SCIENTIFIC AMERICAN

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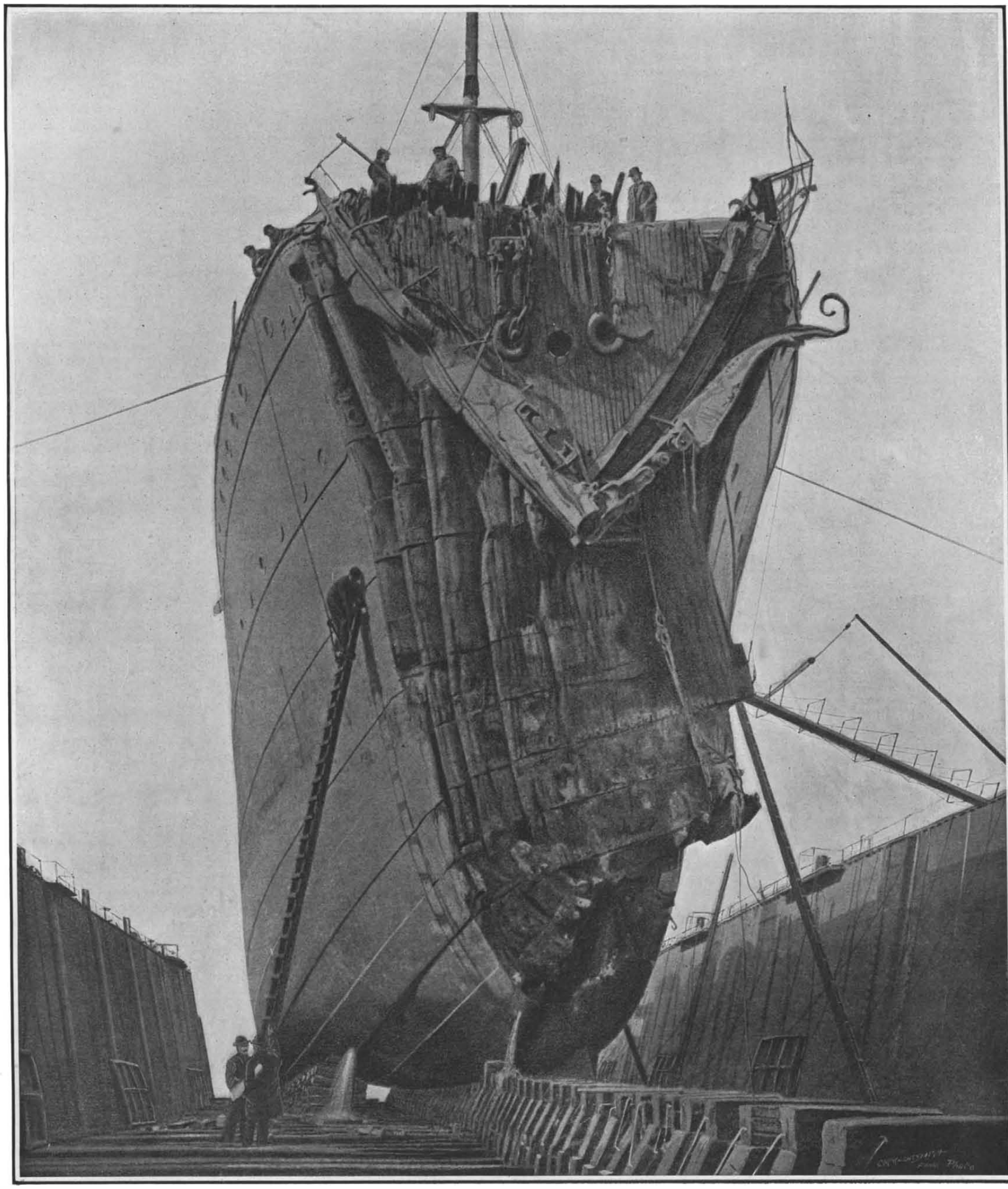

The above illustration shows the "Florida" in the Morse drydock for repairs. The force of the collision flattened thirty feet of the bow, concertina fashion, into a space of five feet. The wreckage was cut away and a new bow built on in twenty-four days.

EFFECT OF COLLISION ON BOW OF ATLANTIC LINER.—[See page 140.]

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NEW YORK, SATURDAY, AUGUST 28th, 1909.

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

ANCHORING DOWN THE FLOOR OF THE GATUN LOCKS.

The magnitude of the problems confronting the engineers who are building the huge locks at Panama, by far the largest work of the kind yet attempted, is shown by the nature of recent experiments which have been carried on at the site of the lock foundations. The object of these experiments is to determine the best way to anchor down the floor of the locks, and prevent it from being lifted bodily by the pressure of the water.

Now, to the average reader the statement that the floor of this huge concrete structure has to be anchored down to the mother rock below, will come very much as a surprise; for it has a uniform thickness of thirteen feet. Moreover, since the locks, when in operation, will be filled with not less than forty-five feet of water, one would imagine that the pressures on the floor would be altogether downward. Yet, as a matter of fact, provision has to be made for maximum upward bending stresses upon the floor, which will occur, not when the locks are full, but when they are unwatered for inspection. This upward thrust might become so great that the weight of the thirteen-foot thickness of concrete, plus its own strength to resist bending and breaking stresses, would not suffice to prevent its being thrust up from below and wrecked.

Now, since the floor of a single lock would weigh over one hundred thousand tons, it can be understood that this upward pressure tending to burst in the floor when the lock is empty, must be of enormous proportions. The question will naturally be asked, What is the character of a force which is capable of lifting up and breaking apart a mass of concrete one thousand feet long, one hundred and ten feet wide, and weighing one hundred and four thousand tons?

The answer is, that water seeping through the surrounding ground, and possibly following along the sides of the lock from the Gatun Lake, and collecting below the floor of the lock, might expose the latter, when the lock was emptied, to a hydraulic pressure equivalent to that exerted by a column of water eighty-seven feet in height; that being the vertical distance or "head" from the under side of the floor of the lock to the level of the water of the Gatun Lake. Those of our readers who are familiar with the principles of hydraulics, will understand that should such a seepage occur, and a film of water gather beneath the lock when it was empty, and should there be a clear connection between this film of water and the body of water in the lake, a hydrostatic pressure acting vertically against the under side of the floor of the lock would be established.

The engineers have guarded against such seepage of water by sinking a deep curtain wall through the ground beneath the entrance to the locks, extending this wall down the full length of the locks against the outside wall, and sinking it everywhere to the impervious underlying rock. The possibility of seepage past this wall is very remote; but such is the extraordinary care which has been taken to render the Panama Canal absolutely secure against disaster, that it has been decided to consider the floor of the locks as liable to this seepage and this upward pressure, and take special steps for anchoring the floor down to the rock below. Experiments have been made to determine the effect of anchoring steel bars in the rock underlying the floor, for the purpose of ascertaining to what extent they could be trusted to hold the floor down against upward pressure. A number of old French steel rails were sunk in the rock to depths of from five to fifteen feet, and secured therein by concrete. In the test on a rail put down five feet, the rock began to crack under a pull of 98,250 pounds, and finally gave way under a pull of 136,800 pounds. The second rail anchored ten feet deep resisted all efforts to pull it up, the apparatus breaking under a pull of 237,750 pounds.

The Board of Engineers having the investigation in hand found that the maximum thrust to be resisted above the intermediate gate sill is that due to eighty-seven feet of water. This thrust would occur in case the lock and forebay should be pumped dry for examination, and a full head should develop under the entire area of the floor. It has been decided that this can be resisted by a floor thirteen feet in thickness, anchored down to the rock below by rails spaced six feet apart over the whole floor of the lock, each rail having a resistance of 128,000 pounds. The depth of the anchoring rails in the rock will be increased to fifteen feet in the middle part of the lock floor.

FAR-SIGHTED POLICY OF IMPROVEMENT.

When the early railroads of the United States were projected, the scarcity of capital made it necessary to build them on the cheapest possible plan. In locating the new lines, care was taken to interfere with the natural configuration of the ground as little as possible. Deep cuts were avoided. When the engineer encountered a bluff, he located his line around instead of through the obstruction; and if his survey was being made along the flanking hills of a tortuous valley, he made the line conform closely to the configuration of the ground, using many and sharp curves, in the effort to avoid costly work of excavation with pick, shovel, and dynamite.

