaw it without any fracture. I take it that such a conclusion is based upon insufficient evidence and reasons, and hold that, if the pipe should begin to leak upon the application of hot water, the crack had been previously formed. Kindly give me your opinion upon this subject. You will pardon a few words stating my position. Suppose we start with a pipe filled with water at any temperature, say 20 deg. C. As the temperature lowers, both pipe and water contract until 40 deg. is reached, when the water begins to expand. Suppose freezing takes place without bursting the pipe, and a temperature of —20 deg. is reached. Now, as the temperature rises both pipe and water expand, repeating every stage or condition passed through as the temperature lowered, and if a point is reached where the strain is sufficient to burst the pipe, that point would have also been reached as the temperature lowered, and the fracture would have taken place previously. There is another consideration which favors the fracture on cooling rather than heating. Inasmuch as the conductivity of the metal pipe is far superior to that of the water, the pipe would "lead" in the contraction on cooling, and also, in expansion on heating, and so there would be an additional strain on the pipe as the temperature lowers, due to difference of temperature of pipe and water, and as the temperature rises, this strain would be diminished. This difference, while usually negligible, becomes very appreciable when hot water is used in thawing. I am very sure that this opinion about hot water bursting pipes is due to insufficient investigation. No one is able to say that there was not an incipient crack before the water was applied, and the hotter the water the more promptly the vent will be opened. The fracture cannot be due to unequal expansion of the outer and inner surfaces of the pipe, else a smith would shiver a piece of steel when he goes to temper it. It cannot be due to the formation of steam within the pipe, for the temperature of the water in the pipe will always be a mean between its original temperature and the temperature of your hot water, say 100 deg. I can only think of one theory which will explain the phenomenon in question, viz., viscosity of ice. That is, to suppose that more ice has accumulated in the pipe per cubic centimeter than was present before freezing. Suffice it to say I do not think this theory applicable. Please state your opinion definitely, if I wish to show your leter to the disputants. A. It is not an uncommon phenomenon for pipes which have been frozen to burst in the process of thawing. Your reasoning regarding the contraction of water is correct up to a certain point, but you forget one point: Water contracts as the temperature is lowered until 4 deg. C. is reached. From 4 deg. to 0 deg. it expands. In the process of freezing water at 0 deg. to ice at the same temperature there is another expansion much greater than the expansion of the water between 4 deg. and 0 deg. After the ice is formed, however, it contracts as the temperature is lowered below 0 deg. centigrade, just as any other solid contracts. This is the fact that you overlooked. As the temperature rises from any point below the freezing point the exact reverse of the above occurs. Therefore, if a pipe is filled with ice at a temperature of —20 deg. C. and the temperature is gradually increased uniformly along the entire length of the frozen section, there will be the instant before the ice melts the same strain on the pipe that there was the instant that the water froze. The pipe may be able to stand this strain once, and yet not be able to stand it the second time. It therefore may burst on thawing, even though it did not burst when the water froze. The above reasoning is based on the supposition that the frozen section is increased in temperature uniformly. If, however, the heat is applied only at the center of the frozen section, I think you can readily see that the strain on the pipe will be greater than it was when the pipe was frozen, provided the temperature then was lowered uniformly along the entire length of the frozen section, as it usually would be.

(9760) M. F. Co. asks: In running a short telephone line connecting several houses together, will you please advise us if you think there is great danger of lightning striking the wire and damaging the houses? Can this danger be entirely removed by running ground wires down the corners of the houses so the lightning can take a short path to the ground? A. There is always danger that a wire in the air will be struck by lightning. The proper mode of protecting buildings into which such wires enter is by the use of lightning arresters properly installed. Ground wires will not answer the purpose, since they will injure the service of the telephones on the line.

(9761) G. E. M. asks: What are the principles of a steam turbine? What are the principal defects in the Parsons type? Does the steam enter through nozzles or does it enter in bulk? Why does the efficiency of the steam decrease when the steam is throttled? Is there much difference between a Parsons and a Curtis? Please inform me where I can obtain books on the above subject. What is the power (about) in foot-pounds of an ordinary 8-day clock spring? A. The principle of a steam turbine is exactly the same as the principle of an impulse water wheel, like the Pelton wheel, the only difference being that there are very many more buckets for the steam to strike against. The work done by a steam turbine depends on the velocity of the steam as it issues from the steam nozzle. Throttling the steam decreases the velocity and therefore decreases the efficiency of the turbine. There is very little difference in principle between the Parsons and the Curtis turbines. For more detailed information we would refer you to "Descriptions of Turbines and Their Efficiencies," published by the General Electric Company, of Schenectady, and to the Westinghouse Manufacturing Company, of Pittsburg, and to the De Laval Steam Turbine Company, of Trenton, N. J. We cannot tell the power in the spring of an ordinary eight-day clock. It varies with the size and character of the clock, but in most cases would probably not be much over two or three foot-pounds.

(9762) E. G. asks: Kindly give me a clear definition of adiabatic heating, explaining fully the difference between a gas adiabatically heated and one heated by mechanical compression. A. The word "adiabatic" is derived from the Greek and has three parts. *A* means without; *dia* means through; *batic* means going. This word as a whole means "without going through." Applied to heat, the sense is that no heat passes through to affect the temperature of the gas under test, be it steam in a boiler or any other gas in any receptacle or in the air in the atmosphere. A gas which is compressed without any heat leaving it becomes hotter, and a gas which is expanded without any heat coming into it grows colder. Both of these are adiabatic changes. The gas which is heated by mechanical compression is heated adiabatically. Adiabatic changes are of great importance in the atmosphere. 2. In reducing a barometer reading of a given altitude to sea level, the average temperature of the air must be known. Is this average obtained by taking the average of the dry thermometer readings at the A. M. and P. M. observations, or by taking the average of the maximum and minimum temperatures for the day? A. The average temperature of the air in the problem of the reduction to the sea level is the average of the temperature of the air at the various altitudes from the sea level to the altitude of the observation. This can be found only with considerable probable error, since the change of air temperature with altitude varies greatly in different regions, and any error in this causes an error in the weight of the air column to be calculated. The actual temperature at the place at the time of observation is the only temperature to be employed in the reduction of that observation. 3. Is water vapor properly classed as one of the constituents of the atmosphere? A. Water vapor is one of the constituents of the atmosphere. No percentage value can be given for it, since it varies very much, from a mere trace to as much as five per cent of the amount of dry air. The chemical composition of air as ordinarily given is usually that of dry air.

NEW BOOKS, ETC.

On Tybee Knoll. A Story of the Georgia Coast. By James B. Connolly. New York: A. S. Barnes & Co., 1905. 12mo.; pp. 285. Price, $1.25.

This little story of the Georgia coast, by the author of "The Seiners," will be found interesting reading for a hot vacation day. It is a stirring story of the men who clear the channels for the ships and whose lives are filled with considerable adventure and picturesque incident. It is illustrated with four half-tone plates from original drawings.

Modern Asphalt Pavement. By Clifford Richardson. New York: John Wiley & Sons, 1905. 8vo.; pp. 580; 32 figures. Price, $3.

The object of this work is to describe the nature of asphalt pavements and show the causes of defects in them, in order to bring about improvement in the methods of their construction and to show, if possible, how this can be done. The author has had an extended experience in the asphalt paving industry, as well as in the inspection and construction of pavements for large cities, and he has found that the best results are frequently not obtained because of the lack of knowledge of the engineers in charge as to the proper tests of material and methods of laying the same. In this work, therefore, he describes the forms of construction which have been shown by experience to be the most satisfactory, the character of the materials employed in the composition of asphalt pavements, the most refined methods used in the industry to-day, and the reasons which have led to their adoption. The book also contains specifications for asphalt pavements for various conditions and use, and considerable data as to their maintenance and cause of deterioration. It will be found extremely valuable to all interested in this industry.

The Radford American Homes. New York: Industrial Publication Company, 1905. 8vo.; pp. 255. Price, $1.