Sharp curvature and steep grades, however, though they may secure for the railroad company a line that represents but little first cost, involve a very heavy cost of operation. The resistance of sharp curves and grades of two per cent and over limits the number of cars that the individual locomotive can pull. To move a given tonnage of freight or number of passengers over a crooked and hilly road, may call for two or even three times the number of locomotives and train hands that are necessary to haul the same traffic over a road that is fairly straight and reasonably level.

As the years went by, it began to be evident to the railroad companies that it would pay to spend a considerable sum of money in straightening out curves and reducing grades; since the interest on the capital thus invested would be more than offset by the reduced expenses of operating the improved road. Consequently, the railroads, as soon as their finances would permit, began to eliminate the worst features of these hastily and cheaply constructed pioneer roads. The work of revision has been carried on more or less steadily throughout the seventy-five years that our railroad system has been in existence; and during the past two decades, the sums of money that have been spent in relocating and rebuilding the lines have been enormous. The Union Pacific Railroad expended a few years ago between thirty and forty millions of dollars in cutting down grades and straightening the line on its Rocky Mountain division; and more recently the Pennsylvania Railroad has laid out an even greater sum on its crossing over the Alleghany Mountains.

The latest, and in some respects the most striking enterprise of this character, is a cut-off which is being made by the Delaware, Lackawanna & Western Railroad, by which it will shorten a forty-mile stretch of its line between New York and Buffalo by eleven miles; reducing the grades from sixty feet to the mile to a maximum of less than thirty feet, and reducing the total length of the curves from thirteen miles to less than five miles. Yet, although the total length of the cut-off will be only twenty-eight and one-half miles, its construction will cost $13,000,000, which is equal to an average of about $450,000 per mile.

The principal object of this cut-off is to enable the railroad to haul its heavy coal traffic by a short and easy route across the divide between the Delaware and the Passaic and Raritan rivers. The present line runs to the south of a direct line, making a detour of forty miles, in which, as mentioned above, the grades reach sixty feet to the mile, and there are over thirteen miles of curvature. The new line extends from Lake Hopatcong north to Andover and to the Delaware River in an approximately straight line. In order to eliminate curvature and grades, it became necessary to make some of the deepest cuts and the loftiest and longest embankments in existence. One cut through the solid granite is over one hundred and fifty feet deep at the point of greatest maximum depth, and is over a half a mile in length. Out of this cut alone must be blasted over half a million cubic yards of rock. Beyond the cut is being built the greatest railroad fill in this country, if not in the world. It will be over three miles in length, and from seventy-five to one hundred and ten feet in height. Into the embankment, when it is completed, there will have entered over six and one-half million cubic yards of material. This is about one and one-half times as much material as was taken out of the two huge excavations in New York city for the new Pennsylvania and New York Terminal stations.

THE WRIGHT AEROPLANE INFRINGEMENT SUIT.

A suit in equity has been brought by Orville and Wilbur Wright against the Aeronautic Society of New York, to prevent further exhibition and use of the Curtiss aeroplane owned by the Society, on the ground that the machine is an infringement of the Wright patents. If the suit is brought to a final hearing, it will result in the first complete review of the state of aeroplane art in patent law, and will settle once and for all who should be legally acknowledged as the inventor of the balancing devices which are now employed in many aeroplanes.

Although we have not complete data before us, it is safe to say that the Wrights will undoubtedly base their chief claims for infringement on their method of warping the planes. Whether or not this method is new with them must, of course, be determined by a court. To understand just what warping the wings means, we must first understand something of the principles of an aeroplane's flight. An aeroplane may be defined as a surface propelled horizontally in such a manner that the resulting pressure of air from beneath prevents its falling. Such a plane runs on the air like a skater over thin ice, to employ a simile invented by the late Prof. Samuel P. Langley. The most familiar example of an aeroplane is the kite of our boyhood. We all remember how we kept it elevated even in a light breeze by running with it against the wind. The cord may be regarded as the resultant of two forces acting at right angles—the one the pressure of the wind, the other the weight of the kite. Substitute the pull or the thrust of a propeller for the horizontal component (pressure) and an areoplane flying machine is created. If this were all, the problem of artificial flight would have been solved long ago. There remains the extremely difficult art of balancing the plane so that it will skate on an even keel. Even birds find it hard to maintain this stability. In the constant effort to steady himself, a hawk sways from side to side as he soars, like an acrobat on a tight rope. Occasionally a bird will catch the wind on the top of a wing, with the result that he will capsize and fall some distance before he recovers himself. If the living aeroplanes of nature find the feat of balancing so difficult, it is no wonder that men have been killed in endeavoring to discover their secret.

A sailing canoe in a stiff breeze affords a striking example of what this task of balancing an aeroplane really means. As the pressure of the wind on the sail heels the canoe over, the canoeist must climb out on the outrigger, so that his weight will counterbalance the wind pressure and so that the moment of gravity will counterbalance the moment of air pressure. In a canoe the feat is comparatively easy; in an aeroplane it may demand constant and flashlike shifting of the body, because of the incessant variations of the wind. Otto Lilienthal, a pioneer experimenter with the aeroplane, met a tragic death after he had succeeded in making over two thousand short flights in a gliding machine of his own invention, simply because he was not quick enough in so throwing his weight that the centers of air pressure and gravity coincided. Pilcher, an Englishman, came to a similar violent end for a similar reason. Octave Chanute in the United States continued the work of the ill-fated Lilienthal. Realizing the inherent danger of a glider in which the operator must adapt himself to the changing center of air pressure with acrobatic agility, Octave Chanute devised an apparatus in which the center of air pressure was mechanically controlled, so that there was no longer the perilous necessity of indulging in aerial gymnastics. In his machine, the tips of the planes, when struck by a gust of wind, would fold slightly backward, thus considerably curtailing the tendency of the center of air pressure to shift. The Wright brothers warp the ends of the planes for the same purpose. In his earlier machines Curtiss, instead of warping the ends of the planes, employed wing tips, which were moved up or down. The effect was the same. In the new Curtiss machine acquired by the Aeronautic Society and involved in the present infringement suit, no attempt whatever is made either to provide the main planes with movable tips or to warp them. Instead, the balancing planes are carried between the main supporting planes. These intermediate balancing planes are rotated about horizontal axes, in order to balance the entire machine. The court will therefore be called upon to decide whether or not these intermediate planes of Curtiss, entirely unconnected with the main supporting planes, are the mechanical equivalents of the Wright brothers' plane-warping devices. If they are, the court will further have to pass upon the question whether Chanute's wing tips were an anticipation of the Wright brothers' plane-warping invention.

ENGINEERING.

The first National Conservation Congress of the United States will be held on August 26th, 27th, and 28th at the Alaska-Yukon-Pacific Exposition. Invitations have been sent to ten thousand prominent men in the States where conservation is receiving official attention. The Seattle congress will perfect a permanent organization, and will select representatives to attend the World's Conservation Congress at The Hague.

The squadron which Germany will send to the Hudson-Fulton Celebration will consist of Germany's latest armored cruiser, the 11,600-ton 22.5-knot "Gneisenau"; the protected cruisers "Hertha" and "Victoria Louise" of 5,660 tons and 19 knots speed; the "Bremen," 3,250 tons and 23.3 knots, and the "Dresden," one of the new 3,600-ton fast scouts of which Germany is building so many, of 24.5 knots speed.

With the old Metropolitan line, 71 miles in length, and the Metropolitan District line, 28 miles in length, included, the network of London's subways and tubes has a total length of over 145 miles. London was the first city to inaugurate subway travel. The Metropolitan line, which for many decades was operated by steam, was put in operation over half a century ago.

In his testimony before the House Committee, Rear Admiral Mason recently estimated the life of an 8-inch gun at 200 rounds. As first constructed, the 12-inch gun began to deteriorate by erosion at 80 rounds; but by reducing the velocity and using a broader copper rifling band, its life has been extended to about 150 rounds. After 150 rounds it would be necessary to reline the gun at a cost of $12,000, which is about one-fourth the first cost of the gun.

As one outcome of the experiments and conferences that have been held during the past three years between railway men and rail makers, it was determined to seek the co-operation of the Bureau of Standards of the Department of Commerce and Labor. Director Stratton has entered into hearty co-operation, and experiments looking to the improvement of steel rails will henceforth be made under the joint auspices of the maintenance of way engineers, the managers of the rail mills, and the experts of the Bureau of Standards.

The navy collier "Nero," which went ashore on Brenton's Reef on July 2nd, during a dense fog, was successfully floated by the Arbuckle compressed-air method. The deck was made airtight, and by means of powerful compressors the water was gradually expelled from the hull through the rents in the bottom. When the ship had been sufficiently lightened, she was pulled from the rocks by the united efforts of tugs and salvage vessels.

There is now nearing completion a six-foot steel main, which is being built to supplement the masonry conduit which carries the Brooklyn water supply from Nassau County. It is twenty-three miles in length, and will cost over $2,500,000. The present masonry conduit has a daily capacity of 120,000,000 gallons. The daily consumption of Brooklyn and Queens is 142,000,000 gallons, part of which is drawn from local artesian wells. The new steel main will have a capacity daily of 55,000,000 gallons.

That the illumination of New York city in connection with the Hudson-Fulton Celebration has been planned on a worthy scale is shown by the announcement that it will include 1,500,000 additional incandescent lights, 10,000 arc lights, and two batteries of searchlights, the total capacity of which independently of the city lights and private illumination will be 26,260,000 candle-power. A dramatic feature will be the lighting of twenty immense signal fires upon mountain peaks along the Hudson from New York city to Newburg.

Everyone who admires the stately trees of the old New England towns—and who does not?—will be gratified to know that tree planting is being carried on systematically on the Massachusetts roads. The report of Mr. E. W. Breed, forester of the State Highway Commission, shows that during the year ending November 30th, 1908, 1,184 new trees were planted and 744 old trees were replaced. During the preceding five years, 13,113 trees had been distributed among fifty-five towns. The cost in 1908 of new trees averaged $1.29 each, and the average cost of maintenance was 20 cents per tree.

By the courtesy of the commandant of the Naval Training Station, the committee which have in charge the Portola Festival, commemorating the discovery of San Francisco Bay by Portola in 1769, have constructed on Yerba Buena Island, San Francisco Bay, what is probably the largest sign ever erected. The sign, which has been cut on the sloping hills of the island, is 1,300 feet long by 135 feet high. The words "Portola Festival, October 19th-23rd," are arranged in two lines, each letter of which occupies a space 45 feet by 45 feet, the outline of the letters being 8 feet in width. The work was done by digging trenches 8 inches in depth and filling them with lime, which shows up clear and white against the green of the hillside.

ELECTRICITY.

The eight-track swing bridges across the main channel of the Chicago drainage canal near 31st Street will be operated by electricity.

An interesting article in the August number of the Fine Arts Journal describes the artistic possibilities of electricity both for decorative lighting and more utilitarian purposes of facile hospitality, from electric toast racks to chafing dishes.

The electric railway up Mont Blanc is now open to the public as far as the Col de Voza, 5,495 feet high. The first train took nearly an hour to accomplish the journey of 4½ miles. There are no tunnels, and the steepest grade is 20 per cent, some magnificent views of Alpine scenery being obtainable from the cars.

The Boston & Maine Railroad has bought the hydro-electric power plant at Eastman Falls on the Pemigewassett River, and concessions for undeveloped water power in the same neighborhood. The company has large shops in the vicinity, and also operates trolley lines, for which this power will be available.

With very little ostentation, the Commercial Cable Company has recently completed what will probably be a very valuable improvement, landing at Manhattan Beach the shore end of a new cable from St. John's, Newfoundland. The new line is 1,300 miles long, and is spliced to the transatlantic line 270 miles east of St. John's. It is expected to greatly accelerate transmission of messages from New York and southern points to Europe.

Few people would imagine that an electrical instrument factory requires a staff of expert jewelers, but the cutting in special forms, polishing, setting, and mounting of diamonds, sapphires, and rubies forms an important part of the work of the General Electric Company's meter factory at Lynn, Mass. Details of the operations involved are described in an interesting article by J. G. Baker in the current Electrical Review.

The increasing use of electrical energy upon a large scale in industrial establishments renders necessary the adoption of numerous precautionary measures, and it is to the credit of the great industrial corporations of this country that they not only recognize this fact, but employ special officials to give effect to the safety regulations adopted. An admirable article on this subject by Mr. R. J. Young, safety inspector of the Illinois Steel Company, appears in the Electrical World of August 12th.

A fire alarm was recently sent to a station ten blocks from the scene of the fire by a route over 200 miles long. A car of coal caught fire at Edwardsville, Ill., the station of which has no telephone. The station agent called Decatur, 100 miles away, by telegraph, where the dispatcher called Poag, the nearest station to Edwardsville having a long-distance telephone. The Poag operator rang up the Edwardsville exchange, where the telephone operator rang the alarm in the fire station, and the engine was on its way only three minutes after the station agent reported the fire.

Rio de Janeiro is one of the first capital cities of the world to be adequately supplied with hydro-generated electric power. The current is transmitted at 88,000 volts from the generating station at a water power 51 miles away to a receiving station in the city, where it is stepped down by transformers to 6,300 volts, at which pressure it is supplied to the general feeders for lighting and power. The general distribution is by means of four-wire three-phase system, giving 120 volts to lamps, etc., between outside wires and neutral—the first time that this system has been tried upon so large a scale.

A patent was granted to Mr. J. H. Cuntz on July 13th for a method of making wireless signals selectively audible by means of acoustic attachments. A tuning fork is magnetically associated with a mechanical interrupter in the sending circuits, by means of which the high-frequency wireless telegraph current is interrupted throughout each signal at a rate corresponding to the pitch of the tuning fork. An identical tuning fork magnetically associated with the receiving circuit gives forth an audible sound when the wireless signals are interrupted at a rate corresponding to its pitch, signals being heard only when the forks at both stations have equal pitches.

The great silver-mining district of Cobalt has been turning its attention to generation of power by water on account of the high cost of power, due to the distance which fuel has to be conveyed. The average cost of power hitherto has been $175 per horse-power year, some mines even paying as much as $400. A grant of land has been made at the head of Lake Temiskaming on the Matakichewan River, about 25 miles from Cobalt, where there is a large water power available, and a big hydro-electric power plant is being erected. The current will be conveyed to the mines, and either electricity for other power purposes or compressed air from electrically-driven compressors will be sold to consumers.

SCIENCE.

The municipal council of St. Petersburg has decided to name the newly installed municipal laboratory after the celebrated Russian biologist Metchnikoff, who is at present connected with the Pasteur Institute of Paris. It will moreover found an annual prize of 1,000 rubles, this to be known as the Metchnikoff Prize, and it is to be awarded for the best work in biology.

In a recent lecture before the Society of Arts, Eyde gave some details concerning the present condition of the manufacture of artificial nitrates at Notodden, where large quantities of calcium nitrates are produced and sold in competition with nitrates from Chile. The annual production of nitrate of soda in Chile is 1,800,000 tons. In 1920 this may be expected to be increased to at least 2,500,000 tons. At the same epoch the Norwegian production will amount to about 300,000 tons, or only 12 per cent of the Chilean. Meanwhile, of course, other factories may be established, which will largely increase the total production of artificial nitrates. Nevertheless, Eyde does not fear competition, in view of the constant increase in demand throughout the world. From experiments made in various countries, it may be concluded that artificial nitrate is as good a fertilizer as Chile saltpeter, and on some lands a better one.

The age of a fish can be determined with accuracy by inspection of the otoliths, or bony concretions, which are found in the auditory apparatus. These otoliths increase in size during the entire life of the fish, each year adding two layers, a light-colored one formed in summer and a dark one formed in autumn and winter. The alternate layers are sharply contrasted and very distinct, so that there is no difficulty in counting them. The number of pairs of layers is equal to the number of years the fish has lived. By this method Wallace has made an interesting study of the distribution of fishes of the plaice species over various sea bottoms, according to age. In this way the rapidity of growth of fishes and the effect of fisheries on the population of the sea can be determined.

The new German exchange professor for Columbia University is Dr. Karl Runge of Göttingen, Germany. Prof. Runge was born at Bremen in 1856, studied at Munich and Berlin, receiving the degree of doctor of philosophy at the latter institution in 1880. Before his appointment at Göttingen, he was professor in the Technical High School at Hanover. He has an excellent command of English. Dr. Runge's first original work was in pure mathematics, and he early obtained a high position among German mathematicians. Of later years his interest has been more largely in applied mathematics. He has, for instance, made important investigations in spectrum analysis and in astronomical and nautical researches. His most recent specialty, and one upon which he will give a course at Columbia, is the study of graphical methods in physical and technological research.