This book contains floor plans and perspective views of 100 different designs of low and medium-priced houses. Complete plans and specifications of the houses shown in the book will be furnished by the Radford Architectural Company, Riverside, Ill., for $5 each. The houses shown are a very good selection of modern American types, and the book will doubtless aid materially anyone intending to build a house, in selecting a design which pleases.

Manual of Chemical Analysis as Applied to the Assay of Fuels, Ores, Metals, Alloys, Salts, and Other Mineral Products. By Eugene Prost, D.Sc., of the University of Liège. Translated from the original by J. Cruickshank Smith, B.Sc., F.C.S. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 300. Price, $4.50.

This work by Prof. Prost is an extremely valuable volume which treats, in a clear, succinct, and practical manner, of the various ores, minerals, mineral salts, metals, and alloys commonly met with in chemical practice, of an industrial and technical character. The author has succeeded in compressing within a limited space, a large mass of useful information and helpful suggestion by avoiding repetition and referring constantly to other parts of the book. Prof. Prost has been extremely careful to give details of manipulation, and to indicate precautions which should be observed in connection with the various processes described—points in laboratory experience that are too often left to be picked up in a haphazard way. Throughout the work temperatures are expressed in terms of the Centigrade scale and the metric system of weights and measures is used, except in special cases, which are indicated. The book contains a selection of methods for analyzing the chief mineral products, both native and manufactured, which the industrial chemist, and more particularly the metallurgical chemist, most frequently comes in contact with in the course of his practice. Only such processes have been described as the author has found from his own experience to lead to satisfactory results, or the details of which have been obtained from specialists in charge of important laboratories and having large experience in industrial analysis. The book will no doubt prove extremely useful to technical chemists, analysts, assayers, engineers, and others interested in the analysis and valuation of industrial products of mineral origin. The translator has succeeded very well in reproducing not only the substance and spirit of the original but also in preserving the form of expression as well.

Rustless Coatings. By M. P. Wood. New York: John Wiley & Sons, 1904. 8vo.; pp. 432; 85 illustrations. Price, $4.

This book deals in a very complete manner with the corrosion and electrolysis of steel and the best paints and other substances to be used for their prevention. The characteristics of oils, pigments, and paints that form the principal protective coatings for ferric and other structures are given at length under their respective chapters. The collected data are a reliable source of information of the composition of these paints and of what may be expected of them. The book is illustrated with a considerable number of photographs and is completed with an index. Most of the analyses and tests of the commercial pigments and paints have been repeated many times without any material discrepancy from the data given. The results from the use of many of these paints are apparent from the incessant and continual corrosion of important iron structures everywhere. Not only is the subject of paints dealt with, but also coating by galvanizing and by electrolysis is described in detail.

The Beginner's Guide to the Lathe. By Percival Marshall, A.I.M.E. London: Percival Marshall & Company, 1905. 16mo.; pp. 76. Price, 25 cents.

This pamphlet, which forms No. 25 of the "Model Engineer" series, is an elementary instruction book on turning in wood and metal. Besides the clear, concise text, it is illustrated with some 75 figures, specially drawn for the purpose. It will be found a useful handbook for the beginner.

Descriptive Geometry for Students of Engineering. By James A. Moyer, S.B., A.M. New York: John Wiley & Sons, 1905. 8vo.; pp. 198. Price, $2.

As experience has shown that most students in technical schools have difficulty in applying their knowledge of geometry to their work in structural and machine design, two things have been attempted in the present volume in order to overcome this failure. In the first place the notation is essentially the same as that used in mechanical drawing, and in the second, the exercises have been carefully graded so as to encourage the student to think for himself. There are many concrete exercises showing practical applications. The data used in the exercises are stated by the system of co-ordinates employed in analytical geometry. An unusually large number of perspective and orthographic drawings have been inserted. As this work has now reached its second edition, it can be seen that the methods employed in it for the instruction of students have been found valuable.

The Credit Man and His Work. By E. St. Elmo Lewis. Detroit: The Book-Keeper Publishing Company, Ltd., 1904. Small 8vo.; pp. 308. Price, $2.

The author of this book has dealt with the subject in hand in a comprehensive manner. Starting with a history of credit, he follows it step by step until he comes to modern commercial credit. In a chapter entitled "What is Credit?" he gives some new and striking suggestions, especially as to the basis of normal commercial credit, i. e., it is based on the demand for marketable goods. Proceeding in the development of the scheme, he shows what influence "The Character of the Business," "The Character of the Management," "The System of Organization," "Competition," "Business and Accounting Methods," have upon the value of a risk, in compromising the value of marketable commodities. Other chapters of the book are devoted to the "Balance Sheet," "Capital and Resources," "Credit Indemnity Insurance" (which is discussed by the foremost experts), "Cost of Production," as applied to determining valuations and profits. Other chapters are devoted to "Systems for Collections and Credit Information" and the legal side of the credit man's work. A discussion of the value of information bureaus and agencies is also gone into. The book is one which should be in every business man's library.

How to Get Speed in Shorthand. By Frederick Pitman. London: Guilbert Pitman, 1905. Price, 25 cents.

This pamphlet contains a series of exercises, reprinted from the Shorthand World, and intended to give the student facility in speed in reporting with the Pitman system.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 29, 1905