By using the soundings shown on the Admiralty charts, Prof. Edward Hull has demonstrated that a series of iso-bathic contours can be drawn, showing the form of the ocean bed. In this way we can determine the margin of the continental shelf, which breaks off into deep water near the 100-fathom contour; as also the channels of the submerged river-valleys which traverse it down to depths of about 1,000 fathoms. By this means those of the "English Channel River" and those of the Loire, the Gironde, and the Adour, off the coast of France; also those of the Caneira, Arosa, Lima, Douro, Mondego and Tagus from off the coast of Spain and Portugal, have been determined. The existence of these channels, formed by erosion under land conditions, indicates great changes of level in late Tertiary times, resulting in the climate of the "Glacial period."

The existence of a rich fauna in the sea proves that the salts contained in potash wastes, if sufficiently diluted, are not injurious to fish. Nevertheless, it has frequently been observed that if strong saline solutions are discharged into streams, the salt is distributed throughout the water very slowly. In some cases, a strong saline current, sharply distinguished from the rest of the stream, persists for several miles, and may destroy either the fish or the organisms upon which they feed. Chemical purification of the waste waters of the potash manufacture has been attempted. In the Mehner methods, the waste water, which contains a large percentage of magnesium chloride, is mixed with lime, which precipitates the magnesia in the form known as Sorel cement. This mass, mixed before setting with inert substances, may be used for filling the voids caused by the extraction of the potash salts, or solutions of magnesium chloride may be concentrated to a strength of four molecules of water, in which condition the salt takes up two additional molecules of water and may, therefore, be used in dehydrating additional quantities of solution, thus producing a pasty mass which is convenient for the filling of voids.

REPAIRING THE CRUSHED-IN BOW OF THE "FLORIDA."

The extraordinary photograph reproduced on the front page of the present issue shows the result of one of the most tremendous collisions in the history of ocean navigation. That concertina-like mass of crumpled-up steel plating and framing represents the effect of the blow struck by a steamer weighing seven thousand tons, and moving through the water probably at not less than twelve knots an hour, when it crashed squarely into the side of an even huger vessel, weighing about twenty-five thousand tons and itself moving at a speed somewhat less. The energy of the blow struck by the "Florida" was not expended until thirty feet of her bow had been crushed and jammed tightly together into a space of five feet. But with this dramatic picture before us, telling its own unmistakable story, it is needless to multiply words by way of description.

It was during thick weather on January 23rd, 1909, that the steamship "Republic" of the White Star Line was feeling her way past Nantucket lightship, when suddenly out of the fog loomed up the bow of the "Florida," so closely aboard that nothing could be done to avert the collision. The blow was delivered squarely amidships. The "Florida's" bow crushed through the side plating of the "Republic" and entered the engine room, tearing open a gaping vertical hole, which extended from the main deck down to the bilge. The subsequent history of the disaster, including the call for help by wireless and the speedy rescue of the passengers of the "Republic," needs no repetition here. The gradual giving way of the bulkheads of the stricken ship sealed her fate, and she now lies in some four hundred feet of water. Thanks to the staunchness of the construction of her collision bulkhead, the "Florida," although thirty feet of her bow had been smashed in, was able to make her way to New York under her own steam.

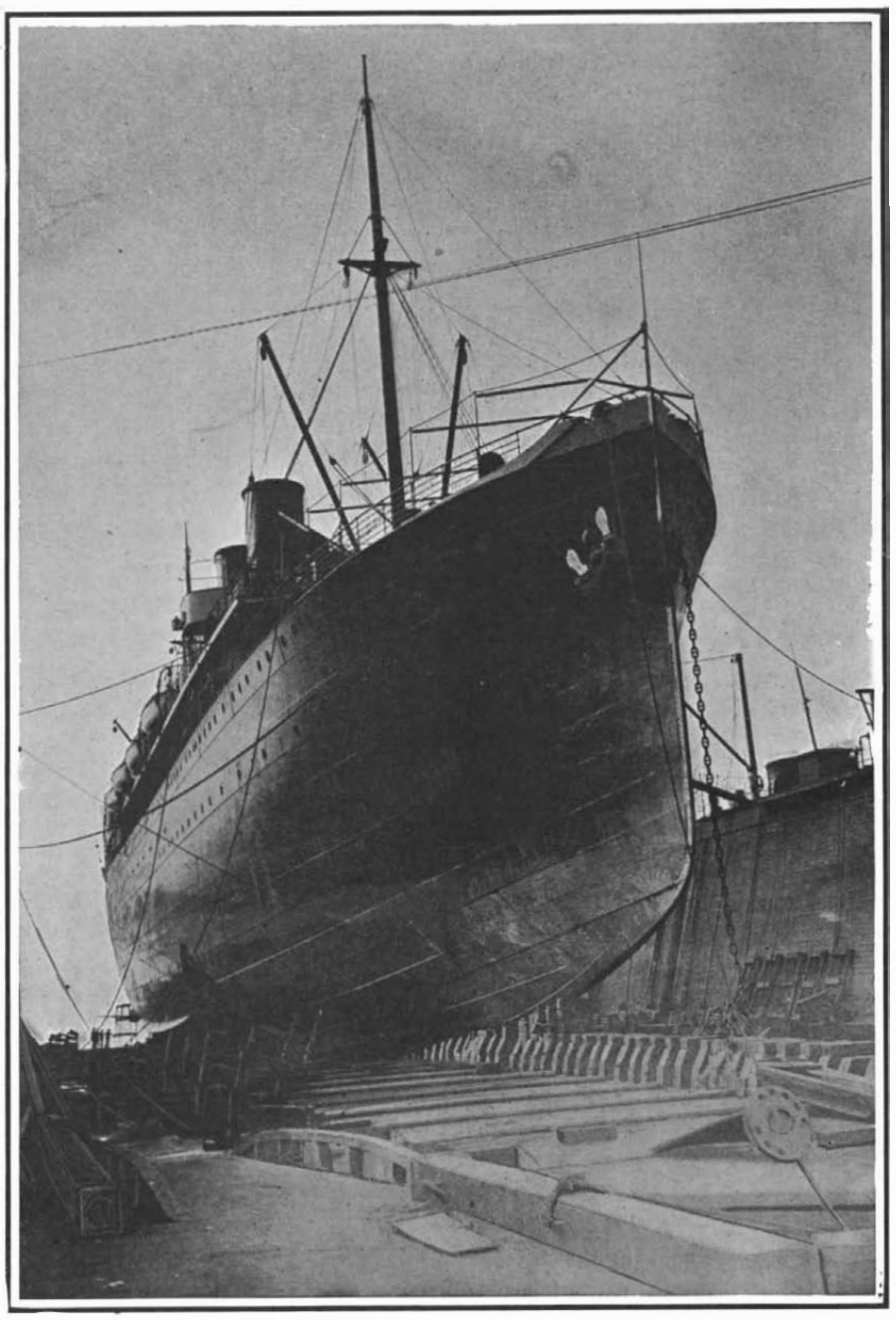
To those who went down to the Bush docks in South Brooklyn to take a look at the "Florida," it seemed as though the terrific impact of the collision must have strained the ship so severely as to necessitate many months of careful overhauling and repair. Several weeks elapsed indeed before the owners made any call for tenders for the work of repair, which involved the construction of an entirely new bow on the vessel. The contract was let to the Morse Dry Dock and Repair Company, who agreed to cut away the old wreckage and build a completely new bow, in the extraordinarily short time of twenty-four running days and for the sum of $39,500. The nearest competitor asked for thirty-four days; while one contractor considered that to complete a job of this magnitude would require fifty-six days, or two and one-third as much time as that in which the job was actually done.

It has been a matter of common belief on the part of the public that American shipyards are unable to turn out work at the speed which obtains in foreign yards. There was a day when this may have been true; but with the increased experience, the better tools and the splendid plants which have been built of late years around our seaboard and on the Great Lakes, the art of shipbuilding has made prodigious strides. It is safe to say that work can be turned out of as high quality and in as short a time in the best of our yards to-day as it can in those of the European shipbuilders; and of this fact the remarkable job done on the "Florida" affords strong evidence.