AND EACH BEARING THAT DATE

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

Acid flues, fan case for, N. L. Heinz 798,100
Acid, making nitric, H. H. Niedenfuhr 798,205
Acid producing apparatus, carbonic, G. Walzel 798,239
Acid tank, W. O'Neill 798,444
Air brake for railway trains, compressed, C. Luyers 798,429
Air brake hose, F. A. Magowan 798,137
Air electrolyzing apparatus, A. Johnson 798,511
Alkaline metal oxide, making, R. Hutzler. 798,103
Alloy, A. E. Hobson 798,181
Amusement apparatus, Cobley & Cavanagh. 798,392
Animal blanket, C. H. Carli 798,320
Annealing furnace, wire, J. F. Warwick ... 798,242
Annunciator, electric, H. Usener 798,236
Anthracite compound and making same, M. H. Isler 798,104
Apparel, device for drying, stretching, and airing articles of, K. Walsh 798,547
Awning, window, A. W. Stutenroth 798,369
Bags, article carrier for hand, J. C. A. Riecke 798,531
Bait moving device, Holz & Haerry 798,344
Baling press block inserter, J. H. Pitkin.. 798,071
Bar. See Sash bar.
Bark splitting machine, duplex, H. L. Staley 798,465
Bearing, propeller shaft thrust, S. S. Eveland 798,096
Bed clamp, W. D. Patrick 798,529
Bed rail joint, metal, A. E. Simms 798,535
Bedstead, C. H. Gasau 798,330
Bedsteads, swinging leg for folding, F. B. Williams 798,085
Beer cooling apparatus, A. Pelstring 798,112
Belt replacer, W. Volkel 798,238
Bills, etc., duplicating apparatus for, G. M. Stroud 798,541
Binder, J. Schade, Jr. 798,301
Binder, loose leaf, Blackmar & Robson 798,157
Blasting compound, G. Dittmar 798,398
Boat, submarine, R. d'Equevilley 798,501
Boiler, W. W. Bonson 798,259
Boiler and tank head, A. Kraetzer 798,136
Boiler furnace, steam, H. S. Woolley 798,248
Boiler tube cleaner, M. H. Thompson 798,468
Bottle, C. M. Conradson 798,265
Bottle cap removing device, F. R. Kent 798,513
Bottle capping machine head, G. H. Gillette 798,579
Bottle closure, P. Manus 798,434
Bottle, non-refillable, C. H. Conradson 798,266
Bottle, non-refillable, G. T. Ross 798,451
Bottle, non-refillable, O. H. Fishburne 798,503
Box cover, E. M. Wright 798,122
Box lid lifter, S. F. Gilmore 798,132
Bracket shelf, H. F. Lattey 798,193
Brake shoe, C. L. Bundy 798,263
Brush and mop holder, convertible, Kelley & Sutton 798,134
Brush, scrub, I. B. Sanders 798,532
Brushes, machine for the manufacture of, P. H. Alexander 798,381
Brushes, manufacture of, P. H. Alexander 798,380
Bucket, ash, E. A. Bagby 798,316
Buckle, cross line, W. I. Kenison 798,135
Buckle guard, T. N. Martin 798,066
Buggy top rest, E. Wiet 798,311
Butter cutter, P. M. Scanlan 798,453
Butter separator, N. T. Hanson 798,280
Button, crochet work, I. Kalliwoda 798,346
Cabinet, portable dressing, F. E. Mistrot.. 798,140
Calculator, J. B. A. Paradis 798,206
Camera, J. B. Levy 798,426
Camera stand, J. B. Levy 798,353
Canning apparatus, J. T. Wilmore 798,244
Car coupling, M. J. Carter 798,322
Car door, C. L. Spurlin 798,120
Car door, H. E. Sallee 798,148
Car draft rigging, railway, J. F. O'Connor. 798,111
Car draw bar centering device, railway, J. F. O'Connor 798,109, 798,110
Car fender, W. W. McClung 798,069
Car seat pedestal, R. Dunning 798,574
Car, stock, E. Wyatt 798,378
Car switching, J. E. Swonson 798,370
Cars, antifriction bearing for railway, Lake & Deverell 798,350
Cars, fan driving mechanism for railway, S. Terzian 798,230
Carbureter, G. Johnson 798,418
Carbureter, gas engine, S. B. Wolgamott.. 798,150
Caster, E. E. Canedy 798,564
Cattle guard, G. O. S. Conway 798,091
Cement block molding machine, D. D. Stringer 798,306
Cement clinker, manufacture of, C. Ellis.. 798,175
Centrifugal separator, P. H. Watts 798,243
Chair attachment, M. Libotte 798,355
Chandelier and gas bracket, G. W. Pond.. 798,210
Chute, merchandise, C. F. Cormack 798,323
Cigar perforator, D. L. Hill 798,341
Cigarette maker, E. P. Lawton 798,194
Circuit breaker, H. P. Davis 798,171
Circuit controller attachment, supplementary, W. Lintern 798,427
Clamp. See Bed clamp.
Clamp, H. Diflo 798,499
Clock, electric alarm, J. McCarthy 798,143
Clutch mechanism, W. H. Scotton 798,219
Clutch mechanism, variable speed, T. J. Kehoe 798,188
Coal screen and slater, F. Allard 798,382
Coil protector, field, H. E. Dubois 798,326
Coin controlled device, J. H. Dean 798,269
Coking furnace, G. Wolters 798,086
Concrete block molding flask, Swanson & Clarkson 798,228
Conduit for electric wires, R. W. Lyle 798,196
Conduits, building, P. Aylett 798,487
Confectionery and the like, apparatus for manufacturing, H. T. Averay-Jones ... 798,251
Control system, E. R. Carichoff 798,160, 798,162
Controller, H. E. White 798,375
Controller, G. H. Hill 798,410
Conveyer trough and chute, Young & Tetor 798,477
Copy holder, I. Hartley 798,338
Cork feeder, crown, W. H. Wheeler 798,549
Corn popper, H. Dalby 798,570
Coupler mechanism, D. Schustek 798,459
Crate, folding, H. H. Bell 798,257
Cream separator, H. Kibele 798,107
Crushing and grinding mill for quartz, centrifugal wet, L. C. Graupner 798,278
Crushing rolls, R. K. Humphrey 798,415
Cultivator, G. W. & J. A. Smith 798,537
Curtain stretcher, H. A. Schwarz 798,076
Cuspidor, sanitary, C. E. Bostwick 798,562
Designs, pictures, letter press, and the like, reproducing, W. Ostwald 798,528
Die punching apparatus, J. G. & M. O. Rehfuss 798,530
Die stock, M. L. Bush 798,088
Die, threading, W. A. Leonard 798,352
Dinitroglycerin and making the same, A. Mikolajczak 798,436
Display board for seed packages, W. D. Ross 798,115
Door bolt or fastener, S. L. Harris 798,583
Doubletree and whiffletree, F. G. Winnek.. 798,245
Dough or like plastic material, machine for dividing, R. Morton 798,361
Dress suit case and the like, J. D. Wood.. 798,377
Drill presser wheel attachment, T. Brennan, Jr. 798,159
Drum, heating, Holt & Swenson 798,183
Drying apparatus, F. Johnson 798,345
Dust collector, O. M. Morse 798,437, 798,438
Dye, yellowish azo, F. C. Gunther 798,098
Edge setter, P. R. Glass 798,331
Electric circuit controller, E. R. Carichoff 798,161
Electric circuit controller, automatic, A. Sundh 798,082
Electric generator cooling apparatus, B. Bidwell 798,156
Electric machinery, brush or collector for dynamo, J. H. Hallberg 798,279
Electric motor controller, Laird & Todd 798,190
Electric switch, H. E. White 798,374
Electric switch, pressure operated, E. H. Dewson 798,270
Electrical distribution system, A. S. Hubbard 798,414
Electrical machines, ventilating device for cores of, R. Siegfried 798,222
Electrocapillary apparatus, Armstrong & Orling .... 798,481 to 798,483
Electrocapillary apparatus, actuating, Armstrong & Orling 798,484
Electrode of electrolytic apparatus, G. J. Atkins 798,314
Electromobile charging device, F. P. Cox.. 798,588
Elevator lock and stop, H. E. Schneider.. 798,075
Elevator safety cut-off, automatic, L. J. Adams 798,124
Elevator shaft doors, automatic releasing mechanism for, J. Stevens 798,081
Ellipsograph, J. L. Perkins 798,446
Engine indicator, steam, C. B. Bosworth.. 798,490
Engine starting crank, explosive, W. H. Schoonmaker 798,366
Engines, air cooling device for, G. Wolke. 798,247
Engines, excavating attachment for traction, C. H. Wolfe 798,246
Engines, starting and signaling mechanism for explosive, A. Winton 798,553
Engraving or etching metallic surfaces, machine for, C. A. & W. A. Ker 798,421
Evener, four and five horse, E. O. Doak 798,573
Exercising device, A. Rosenthal 798,114
Eyeglass case fastener, M. S. Chism 798,089
Fabrics, manufacturing plaited, C. A. M. Flamant 798,404
Fastening device, H. A. Donalds 798,271
Faucet, S. F. Baker 798,386
Faucet, measuring, O. Ludwig 798,428
Feed water regulator, C. B. Edwards 798,273
Fence, J. C. Chiber 798,567
Fence loom, J. S. Barnes 798,154
Fence post, E. Bruley, reissue 12,385
Fender. See Car fender.
File, letter, R. Spurgin 798,080
Filing case, metallic, E. L. Krag 798,514
Films, adjustable holder for shading, J. J. Drumb 798,272
Filter press, H. T. Shriver 798,304
Filters, removing solid or semi-solid material from containers of pressure, C. W. Merrill 798,200
Filtering apparatus, W. W. Wilson 798,473
Fire alarm, H. A. Marshman 798,197
Fire box and grate, C. W. Jewett 798,417
Fire extinguisher, H. A. Myers 798,142
Fire extinguisher, H. L. Carpenter 798,565
Firearm sight, J. Windridge 798,474
Firearms, ejector mechanism for breech loading, E. S. Watson 798,469
Fireproof blinds or curtains, roller for, E. H. McCloud 798,203
Fish trimming and splitting machine, C. P. Hale 798,334
Fishing device, F. K. Eastman 798,575
Fitting, C. B. Lord 798,357
Floor surfacing machine, M. L. Schlueter.. 798,455
Formaldehyde generating apparatus, E. F. Billings, reissue 12,384
Fountain comb, P. L. Frost 798,407
Funnel, measuring, L. H. Sternheimer 798,539
Furnace bosh wall cooling device, E. Dreyspring et al. 798,402
Furnace smoke consumer, Thorp & Drewyour 798,232
Galvanoscope, Armstrong & Orling 798,152
Game apparatus, M. S. Cross 798,170
Garment hook, A. Berg 798,318
Garment supporter, E. M. Town 798,543
Gas burner mantles, support for incandescent, M. Herskovitz 798,340
Gas burner, self-closing or safety, J. Thiers 798,231
Gas, generating, C. Ellis 798,176
Gas generator, acetylene, A. Fornander 798,275
Gas heater, M. C. Green 798,408
Gas mantle, self-lighting incandescent, F. C. von Heydebrand 798,282
Gas producer, C. Ellis 798,500
Gases, removing arsenic from, Scharff & Slama 798,216, 798,302
Gaseous fuel burners, starting torch for, R. J. Miner 798,359
Gate, E. Butts 798,128
Gear, speed changing, W. H. Scotton 798,218
Gear, variable speed, C. Schoppner 798,217
Glass washer, O. Karlss 798,186
Grader and excavator, road, Kepner & Smith 798,586
Grain drill, H. J. Case 798,164
Greenhouse roofs, repair clamp for, A. Klokner 798,065
Grinding machine, W. H. Stedman 798,538
Grinding machine, H. Wilson 798,552
Grinding mill, G. A. Bell 798,255
Gun control system, J. L. Hall 798,335
Guns, pivotal cartridge carrier for bottom loading, T. C. Johnson 798,512
Harmonica or mouth organ, H. H. Neilson . 798,527
Harvester, cane, W. B. Sharp 798,534
Hat box, J. B. La Rock 798,351
Hat box stock indicator, J. C. Buie 798,262
Hay fork, J. Ducret 798,172
Hay or the like, apparatus for discharging and stacking, C. von Bechtolsheim ... 798,560
Hay press, C. E. Davis 798,571
Heater, S. G. Scanlan 798,454
Heating systems, apparatus for hot water, C. C. Peck 798,207
Heel beading machine, J. M. Grogan 798,333
Heel making machine, E. H. Taylor 798,467
Hides, treating, F. J. Oakes, 798,070, 798,293, 798,294
High potential switch, E. S. Halsey 798,336
Hinge, J. Fossee 798,405
Hoe and edge trimmer, combined, J. C. Hough 798,412
Hoist brake, H. J. Kimman 798,286
Hoisting apparatus, V. R. & E. H. Browning 798,494
Hone and strop, combined, C. E. Overshine 798,445
Hoof plane, A. Johnson 798,063
Hook. See Garment hook.
Horse fork, manure, A. S. Milne 798,067
Horseshoe calk, G. F. Hailman 798,582
Hose coupling, L. R. Nelson 798,441
Horse supporter, D. Basch 798,253
Hose supporter, E. S. Dorman 798,400
Hub, elastically controlled wheel, H. M. Butler 798,495
Hydraulic press fastening device, transportable, H. Huber 798,284
Ice pick, Morgan & Whitcomb 798,141
Indolic bodies, making, P. Seidel 798,077
Injector, C. Fero, Sr. 798,177
Injector, N. B. Dodge 798,399
Inkstand, F. Jones 798,419
Insulated handle, Hobson & Brown 798,062
Insulating electrical conductors, W. H. Bristol 798,260
Insulation of electric conductors, G. H. Rupley 198,365
Insulator, W. R. Twiggs 798,235
Internal combustion engine, two cycle, Ferrero & Franchetti 798,328
Iron, brazing cast, Green & Pearse 798,332
Jar, J. C. Anderson 798,480
Kettle, confectioner's, G. F. Dickson 798,498
Kiln heating and ventilating device, dry, E. F. Rouse 798,116
Knob, door and latch, B. Phelps 798,209
Kraut press, Green & Richey 798,133
Label dispensing device, G. H. Brown 798,261
Ladder, Bodendieck & Pribble 798,388
Ladder, step, H. C. Rush 798,117
Last, W. A. Krentler 798,423
Lasting machine, T. E. P. Hodgson 798,343
Latch, E. Praeger 798,296
Lavatory or shampooing bowl, M. Householder, reissue 12,386
Leaping the letter S., C. T. Honneus 798,102
Leather splitting machines, spring roll for, Quigley & Gay 798,072
Lens, bifocal, B. Mayer 798,435
Lever attachment, W. Gordon 798,505
Lewis, T. E. McNulty 798,440
Linotype machine, J. R. Rogers 798,298
Liquid separator, centrifugal, J. C. Cromwell 798,324
Load puller for inclined bridges, etc., E. Roberts 798,450
Locomotive reel, mine, H. Booker 798,389
Log loading and skidding machine, M. Schmaltz 798,456
Loom for producing several firm bordered tissues side by side, power, C. Wilmsen 798,472
Loom spindle oiler, C. F. Thompson 798,084
Lubricating press, horizontal, Hoppe & Eggers 798,184
Lubricator, J. A. Swenson 798,083
Magnetic brake, G. W. Gilmore 798,580
Mail crane, Nelson & Torgersen 798,363
Manure spreader, T. Solberg 798,119
Massage apparatus, self-galvanic, S. R. E. Schmidt 798,457
Mattress filling machine, E. J. Antoni 798,126
Measure, tape, F. D. Sole 798,223
Measuring instrument, F. Conrad 798,167
Measuring instruments, spring abutment for, F. Conrad 798,168
Meat meal, preparing, E. Maragliano 798,138
Mechanical movement, H. Brammer 798,492
Metallurgical furnace, G. H. Benjamin 798,258
Milling, L. Cron 798,267
Mine door, L. L. Logan 798,517, 798,518
Mining machine, E. R. Merrill 798,108, 798,201
Mixing and kneading machine, L. A. Roberts 798,214
Monkey-wrench, J. S. Laitinen 798,424
Motion transmitting mechanism, T. J. Kehoe 798,285
Motor control system, G. H. Hill 798,342
Motor controller, alternating current, H. L. Van Valkenburg 798,237
Mower fender rod, W. C. Rarig 798,297
Mower, lawn, J. Peterson 797,113
Mules, winding motion for self-acting, J. Wilkinson 798,550
Music leaf turner, M. J. Martin 798,198
Musical instrument, mechanical, L. Stockes 798,226
Musical instrument, multiple sheet self-playing, H. W. & C. M. Shonnard 798,221
Musical instruments, tone modifying device for mechanical, J. O'Connor 798,442
Nails and similar articles, machine for making, Latham & Fuery 798,516
Needle threader, W. Currier 798,497
Nut holding wrench, A. Schurr, Jr. 798,303
Nut, lock, I. W. Exley 798,576