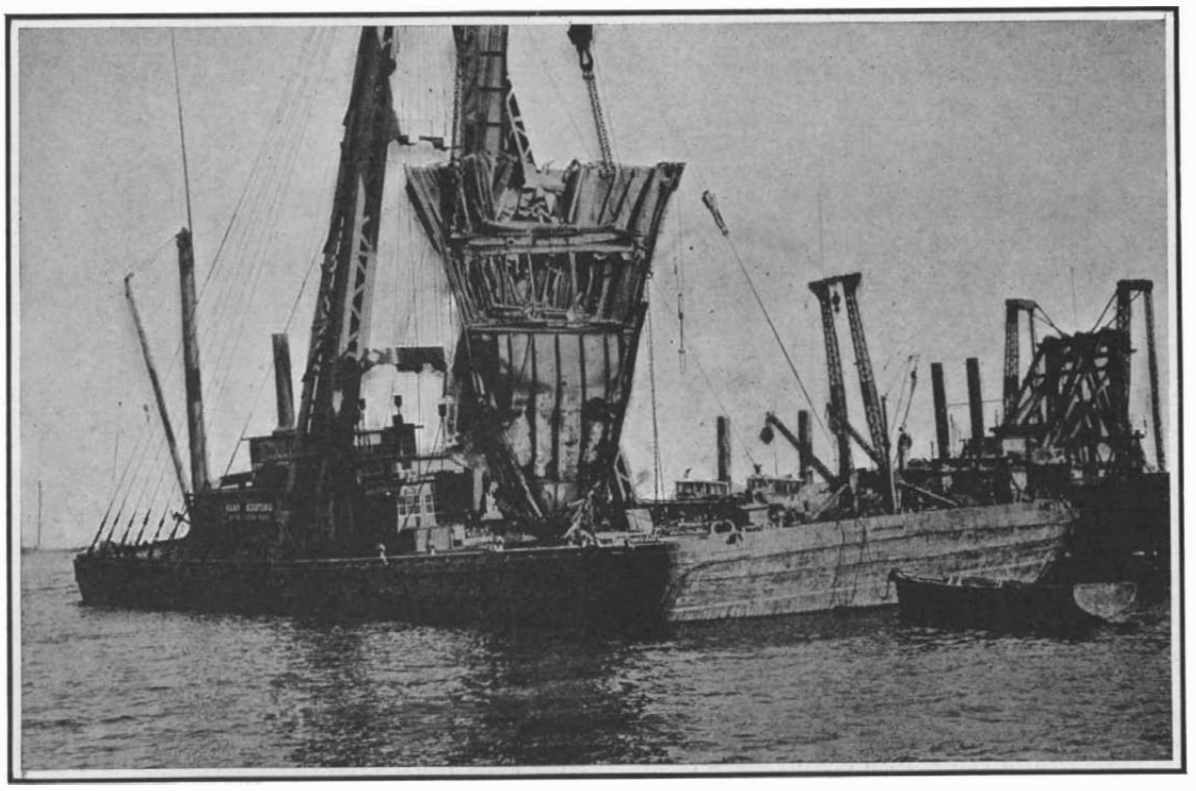
Immediately upon the awarding of the contract, workmen armed with pneumatic tools cut through the plating and the decks from the rail down to the waterline, the general line of cutting being about two feet aft of the farthest point of damage. Telephone and telegraph were meanwhile busily at work; and while the wreck of the bow was being cut off, the mills were furnishing the new steel frames and plating, and a new steel stem piece was being cast by the New Jersey Steel Company in New Jersey. The contract time for the latter was six days; but the patterns for the stem piece and the steel casting itself were made, and the latter delivered at the Morse yard, in three and a half days' time. In five days after beginning repairs the "Florida" was placed in drydock, stern first; and at one o'clock the workmen were cutting through the remaining portion of the hull from the waterline down to the keel. The 300-ton floating derrick "Monarch" was now brought to the open end of the floating dock. Chains were shackled onto the broken bow; and at a quarter past six the same evening the shapeless mass, weighing about one hundred tons, was lifted from the ship. It was subsequently sold as junk for seventy-five dollars.

The next step was to lower the floating dock, float the ship out, turn her around, and float her back into the dock, so that the bow would be near the workshops and convenient for the transport of material. The new stem was immediately placed in position; the new frames erected; the riveting of the plating begun; and so quickly did the work proceed, that thirteen days after the lifting off of the old bow, the ship was floated out of the dock with the plating in place, riveted, and painted to some distance above the waterline. Less than two weeks later, the job, as specified by the contract, was completed with the decks, rooms, and all fittings in position. It was done within the contract time of twenty-four days, with a margin of a few hours to spare.

Before closing, reference should be made to the curious fact, as shown by the photograph, that the forecastle deck was not crushed together like the body of the bow below. Evidently, at the time of collision the top deck of the "Florida" stood a few feet higher above the water than the top of the side plating of the "Republic"; and, as the ship crushed into the "Republic," her forecastle deck must have reached out intact above the main deck of the "Republic." When the two ships tore apart, the thirty feet of projecting deck of the "Florida" broke and bent over with its own weight, and hung down in the position shown in the engraving. Our thanks are due to Mr. E. P. Morse, general manager of the Dry Dock Company, for photographs and data used in the preparation of the present article.



The "Florida" with her new bow completed, 24 days after repairs were commenced.



View looking forward, showing after side of the chain-locker bulkhead. This section, representing 30 feet of the bow and weighing 100 tons, was crushed into a mass 5 feet in thickness.

Wrecked bow lifted away from the ship by floating derrick.

REPAIRING THE CRUSHED-IN BOW OF THE "FLORIDA."

In the early part of the present year the French Academy of Sciences discussed a communication in which it was asserted that the human body emits radiations which affect photographic plates. In the course of the discussion De Fontenay demonstrated that the effects which had been attributed to radiations could be explained perfectly by the warmth and moisture of the body. Later, an attempt was made to sustain the theory of human radiations by the statement that the Lumière company had been compelled to discharge several employees who fogged the plates that passed through their hands. De Fontenay investigated the matter and found that nothing of the kind had ever occurred at the Lumière factory. Each case of fog was due to accident and to well-known causes—finger marks, packing strips, lantern fog, etc.—not to any mysterious human radiation. In regard to animal magnetism and other occult agencies, it is bad enough to be assailed with crude experiments and unproved assumptions, without false testimony.

THE EDISON CONCRETE HOUSE.

Although Mr. Edison has left his mark upon more different developments of the world's progress than perhaps any other living scientist, and is now past the age at which the majority are most productive, he is now giving most of his time to an invention which he himself considers the greatest thing he has ever done.

The name of Edison is associated in the popular mind principally with electricity, the wide range of the inventor's improvements in telegraphy, telephony, and lighting being principally concerned with ingenious cajoling of that mysterious fluid; but his present work is as far removed from delicate electrical devices as monolithic masonry. Even more widely known than his electrical devices are Mr. Edison's inventions of which the principal use is the amusement of the people, the phonograph and the kinetoscope, the former of which, considered by itself apart from its commercial or industrial value, remains perhaps the most wonderful machine of all; but Mr. Edison now goes on from the amusement and recreation of the masses to the amelioration of their material surroundings, and thereby to increasing their self-respect. This, as Mr. Edison says, is surely worth doing, and in its intended effect in the betterment of mankind is truly more a philanthropic than a commercial undertaking.

The ultimate object of the present invention is no less than the provision of a means whereby individual workingmen's homes—artistic, comfortable, sanitary, and not monotonously uniform—may be turned out in such quantity and so cheaply that their rent, including car fare to and from the tenant's work, will not exceed, say, nine dollars a month. Mr. Edison hopes thereby to depopulate the swarming tenements of congested cities, and provide their occupants with surroundings morally, mentally, and physically more healthful.

Reinforced concrete is the material adopted; and by Mr. Edison's method, after the erection of suitable molds, an entire house, including walls, floors, roof, molding, cornices, bath and laundry tubs, is "poured" at one operation, much as one might squeeze paint out of a compressible tube and leave it to set.

Rumors of this intention have been in the air for some time, and have been received with more or less incredulity or derision by the technical press, but experiments upon a practical scale have now reached a stage of progress at which Mr. Edison is confident of ultimate success, and permits the present authentic description.

Mr. Edison's first intention was to build a two-family house, and considerable work was done in preparation of the molds, but the designs submitted by architects he had employed did not prove adaptable to the system, and it was found that there was a growing demand for single houses. Mr. Edison therefore set his own engineers, Messrs. H. J. Harms and G. E. Small, to work exclusively upon the development of the concrete house plans, with the result that under their direction an extraordinarily adaptable set of molds has been produced.

The completed "form" for a single house may require as many as five hundred different sectional molds of cast iron bolted together, but the latter are so designed that a dozen houses in a row may be built on the same cellar plan, the first floor molds being disposable in several different ways, and the second floor molds likewise, so that no two houses of the dozen need be alike, thus avoiding monotonous uniformity of appearance.

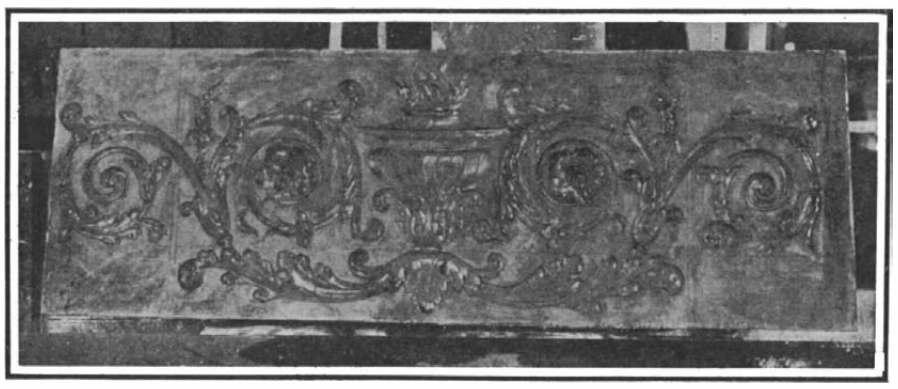
The typical house shown in our illustration has a floor plan 25 x 30 feet, intended to be built on lots 40 x 60. The front porch is 8 feet and the back 3 feet wide. On the first floor is a living room 14 x 23 x 9½ feet high, and a kitchen 14 x 20 x 9½ at the back. From the corner of the living room a staircase leads to the second floor, containing two roomy bedrooms and a bathroom 7½ x 7½ x 8 feet. The third floor contains two large low attic rooms, but each room has large windows, providing an abundance of light and fresh air. A cellar 7½ feet high extends under the whole house, containing boiler, wash tubs, coal bins, etc.

All the moldings and decorations are cast in the concrete, and not *appliqué* as hitherto in concrete work. Our illustration shows a typical piece of decoration with the mold from which it was cast, such decoration molds being, of course, changeable with each of a row of houses built.

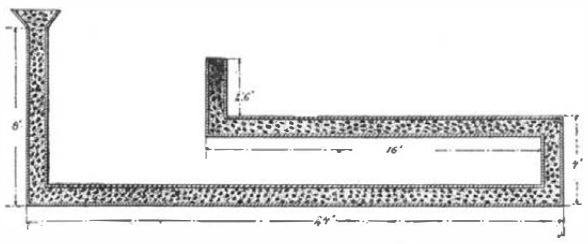
The inside walls require no plaster finish, the special mixture used leaving a perfectly smooth surface, which can be tinted as desired. Only the doors and window frames and the pipes for water, gas, or electric light wires are of wood or metal, making the house not only water-proof and vermin-proof, but practically fire-proof, reducing if not eliminating insurance cost.

The foundation and cellar floor should be laid some days before the weight of the molds is put upon them. The latter are then assembled complete from cellar to roof, and the special concrete is conveyed from large mixers into a distributing tank at the top of the house, whence it flows to every nook and crevice of the molds by gravity until the form is full and the concrete overflows at the top.

Specimen mural decoration cast in concrete.



Mold from which it is cast.

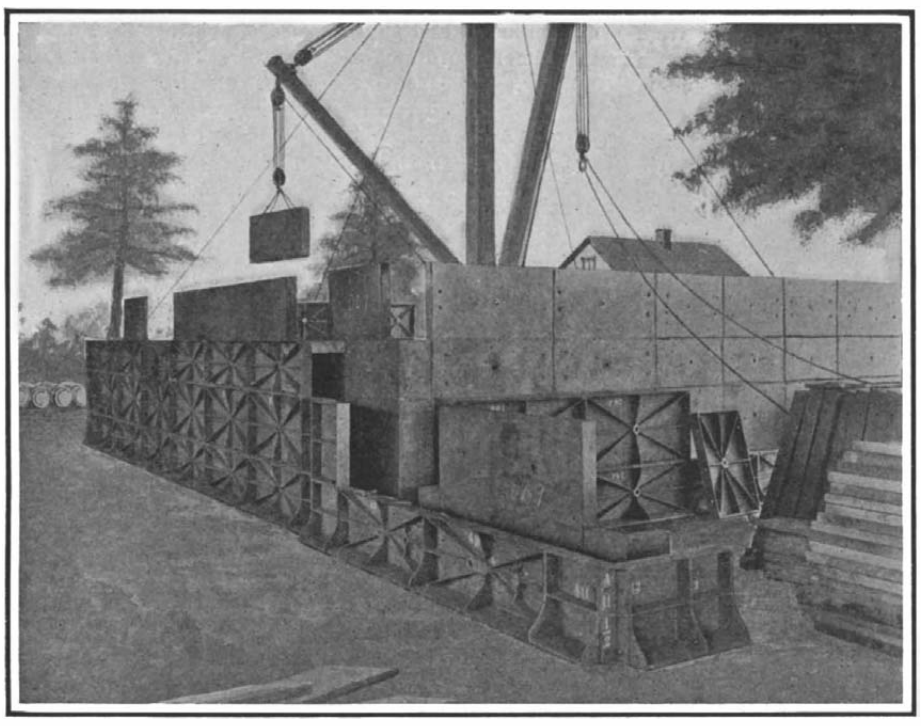


Result of test of gravity flow of concrete.

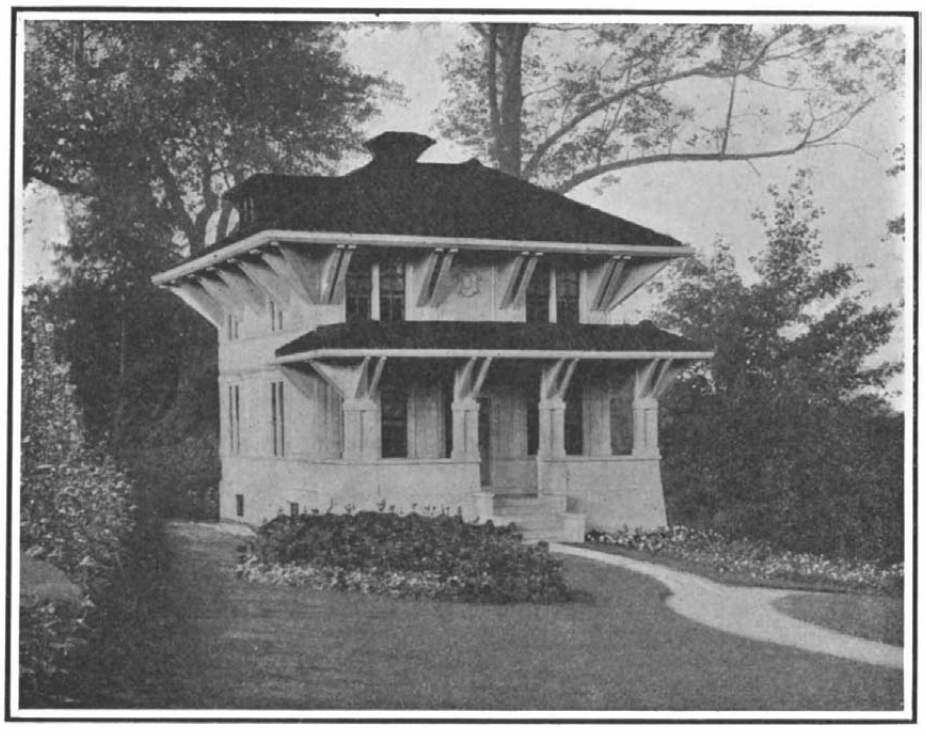
The mixture used is much more liquid than usual concrete, in order to obtain free flow, in spite of which there is no segregation of the material or settlement of the heavier aggregate. One of our illustrations shows a wooden form or conduit of only 4 inches square section, which has been completely filled with concrete poured only a bucketful at a time into the highest end. The concrete flowed down 8 feet, horizontally 24 feet, up 4 feet, horizontally again 16 feet, and then up over 2 feet to within a foot of where it entered, entirely by gravity, and, on the board at one side of the form being removed when the concrete had set, showed almost perfect uniformity of the material. This is a much more extreme test of fluidity than the material would be subjected to in the pouring of a house from the top. This result is obtained by the mixture with the concrete of a special colloid, which for the present is Mr. Edison's secret.