Obstetrical appliance, J. H. F. Smokey.... 798,367
Oil flowing device, J. Kambish, Jr......... 798,347
Ordnance sight, J. Kurig 798,349
Ore concentrator, W. O. Journeay......... 798,064
Ore roasting kiln, J. McNab.............. 798,524
Ores, slimes, and other materials, apparatus for treating crushed, A. Z. Clark...... 798,568
Packing pad, A. D. Alexander............ 798,313
Packing, piston, L. W. J. Marsden 798,139
Packing, piston rod, C. C. Mason......... 798,199
Pad. See Packing pad.
Paper box, E. B. Weston 798,121
Paper holding and guiding mechanism, A. Schneeloch 798,118
Paper winding machine, J. J. Warren..... 798,241
Peanut digger and stripper, J. W. Smith.. 798,305
Pen, reservoir, J. Ballance 798,250
Pencil point protector and eraser, E. P. Alexander 798,379
Phonograph motors, means for sustaining, E. L. Aiken 798,478
Phonograph repeating attachment, E. L. Aiken 798,087
Piles, etc., device for protecting, P. Aylett 798,384
Pillow block, H. Slear 798,536
Pipe cleaner, folding, W. H. Taylor...... 798,229
Pipe coupling, train, M. J. Carter......... 798,321
Pipe or conduit, P. Aylett............... 798,486
Pipe stem cleaner, F. W. Cooley 798,169
Pipe union, screwed, J. Simpson 798,078
Pipes, means for excluding water from steam supply, O. L. Hallbeck 798,180
Planting machine, cotton seed, W. T. Evans 798,502
Plastic material and the like, machine for handling or working, R. Morton 798,362
Plastic material, apparatus for cutting, W. Niebur, Jr. 798,291
Plow, J. Beard 798,317
Plug, automatic steam chest, P. Wertz.... 798,470
Pocket protector, garment, H. Einehr.... 798,174
Poultry fountain, N. H. Brown........... 798,493
Power transmitting and speed controlling mechanism, D. H. Reimers 798,074
Presses, mold filling and tamping device for brick and similar, H. J. Flood........ 798,329
Printing device for paper bag machines, L. P. Eisenbeis 798,274
Propeller wheel, G. M. Welsh 798,372
Pulley, H. M. Dumas 798,403
Pump or compressor, M. W. Hall.......... 798,506
Pumping stand, pulley, F. E. Linder...... 798,356
Punch cutting machine, J. W. Lewis...... 798,354
Punching out blanks of circular or regular polygonal shape from plates of sheet metal or the like, machine for, G. P. Hoffmann 798,101
Radiator, W. R. Kinnear 798,422
Rail contact shoe, third, S. B. Stewart, Jr. 798,368
Rail joint, T. Refsum..................... 798,213
Rail joint, N. P. Cowell 798,395
Rail tie, A. S. Gulliford 798,581
Railway foot guard, W. Frost 798,178
Railway motor, electric, N. W. Storer..... 798,227
Railway motors, gear casing for electric, H. R. Edgecomb 798,173
Railway point and crossing, R. A. Hadfield 798,099
Railway rail, compound, W. G. MacLaughlin 798,358
Railway switch, H. N. La Flame 798,515
Railway switch, V. Angerer 798,556, 798,557
Railway tie, G. Beal 798,155
Railway tie, H. W. Avery 798,249
Railway track, E. F. Seider 798,220
Railways, grade crossing for, C. S. Osborn 798,145
Razor, safety, R. J. Christy 798,129
Razor strop, R. J. Christy.............. 798,166
Reciprocating tool, electrically actuated, McArthur & Crawford 798,290
Rifle, magazine and repeating, Stevenson & Ryland 798,540
Rivet machine kicker plate, W. F. Dowerman 798,401
Rock drill, M. C. Jackson 798,416
Rod and handle holder, R. Barrett 798,488
Roofing, composite, Gezelschap & Winding. 798,131
Rope retaining device, J. E. Briggs....... 798,563
Rotary engine, F. Egersdorfer 798,094
Rotary engine, I. F. Parmenter 798,295
Rotary engine, B. F. Augustine 798,485
Rugs and the like floor coverings, lining for, J. H. Beale 798,387
Sash bar, G. M. Voltz 798,309
Sash fastener, A. Martin 798,520
Sash holder, G. Malcolm 798,288
Sash holder, N. Van Horssen 798,544
Sash lock, E. L. Wheeler 798,548
Saw, adjustable band, E. T. Manning 798,519
Saw mill, band, C. E. Cleveland......... 798,569
Sawmill set works, W. H. Trout 798,234
Scarf fastener, reversible, J. Baumgarten.. 798,489
Screen. See Coal screen.
Screw machine, J. H. Wesson 798,310
Screw or terminal, electrical binding, M. Bouchet 798,319
Separating machine, W. S. Ayres..789,315, 798,385
Service switch, F. C. De Reamer......... 798,397
Sewing hooks and eyes on cards, machines for, A. Rainert 798,212
Sewing machine hemmer attachment, C. F. Goforth 798,277
Sewing machine spool holder, F. Egge..... 798,095
Sewing machine thread cutting and holding device, G. S. Gatchell 798,130
Sewing machine tool attachment, J. O. Rollins 798,299
Sewing tubular structures, machine for, S. Cohn 798,090
Shade hanger, adjustable window, A. S. Neale 798,525
Shears, G. P. Taylor 798,307
Shelf, book, H. P. Macdonald ..798,430 to 798,432
Shingle cutting machine, W. L. Connett.. 798,393
Shovel handle, tamping, W. P. Burnitt.... 798,127
Sifter, ash, E. McCauley 798,144
Sifter or bolter, G. A. Bell.............. 798,256
Sign, illuminated, D. S. Lamb 798,191
Signal circuit, electrical, E. W. Vogel..... 798,546
Signaling device for use in case of fire or accident, E. Stoll 798,466
Signaling, sound receiving means for submarine, J. B. Millet et al.............. 798,202
Signaling system, electrical, Sauer & Johnson 798,452
Siphon head and neck, D. Landau 798,192
Skate, cycle, W. Wurth 798,554
Skin shaving machine, Quigley & Gay 798,073
Smelting furnace, H. L. & N. Wrinkle.... 798,312
Smoke purifier and gas collector, Lawton & Reynolds 798,287
Soap dispenser, W. T. Carter............ 798,163
Sodium ferrocyanid, making, C. Petri...... 798,208
Spark arrester, M. J. Keelin 798,187
Speed and distance indicator, E. Schultz... 798,458
Speed changing mechanism, Scott & Thumlert 798,462
Spindle, V. Belanger 798,254
Spinning machine yarn traverse regulating device, G. P. Miller 798,289
Stamp and stamp canceling device, J. D. De Pew 798,572
Stamp band, hand, L. K. Scotford 798,460
Starch, obtaining soluble, R. Hartwig..... 798,509
Station indicator, E. E. Rothschild 798,147
Stay, garment, E. K. Warren 798,240
Steam boiler, G. O. Sturtevant 798,542
Steam generator and superheater, B. E. Eldred 798,327
Steam trap, N. Foley 792,578
Stocking pressing machine, J. F. Nelson.. 798,204
Stone rubbing machine, J. R. Peirce...... 798,587
Stove or heater, hot air, L. Judelson 798,420
Stringed instrument attachment, C. Mawer 798,521
Stubble shaver, F. A. Millet............. 798,522
Sulphite digesters, attachment for, W. H. Intyre 798,523
Suspending ring, S. P. Vetter 798,545
Syringe, hypodermic, E. F. Dean 798,093
Telegraphy and transmissions across space, apparatus for wireless, A. Arton 798,153
Telephone and circuit switch or cut-out, C. Adams-Randall 798,555
Telephone, common battery lock out, M. P. Boone 798,561
Telephone switchboard, J. L. Wright 798,123
Telephone wires, antihummer for, B. P. Bartlett 798,252
Tender, E. M. Wheelock 798,373
Theater appliance, G. R. Mullen.......... 798,068
Thermometer, C. W. Putnam 798,211
Thermostatic bar, C. D. Howard 798,413
Thills, means for securing holdback straps to, W. J. Thomas 798,308