The latter thinks it will be possible to assemble the molds complete in four days, to fill the form with concrete in six hours, and, after allowing six days for setting, to remove the molds in another four days. A complete set of molds would therefore be occupied for fourteen days in the building of one house, or would be available for about 21 houses in a year; but owing to the interchangeability of parts, Mr. Edison estimates that with six complete sets of molds, 144 houses may be built in a year.

The greatest care is taken to make all the mold sections interchangeable, a special machine having been designed to plane them uniformly, and all bolt holes in their flanges being drilled to templet. Such are the finish of the molds and the nature of the colloid concrete, that there is absolutely no adherence of the latter to the former. The marks of the joints between the molds are rarely traceable on the finished wall, and the molds may be used over and over again indefinitely. With the present use of wood for forms, it is almost impossible to use the latter over again, owing to breakage and adhesion, and it is cost of the wood that renders the expense of monolithic concrete dwellings prohibitive.



Assembling the cast-iron molds of the "form."
Showing form of cellar walls and extension for front stoop.



Typical house cast in one piece.

THE EDISON CONCRETE HOUSE

Another great cause served by Mr. Edison's system is therefore that of conservation of natural resources, any extensive use of concrete with wood forms causing an actual waste of wood, and materially assisting the much-talked-of depletion of forest reserves.

One complete set of molds will cost about $25,000, and the accessory machinery for mixing, conveying, etc., another $15,000, so that a large capital will be required to build houses in this way; but this Mr. Edison considers an advantage, taking home building out of the hands of irresponsible "jerry" builders looking only toward the quick sale or rental of a house.

Mr. Edison thinks that the cost of such a house as that described will be about $1,200, including materials, labor, interest on plant, complete ready for occupancy with plumbing, heating, and lighting fittings. This prime cost not merely makes low rentals possible, but places the ownership of a home, at least upon the instalment plan, within the reach of any thrifty workman.

The Alteration of the Colors of Flowers by Cultivation.

BY PROF. F. HILDEBRAND.

In general, all the flowers of the same species, in the wild state, have the same color. For example, all plants of crowfoot or buttercup and dandelion have yellow flowers. In a few species, different colors are found. For example, the flowers of the milkwort (*Polygala vulgaris*) may be blue, violet, red, or white. Much greater variation is shown by cultivated plants. In these the variation of color of the flowers appeared long ago, but in recent years, many new colors have been produced which had either not hitherto been observed, or which, if they did appear occasionally, were not selected for preservation and development. The floriculturists of the present day carefully observe and endeavor to fix every new shade, even if it is not particularly beautiful, for the desideratum is novelty, and there is no telling what will please the popular taste. But in these attempts to obtain new colors in flowers, the propagator is entirely dependent upon the innate predisposition of the particular species with which he is working. He can by no means obtain every desired color. In the following sketch will be mentioned, first, a few cases of species in which a color has been obtained, which was formerly considered impossible. Some other examples will be adduced to show that in certain species a great many new colors and shades, but not all colors, have been obtained. Finally, a few other cases will be quoted in which the flowers of a species have shown little or no variation in color during many years of cultivation.

A species of primrose (*Primula acaulis*) in the wild state, always has lemon yellow flowers which vary only slightly in tint. Cultivation has produced both lighter and darker shades but, until recently, no color but yellow. Hence it was the more surprising when, a few years ago, a pure blue variety was produced, which has since retained its general color but has developed all shades, from the palest sky-blue to the deep blue of the corn-flower. The Chinese primrose (*Primula sinensis*), when cultivated in the garden, bore until recently only red and white flowers. In this species, also, other colors have lately been produced, not only violet but also blue, though not so pure a blue as that of the species first mentioned. Another example is offered by the gladiolus, which formerly bore only white and red flowers but has recently developed a blue-flowering variety. A case of a somewhat different character is presented by the asters, which have long shown a great variety of colors, but in which recently a great many new shades have been produced, including some which would not at one time have been considered beautiful, for example, copper-color.

Very numerous, on the other hand, are the species which have long shown great variation in color and have recently developed many new shades, with the exception of blue. Especially conspicuous in this connection is the dahlia, which is now found in every color except blue, although many propagators are making earnest efforts to produce a blue dahlia, which would bring great profit to its originator. A blue carnation would be equally valuable but it has not yet been produced, although the colors of carnations have lately been enriched by many new shades. The new varieties of canna also show great diversity of color, including almost pure white and a beautiful light pink, but a blue canna has not yet appeared. In the begonia not only blue is lacking, but also all shades from red to violet. Finally, we may mention the variety of poppy called the Shirley, which is greatly admired for its play of color. Here, however, the colors range only from white to rose and vermilion. Blue and violet colors are completely wanting and so is yellow, which is very common in the begonia.

Other species which have recently produced many new tones, with the exception of blue, include: Pelargonium, Scahosa, Calceolaria, Antirrhinum, Mirabilis Jalapa (Four O'clock or Marvel of Peru), hollyhocks, immortelles, and some species of Phlox and Godetia. The Gilliflowers, Wallflowers, and Balsams belong in the same category, for the varieties of these three flowers which are described as blue in seedsmen's catalogues are not pure blue, but violet.

It should be observed, furthermore, that among species which have produced many new colors, there are some in which the color yellow is wanting. This is the case with some species of larkspur (*Delpinium ajacis* and *D. consolida*), with *Dianthus Heddewigii* and with the verbenas and Clarkias.

Finally, there are species which, notwithstanding many years of cultivation, have shown little variation in the color of their flowers or have produced only new shades but not new colors. Among these are the fuchsias, which show only various shades of red. A blue or a yellow fuchsia would be a curiosity. Another example is furnished by *Cyclamen persicum*, in which many years of cultivation have only changed the original color scheme of a dark red throat and a white or pink tip so far as to deepen the red throat to crimson and almost to violet and, on the other hand, to efface it altogether, producing a pure white flower. Quite recently, however, an approximation to a yellow has been obtained by the production of a salmon-pink cyclamen. Similar cases are furnished by the Alpine forget-me-not, in which merely the shade of the original blue color has been slightly altered by cultivation, and by the marigold (*Tagetes*), the colors of which vary only from yellow and orange to brown.

From the foregoing remarks it is evident that, although very many new colors have recently been produced by cultivation in the flowers of numerous species of plants, the production of these changes is entirely dependent upon the original predisposition to variation possessed by the plant. Without these tendencies to variation, no new color can be produced, either by the gardener or by natural selection, for if there is no variation, selection is impossible.—Translated for the Scientific American from Umschau.

Decreased Number of British Patent Applications During the Past Year.

Consul Albert Halstead, of Birmingham, reports as follows concerning applications for patents in the United Kingdom in 1908:

According to the report of the Comptroller-General of Patents, patent applications in the United Kingdom in 1908 numbered 28,598, a decrease of 420 from 1907; of the total 572 were from women and 1,459 from abroad, the United States furnishing 572 of that total and Germany coming second with 515.

The greatest number of applications made in 1908 were in connection with locomotion, which, the Comptroller says, was due to the continued interest in motor cars and allied subjects. A great though smaller activity was shown in connection with wheels, efforts being chiefly directed toward the provision of an easily detachable tire-carrying rim, while many applications dealt with valves for internal-combustion engines. Inventions relating to road-tarring machines, compositions for treating the surfaces of roads, and dust-collector fittings for motor cars to abate the dust nuisance showed increased interest, as did tools for the repair of automobiles on journeys. On the contrary, there was some neglect of horse-drawn and railway vehicles.

Many inventors occupied themselves with flying machines of the heavier-than-air type, especially in regard to their automatic balancing and facilities for manipulating the various rudders and planes. Again, patents in connection with the manufacture of artificial silk showed an increased activity in an industry which the Comptroller reports to be developing. It may be said that artificial silk manufactured by a new patent process is one of the new shipments from Birmingham to the United States, and apparently a growing one.

The subjects of short-base range finders and eyes, periscopes for submarine boats, automatic railway signals, and systems for giving signals in the locomotive cab, as well as a controlling apparatus for stopping trains which have reached an excessive speed, were in evidence in patent applications. Processes for the regeneration of waste rubber and the synthetic production of rubber or rubber-like products formed an interesting feature of the patents of last year. New methods of using tungsten and other refractory metals for manufacture, by working them in combination with ductile metals which are afterward removed by heating the finished article, also attracted attention, while the stropping of flexible razor blades is an indication of the way in which the idea of a safety razor, since its development in the United States, has been developed abroad.