Thread dressing machine, G. A. Fredenburgh	798,276
Threshing and flax recleaning machine, J. T. Smith	798,463
Tile drying apparatus, J. A. Odell	798,443
Tire cap, pneumatic, H. Harmon	798,508
Tire for wheeled vehicles, F. H. Sterling	798,225
Tire protector, pneumatic, Locher & Predom	798,195
Tire, vehicle, H. E. Irwin	798,185
Tool holder, W. N. Ager	798,125
Tool, motor driven machine, H. H. Clark	798,391
Toy, O. Hammarlund	798,337
Toy, C. M. Shailer	798,533
Toy gun or pistol, J. H. Wiesman	798,471
Toy money box, J. H. Bowen	798,491
Toy, sounding, M. B. Holstein	798,411
Track gage, C. R. Howard	798,585
Track sanding device, J. E. Holcomb	798,283
Traction wheel, A. de Souza	798,224
Train order delivering service, G. B. Craig	798,092
Transom lifter, J. W. Neff	798,526
Trap. See steam trap.	
Trap, A. Triebe	798,233
Tray, sectional, R. J. Carrier	798,264
Trolley, F. C. Cottrell	798,394
Trolley stand, B. A. Grassberger	798,097
Trolley wire finder, P. McDonald	798,439
Trunk, M. Radziejewska	798,146
Tube corrugating machine, Pogany & Lahmann	798,448
Tubular bodies, device for cleaning, J. Herczeg	798,409
Tumbler cleaning machine, W. F. Altenbaugh	798,151
Turbine, H. W. Fiske	798,577
Turbine, compound steam, C. V. Kerr	798,105
Turbine nozzle, steam, C. V. Kerr	798,106
Turbine speed regulator, B. S. Church	798,496
Type bar cushion, Smith & Gabrielson	798,079
Type writer, J. A. Ruffin	798,215
Type writer cabinet, M. J. Hafgar	798,179
Type writer paper holder, Haws & White	798,510
Type writing machine, E. E. Barney	798,558
Uterus support, prolapsed, L. G. Sprague	798,464
Vacuum tube, W. S. Andrews	798,383
Valve, combination, A. B. Willits	798,551
Valve, combined vent and check, D. F. Morgan	798,360
Valve, explosive engine, G. J. Altham	798,479
Valve gear, H. Lentz	798,425
Valve gear for explosion engines, R. H. Scott	798,461
Valve, throttle, R. A. Norling	798,292
Vegetable cutter, H. J. Hoak	798,584
Vehicle spindle, A. H. Worrest	798,476
Vehicles, control of self-propelled, A. G. Davis	798,396
Vehicles, supporting device for superstructural parts of, T. J. Lindsay, reissue	12,387
Ventilator, P. F. Blue	798,158
Vibrator, electric, H. J. Heeney	798,339
Vise mount, E. E. Ward	798,371
Wagon, dumping, C. Carroll	798,566
Wagon train, A. Koppel	798,189
Watch winding and setting mechanism, C. G. Perrin	798,364
Water bag stopper, Towne & Woodward	798,149
Water column, F. M. Foster	798,406
Water heater, electric, E. E. Sager	798,300
Water seal trap, G. A. Hally	798,507
Water wheel gate, S. E. Heathcote	798,281
Wave motor, F. S. Keyes	798,348
Weaving apparatus, hand, M. E. Bartlett	798,559
Well-cleaning apparatus, oil, W. E. Gardner	798,504
Well drilling apparatus, C. F. Rigby	798,449
Wheel, Caesar & Schell	798,390
Wheel, J. I. Maguire	798,433
Whiffletree, G. F. Danielson	798,268
Window, F. P. Pfleghar	798,447
Window frame and sash, F. A. Winslow	798,475
Wire stretcher, C. L. Chapman	798,165
Wood to flexible material, apparatus for transferring the grain of, T. T. Hollinger	798,182
Work holder, A. A. Whitman	798,376
Wrench, G. H. Daddysman, Jr.	798,325

DESIGNS.

Badge, J. R. Willcox	37,514
Badge, J. S. Goldsmith	37,515
Cane, D. Brown	37,517
Charm, pendant, J. S. Goldsmith	37,516
Clock frame, S. M. Lawson	37,518
Fabric, Pope & Hubner	37,524
Fabric, printed textile, E. N. Eames	37,523
Lace trimming, C. G. Neubarth	37,522
Lavatory, J. H. Gavin	37,519
Radiators for shields, side or bracket, J. W. Johnson	37,520
Suit, boy's, J. B. Welch	37,521

TRADE MARKS.

Air, mechanism for registering or controlling the supply of moisture to the, Johnson Service Co.	45,908
Ale and ginger beer, ginger, Cantrell & Cochrane	45,798
Aluminium kettles, pots, pans, plates, and dishes, Illinois Pure Aluminium Co.	45,948
Ammonia, Plimpton Cowan & Co.	45,789
Anodyne for external or internal use, Norwich Pharmacal Co.	45,792
Antiseptic, germicide, and healing agent, Henry Heil Chemical Co.	45,705
Asthmatic pastilles, E. A. Moulton	45,742
Atomizers and bulb and fountain syringes, S. H. Wetmore Company	45,870
Automobiles and self-propelled road vehicles and parts thereof, Electric Vehicle Co.	45,737
Automobiles, motor cycles, and similar motor propelled vehicles, C. E. Duryea	45,889
Baking powder, Sherman Brothers & Co.	45,670
Barrels, kegs, pails, and buckets and parts thereof, Chickasaw Cooperage Co.	45,885
Bearings, ball, Hess-Bright Manufacturing Co.	45,946
Beer, Chr. Heurich Brewing Co.	45,797
Beer, Flock Brewing Co.	45,802
Beer, lager, F. & M. Schaeffer Brewing Co.	45,690
Beer, lager, Fred, Hollender & Co., 45,739, 45,803,	45,897
Beer, lager, N. Koehler & Co.	45,805
Belts, ladies', H. A. Austin & Co.	45,655
Biscuit, F. M. Lowe	45,912
Bitters, Westerholm Company	45,795
Blood purifiers and remedies for female complaints and liver pills, Lydia E. Pinkham Medicine Co.	45,785
Boiler tubes, C. A. Thompson	45,943
Books and writing paper, blank, National Blank Book Co.	45,683
Boot, shoe, and leather dressings, Herriott Bros. & Co.	45,904
Boots and shoes, leather, L. A. Crossett	45,679
Boots and shoes, leather, Bay State Shoe & Leather Co. of New York	45,736
Boots and shoes, leather, B. A. Corbin & Son Co.	45,755
Boots and shoes, leather, E. T. Wright & Co.	45,772
Boots and shoes, women's, misses', and children's leather, Dorothy Dodd Shoe Co., 45,857 to	45,859
Bulbs and roots, W. Hagemann 45,901,	45,902
Cabinets, kitchen, Hoosier Manufacturing Co.	45,915
Candy, Hawley & Hoops	45,824
Canned, bottled, preserved, pickled, and evaporated fruits and vegetables, M. L. Hall & Co.	45,906
Canned corn, beans, and succotash, H. C. Baxter	45,882
Canned corn, succotash, peas, beans, tomatoes, etc., Merrell Soule Co.	45,827
Canned fruits and vegetables, Bloomington Canning Co. 45,659,	45,678
Canned vegetables and fruits, W. T. Reynolds & Co.	45,813
Cards, compositions applied in making ornamental, Thaddeus Davids Co.	45,653
Cement, Eclipse Cement & Blacking Co., 45,799,	45,800
Chlorate of potash, Fort Hill Chemical Co.	45,823
Chocolate, Walter Baker & Co.	45,811
Chocolate creams, Proctor & White	45,666
Chocolate for eating and cooking, sweet, P. Griffing & Co.	45,807

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

Cigars, C. Soby 45,746
Cigars, J. Vega 45,808
Cigars, S. C. Herbst Importing Co. 45,810
Cigars, Y. Pendas & Alvarez........45,815, 45,816
Cigars, Alles & Fisher 45,822
Cleaning composition, J. T. Stanley 45,833
Clocks, New Haven Clock Co..45,829, 45,830, 45,840
Cloths, woolen, Forstmann & Huffmann Co. 45,865
Coal, Glen Alum Coal Co. 45,891
Coats, greatcoats, waistcoats, and trousers, F. B. Q. Clothing Co. 45,876
Coats, pants, and overalls, Mahler, Albenberg & Co. 45,663
Coats, pants, vests, and overcoats, Mertz & Mertz 45,660
Cocoa, chocolate, broma, and cocoa preparations, Walter Baker & Co. 45,728
Coffee, West Side Roasting and Milling Co. 45,812
Coffee, W. T. Reynolds & Co. 45,813
Coffee, roasted and ground, New Orleans Coffee Co. 45,924
Collars and cuffs, Cluett, Peabody & Co.. 45,695
Collars and cuffs, Reversible Collar Co. 45,766
Colors, dry or mixed with oil, Wadsworth, Howland & Co. 45,727
Concrete block machinery, Ideal Concrete Machinery Co. 45,708
Cooking utensils made of aluminium and aluminium alloys, Aluminum Cooking Utensil Co. 45,726
Corsets, Royal Worcester Corset Co..45,764, 45,765
Corsets, Strouse Adler & Co. 45,767
Cotton fabric, coarse unbleached, Minot, Hooper & Co. 45,741
Cotton fabrics, woven, Minot, Hooper & Co., 45,826, 45,894, 45,895
Cotton ginning machinery, A. M. Gibbes.. 45,899
Cotton piece goods, C. Schmitz & Co., 45,768, 45,769, 45,934
Cotton piece goods, sheeting, shirting, and drills, Suffern & Co. 45,933
Crushing and pulverizing machines, Williams Patent Crusher & Pulverizer Co. 45,950
Cure, roup. Pratt Food Co. 45,685
Dress goods in the piece, Gilbert Mfg. Co.. 45,758
Dress goods in the piece, silk, Gilbert Mfg. Co. 45,759
Drilling, Minot, Hooper & Co. 45,762
Electrical devices, certain, Bryant Electric Co. 45,880
Electrical devices, certain, Perkins Electric Switch Mfg. Co. 45,942
Envelops, Samuel Cupples Envelope Co.... 45,689
Eyeglass nose guard, F. A. Hardy & Co.... 45,862
Fabrics, woven cloth, Minot, Hooper & Co... 45,761
Fertilizers, chemically prepared, Baugh Chemical Co. of Baltimore County, Md. 45,884
Filing devices, L. Canda 45,696
Fire extinguishers, chemical, Knight & Thomas 45,919
Flavoring syrup for beverages, Rudy & Meredith 45,809
Flint, sand, and emery paper and cloth coated with an abrasive, American Glue Co., 45,693, 45,734
Flour, wheat, Pillsbury-Washburn Flour Mills Co. 45,744, 45,927, 45,928
Flour, wheat, Pittsburg Milling Co. 45,926
Flour, wheat, Thornton & Chester Milling Co. 45,937, 45,938
Furniture, certain named, Widdicomb Furniture Co. 45,751
Furniture, willow, reed, ratan, and rush, Scherrer-Williams Co. 45,832
Gin, S. Streit & Co. 45,687
Glass chimneys, lantern globes, and reflectors, Gill Brothers Co. 45,836
Gloves, Fownes Brothers & Co. 45,656
Gloves, P. Centemeri & Co. 45,820, 45,821
Gloves, silk fabric and kid, P. Centemeri & Co. 45,888
Haemostatic, antiseptic, and disinfectant, liquid, Hance Bros. & White........ 45,704
Hair tonic, Mulhens & Kropff........ 45,775
Ham, smoked beef, and bacon, L. Meyer.. 45,711
Harmonicas, mouth, Firm of M. Hohner.. 45,837
Harmonicas, mouth, F. Strauss........ 45,843
Hats, men's and boys' Gauss-Langenberg Hat Co. 45,757
Heat storing devices or articles containing salts, Thermalite Co. 45,939
Heels and soles for boots and shoes, elastic or cushion, F. W. Whitcher....45,770, 45,771
Hooks and eyes, De Long Hook & Eye Co. 45,877, 45,878
Hose, fabric, Eureka Fire Hose Co., 45,673, 45,674, 45,776 to 45,781
Hose supporters, S. C. Kellogg 45,669
Hosiery, H. B. Loeb 45,654
Insulating compound, Standard Underground Cable Co. 45,745
Keyboard instruments, pneumatically-controlled players for, Aeolian Co. 45,718
Knit undershirts or underwaists and bands for children, Minneapolis Knitting Works 45,661
Lamp shade holders, electric, J E M Shade Holder Co. 45,838
Leather, calf, Pfister & Vogel Leather Co... 45,712
Leather dressing and polish, Columbia Shoe Dressing Co. 45,671
Leather, patent and enameled, John F. Kelly Co. 45,944
Lithia, laxative salt of, Vass Chemical Co. 45,872
Lubricators, locomotive sight feed, Nathan Manufacturing Co. 45,896
Magazine, monthly, Street & Smith........ 45,869
Magazine or periodical, American Farmer Co. 45,754
Measurding tapes, Lufkin Rule Co....45,720, 45,721
Medicinal preparation for the cure of diseases of the blood and skin, Eli Lilly & Co. 45,794
Medicinal preparation for the treatment of skin diseases, liquid, Norwich Pharmacal Co. 45,722
Medicinal preparations, antiseptic, Lambert Pharmacal Co. 45,682
Medicinal preparations for diseases of the mucous membrane, Fitchmul Co. 45,793
Medicine for diseases peculiar to women, J. S. Frazier 45,863
Medicine specific for certain named diseases, Pabst Chemical Co. 45,788
Medicines, proprietary, Martin H. Smith Co. 45,710
Medicines, tocological, N. B. Peraza 45,922
Metal polish, W. J. Ladd 45,909
Mineral waters, natural, Fred. Hollender & Co. 45,804
Music rolls, perforated, Holland Development Co. 45,733
Music rolls, perforated, Aeolian Co. 45,849, 45,850
Neckties and neckscarfs, Castle-Windsor Co. 45,725
Opera glasses, F. A. Hardy & Co. 45,860
Organs, comprising pneumatically-controlled playing mechanisms, Aeolian Co..45,717, 45,719
Packing for piston rods, pumps, and valve stems, Pilley Packing & Flue Brush Manufacturing Co. 45,684
Paint, J. S. Reder 45,665
Paints, Tarr & Wonson 45,940
Paints and varnishes, Harvey & Seymour Co. 45,903
Paper employed for packing food products, Paterson Parchment Paper Co. 45,874
Paper or periodical, monthly agricultural, Wilmer Atkinson Co. 45,875
Peanuts, Gwaltney-Bunkley Peanut Co. 45,916
Pencils, lead, Eagle Pencil Co.......45,700, 45,756
Pens, fountain, C. E. Browning 45,856
Pepper, J. H. Burden 45,883
Perfumery, Mulhens & Kropff........ 45,743
Piano players, Aeolian Co. 45,851
Pianos, F. G. Smith........45,844, 45,845
Pianos, Steinway & Sons 45,846
Pianos, Wm. Knabe & Co. Mfg. Co., of Baltimore City 45,853
Pianos, Webster Piano Co. 45,854
Pianos and the parts thereof, Chickering & Sons 45,855
Pianos, comprising pneumatically-controlled playing mechanisms, Aeolian Co. 45,852
Pianos, grand, Steinway & Sons........ 45,847
Pianos, upright, Steinway & Sons 45,848
Pills, liver, Dr. Tutt Mfg. Co. 45,691
Plaster, wall, Granitine Wall Plaster Co... 45,898
Polishing pads, Royal Lubricating Oil Co... 45,790
Preparation for removing stains and for cleaning and polishing metal, S. R. Ericsson 45,801
Pumps, steam, J. E. Cameron 45,887
Razors, Graef & Schmidt........ 45,866
Remedies for certain named diseases, Od Chem. Co. 45,923

RADIUM AND THE RADIO-ACTIVE Substances. No better or clearer scientific account has been published than that contained in SCIENTIFIC AMERICAN SUPPLEMENT **1429**. The paper presents all that is at present known about radium and the radio-active substances. Price 10 cents, by mail. Munn & Co., 361 Broadway, New York City and all newsdealers.

In Chancery of New Jersey.

BETWEEN
MERLE J. WIGHTMAN *et als.*, *Complainants*,
and
PYRO ELECTRIC COMPANY, *Defendant*.
On Bill, etc. Receiver's Sale.

By virtue of an order of the Chancellor of the State of New Jersey in the above-entitled cause, bearing date the ninth day of May, nineteen hundred and five, I shall expose for sale at public vendue at my office, Rooms 433 and 434 Prudential Building, No. 765 Broad Street, Newark, N.J., on Thursday, the twenty-first day of September next, at two o'clock in the afternoon of that day, certain patents belonging to said defendant corporation dated November 1, 1904, and numbered 773,838; 773,839, which said patents are on certain inventions respecting the development of heat and electricity, and especially certain improvements in thermo-electric generators; and also the good will and name of said defendant corporation.

The said letters patent may be inspected at the above-named office of the Receiver and the conditions of sale will be announced upon application or at the time of sale.

Dated August 4, 1905.

EDWARD H. DURYEE, Solicitor and of Counsel with Receiver.
FRANCIS CHILD, Jr., Receiver of Pyro Electric Co.

Remedies for diseases peculiar to women, Martin H. Smith Co. 45,787
Remedies for malnutrition, Carnrick Pharmacal Co. 45,817
Remedy, consumption, Piso Co. 45,873
Remedy for dyspepsia and indigestion, U. B. Kline 45,784
Remedy for genito-urinary and venereal diseases, Benz-Ol Capsule Co. 45,871
Remedy, headache, E. C. De Witt & Co... 45,680
Roofing, shell-surfaced ready, A. H. White Co. 45,881
Rubber horseshoes, Whitman & Barnes Manufacturing Co. 45,945
Safety pins, E. M. Silberman 45,716
Safety pins, J. D. Conover..........45,818, 45,819
Salve, C. S. T. Hansen 45,783
Salve or paste, Eli Lilly & Co. 45,791
Seams, hems, welts, and overedging, Willcox & Gibbs Sewing Machine Co. 45,773
Sewing machines, Willcox & Gibbs Sewing Machine Co. 45,835
Shade fabrics, window, Joseph Bancroft & Sons Co. 45,740
Sheet meal for interior decorative purposes and ornamental plates, Enameled Art Metal Co. 45,699
Sheeting in bolts, brown cotton, John S. Brittain D. G. Co. 45,760
Sheetings, Pelzer Mfg. Co. 45,763
Sheetings and drillings, Loray Mills..45,892, 45,893
Sheetings and drillings, Orr Cotton Mills.. 45,925
Sheetings and drills, Orr Cotton Mills.... 45,668
Sheetings and drills, Easley Cotton Mills.. 45,890
Sheetings and drills, cotton, K. Iwahara, 45,917, 45,920
Shells and cartridges, shot, Winchester Repeating Arms Co. 45,730
Shells, paper shot, Winchester Repeating Arms Co. 45,729
Shirt waists and shirt waist suits, Sondheim, Stein & Co. 45,662
Shoe polish and leather dressing, World Polish Manufacturing Co. 45,732
Shoes, ladies' leather, A. Shuman & Co. .. 45,672
Silk, raw, waste, and spun, Morimura Arai & Co. 45,867
Soap, scouring and toilet, East River Co... 45,782
Soap, toilet, Mulhens & Kropff 45,709
Soap, toilet, Cincinnati Soap Co. 45,879
Soaps, toilet and laundry, Beaver Soap Co. 45,724
Soda fifty-eight per cent dense, pure, Solvay Process Co. 45,936
Specific, croup, W. W. Lee 45,786
Specific, croup, C. H. Huiest 45,825
Specific for kidney and analogous complaints, Foster Milburn Co. 45,864
Spoons, forks, and knives made of steel and tinned, R. Wallace & Sons Mfg. Co. .. 45,713
Starch, gloss, Siegel, Cooper & Co.......... 45,747
Stove polish, Phoenix Plumbago Mining Co., 45,929, 45,930
Stove polish, liquid, W. J. Ladd.......... 45,910
Stoves and ovens, cook, E. H. Huenefeld.. 45,905
Stoves and ranges, Stamford Foundry Co.. 45,941
Stoves and ranges, Eclipse Stove Co...... 45,947
Sugar, syrup, molasses, and glucose, Goyer Alliance Refining Co. 45,900
Surgical instruments, F. A. Hardy & Co.. 45,861
Suspenders and braces, Harris Suspender Co. 45,707
Syrup, maple, Hill Syrup Co. 45,907
Talking machines, A. T. Moore 45,839
Tea, Levering Coffee Co. 45,806
Teas, G. Lockitt's Sons 45,911
Teas, J. M. Montgomery 45,914
Thinners and colors, C. A. Willey 45,664
Tin or terne plates, Conklin Tin-Plate & Metal Co. 45,886
Tobacco, leaf, W. T. Grant & Co., 45,675 to 45,677, 45,701 to 45,703
Tobacco, plug, Monarch Tobacco Works.. 45,828
Tonic, Raimer Heinly Co. 45,749
Tonic, animal, Pratt Food Co. 45,868
Trestles, paper hangers', Miller Ladder Co. 45,750
Valves, cocks, and hydrants, Pratt & Cady Co. 45,931
Varnish stain, Hanna Paint Mfg. Co...... 45,949
Varnishes, Wadsworth, Howland & Co..... 45,753
Varnishes, japans, and floor polish, Lilly Varnish Co. 45,921
Veterinary remedy, Dr. B. J. Kendall Co., 45,697, 45,698
Wagons, Moline Plow Co. 45,913
Washboilers, buckets, cans, kettles, etc., sheet metal, M. Kamenstein 45,918
Washing machines, E. H. Huenefeld...... 45,706
Watchcases, Fahys Watch Case Co......... 45,692
Watches, watchcases, and watch movements, B. L. Strasburger & Co........ 45,748
Watches, watchcases, and watch movements, Keystone Watch Case Co....... 45,834
Watches, watchcases, and watch movements, Philadelphia Watch Case Co., 45,841, 45,842
Water heating apparatus, Renta Water Heater Co. 45,932
Waterproofing and weatherproofing cotton duck, compound for, W. H. Robeson... 45,831
Whisky, United Wine & Trading Co. 45,657
Whisky, Rhomberg Bros. & Co. 45,658
Whisky, S. Streit & Co. 45,667
Whisky, C. H. Ritter & Co. 45,686
Whisky, Lazarus & Nassauer 45,688
Whisky, Betzfelder, Bronner & Co......... 45,735
Whisky, W. L. Weller & Sons 45,752
Whisky, James Clark Distilling Co......... 45,796
Wine, sherry, S. Streit & Co. 45,715
Wines, Brand Brothers Co. 45,694
Woodworking machines, cutter and matcher heads used in, Samuel J. Shinner & Sons 45,935

LABELS

"Berlin Lung Cure," for medicine, Berlin Medicine Co. 12,353
"Bison, Cream Sugar Corn," for canned corn, Riverton Packing Co. 12,346
"Campbell's Best of Wheat," for wheat food, G. G. S. Campbell 12,345
"Old Chatsworth," for whisky, P. Goldberg 12,349
"Olive Massage Cream," for skin food, R. W. Luedeke 12,352
"Premiato Pastificio a Vapore," for macaroni, V. Viviano & Bros. 12,347
"Royal Chef," for cigarettes, Royal Tobacco Co. 12,351
"The Brownie Clip," for paper clips, Flexible Back Loose-Leaf Ledger Co. 12,354
"Tisapure," for malt extract, Paragon Malt Extract Co. 12,348
"Trade Seal," for cigars, A. C. Henschel & Co. 12,350

PRINTS.

"Carolina Brights Cigarettes," for cigarettes, Wells-Whitehead Tob. Co. 1,409
"Circus Dolls No. 2," for patterns for paper dolls, Gray Lithograph Co. 1,412
"Circus Dolls No. 3," for patterns for paper dolls, Gray Lithograph Co. 1,413
"Circus Dolls No. 4," for patterns for paper dolls, Gray Lithograph Co. 1,414
"Pratts Wheel of Success," for medicines, Pratt Food Co. 1,411
"Take a Punch," for cigars, J. W. Smith... 1,410
"The Cow Boy," for beer, Geo. Wiedemann Brewing Co. 1,408
"The Hold Up," for beer, Geo. Wiedemann Brewing Co. 1,407
" 'The Luck of Roaring Camp' Arrival of the first Luxury," for beer, Geo. Wiedemann Brewing Co. 1,406

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

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