Under a section of the patent and designs act of 1907, providing for the revocation of patents worked exclusively or mainly outside the United Kingdom, several patents have been revoked. This section of the British patent law is one that American manufacturers can not neglect without serious danger to their patent rights in the United Kingdom.

Out of the total number of patents sealed—16,284—in 1908, the following numbers were sealed to residents in foreign countries: United States, 2,819; Germany, 2,516; France, 822; Austria-Hungary, 334; Switzerland, 200; Australia, 166; Belgium, 159; Canada, 155; Sweden, 139; Italy, 134.

Liquid Alloys of Sodium and Potassium.

Jaubert has obtained liquid alloys of sodium and potassium by treating sodium hydrate with metallic potassium, and potassium hydrate with metallic sodium. In both cases liquid alloys are formed, corresponding closely to the compounds NaK and NaK_2. The last-named alloy contains about 80 per cent of potassium.

As 23 parts of metallic sodium, which is comparatively cheap, set free 39 parts of the much more valuable potassium, this reaction may be made the basis of a practical method of producing potassium, in the form of a rich alloy.

Air must be excluded during the operation, but if this is conducted under melted commercial paraffine, the temperature cannot be raised above 400 deg. F., and the yield of alloy is diminished by reactions with the impurities of the paraffine. In the laboratory it is preferable to operate in a vacuum, the metal and alkali being placed in a strong retort of Jena glass, which is connected with an air pump and heated by an oil bath. 12 parts of potassium and 4 parts of pure and perfectly dry caustic soda yield the alloy NaK_2. The same alloy is produced when 7.4 parts of sodium are mixed with 16 parts of caustic potash containing 10 per cent of moisture, and the mixture is heated to 437 deg. F., while 5.5 parts of sodium added to 6 parts of potash and heated to 662 deg. F. yield the alloy NaK. The alloy NaK_2 is made on a larger scale at Clavaux, France, in iron retorts, provided with stirring apparatus. The product contains 77 per cent of potassium.

The Current Supplement.

The practical method of aerial photography has long been sought. Very successful results have been obtained in experiments with kites, which were recently made on French naval vessels by a system designed by Capt. Saconney. In the opening article of the current Supplement, No. 1756, this system is described. The rapid advance of theoretical science in general, and of theoretical electricity in particular, is nearly as bewildering to the physicist and chemist, who is not investigating electrons and ions, as it is to the engineer. The old notions, we are told, are not wrong, but they must be modified in the light of recent research. A general exposition of the problem of the conduction of electricity will therefore be welcomed. Such an exposition (a cautious guide and not an immature theory) is given by Prof. J. Koenigsberger. Mr. E. F. Lake's admirable discussion on the Oxhydric Process of Cutting Metals is concluded. Interesting in the light of the recent introduction of tantalum and tungsten for lamps is Dr. C. Richard Boehm's article "The Forerunners of the Metallic Filament Incandescent Lamp." Maria Parloa's treatise on Canning and Preserving Fruit is concluded. Recent discoveries have filled up to a great extent the gaps in our knowledge of Palæolithic man. A general review of the present status of the subject is given by A. C. Haddon. Atmospheric circulation is discussed by R. F. Stupart. The first of a series of articles on Imitation Arms and Armor and how they are made is presented. Arthur Watson writes entertainingly on Conjurers of the Past, and delves up many a bit of historical magical lore. Experiments have lately been made by M. Blum with a simple apparatus designed to demonstrate the rotation of the earth on the plane of oscillation and support of a simple pendulum. The experiments are summarized by J. J. Davis and H. F. Purday.

Ancient Records of Halley's Comet.

Andrew C. D. Crommelin in an article on "The Expected Return of Halley's Comet" in Science Progress (London) gives an interesting account of the early observations of this comet which appears at intervals of about 75 years. The first definite record of this comet is from China where it was observed and fully described in 12 B. C. The various appearances from this time up to that of 1378 were more fully and accurately described in China than in Europe. Its path through the constellations was described in the Chinese records because they "imagined that the terrestrial kingdoms had their counterparts in the sky, and that comets were ambassadors between them indicating corresponding relation between the kingdoms on earth, so that valuable political information was to be gained" from this study of the heavens.

In the West the appearance of a comet was a bad omen and hence recorded, but its path was not an important feature. Josephus mentions the appearance of a comet several months before the fall of Jerusalem. This was probably Halley's comet which appeared in 66 A. D. The death of Emperor Macrinus in 218 A. D. was also preceded by a comet which was probably Halley's.

Correspondence.

TOURMALINE DETECTORS FOR NAVIGATORS.

To the Editor of the SCIENTIFIC AMERICAN:

In the June 5th issue of the SCIENTIFIC AMERICAN, C. A. H. asks if he can use a tourmaline to reduce the glare of sunlight reflected on water, so as to enable him to detect rocks lying under the water ahead of his boat. Light which has been reflected by water under an angle not very far from 37 deg. is partly polarized, and will therefore be reduced in intensity when passing through a tourmaline properly held before the eye. Light which comes from a submerged object passes easily through the tourmaline held in the position which extinguishes the reflected light. Made with a pan full of water and a submerged stone, the experiment is very successful, but practice alone would show how far the principle underlying it can be successfully applied to the detection of rocks submerged in rough water and observed from a moving boat under variable angles. A Nicol prism would probably prove more useful than a tourmaline. A slice of tourmaline, cut parallel to optical axis, costs about $1.50. A Nicol prism, 8 millimeters square, costs $3.50. Both can be had from dealers in laboratory apparatus. GUSTAVE MICHAUD.

Costa Rica State College.

LIGHTNING.

To the Editor of the SCIENTIFIC AMERICAN:

Lightning is universally classified as chain, sheet, and ball, of prevalence in the order named; but, as to ball lightning, the recorded instances are so rare and questionable, with no evidence of its electrical nature, I am inclined to say that the information is not sufficient to enable one to form even a belief, much less a judgment, and least of all to formulate a rule respecting it.

Chain lightning has, perhaps, been as thoroughly studied and explained, and is as well understood, as any of the other great phenomena of nature.

With respect to sheet lightning, I think, the case is altogether different. This designation is given to that diffused illumination, best seen at night in heavy banks of clouds at a considerable distance from the observer, and said to be unaccompanied with thunder.

I have long doubted the existence of sheet lightning as a form, having concluded that it is but an appearance, a reflection, of chain lightning occurring behind a cloud, the chain throwing out a diffused illumination, as may be seen from the tongue of an electric headlight of a locomotive on a foggy night.

My first and greatest reason for coming to this conclusion is direct observation. I have seen, in small clouds, concurrently, sheet-lightning illumination at one edge and a tongue shoot out from the other. In such case, the obscured end of the chain is somewhere on the upper side of the cloud; and, as I have observed that the center of the field of the diffused illumination is directly opposite the visible tongue on the other edge of the cloud, I think we are justified in saying that if the chain is not the cause of this illumination, it is nevertheless such an accompaniment as finds therein a full explanation.

Another reason which has led me to conclude that sheet lightning is but an appearance, a reflection, from the chain, is, that the illumination always occurs on the upper side of a cloud at a point out of view of the observer, and he sees only the reflection at the margin of the cloud, or in the sky above the cloud, if at a considerable distance, no reason appearing why it should always be thus secluded.

The same diffused illumination or reflection may be seen in the sky beyond the horizon on a summer night from lightning occurring at such distances as to be below the range of vision. In such instances, the illuminations are always diffused, and the intervals in such perfect accord with our observations of thunderstorms at close range, I see no reason for not saying that they are due to the bolts of Jove.

My own experience confutes the alleged absence of thunder, that occurring only when the cloud is at too great a distance for it to be heard, said to be from ten to fifteen miles. I have frequently heard thunder accompany sheet lightning at close range, although this may still be open to the objection that the chain was playing simultaneously with the sheet; but, if so, it was above the clouds and out of sight.

My reason for calling attention to this at this time is, that the mountain-climbing season is now upon us; and if those who ascend to the top report the appearance of the lightning they see in storms below them, and those at the bottom do likewise respecting the lightning observed above them, they can determine the fact very readily.

If what I have said be true, then chain lightning, occurring on the under side of the cloud, will appear to those on the mountain above as diffused light around the edge, or sheet lightning; while the sheet lightning, as seen from the foot of the mountain, will be seen as a chain by those at the top.

In this manner, the scientific fact could be ascertained; and if you will call attention to it, the present season will doubtless see the determination of the matter. A. A. GRAHAM.

Topeka, Kan.

FIRST AMERICAN TO CROSS THE CHANNEL THROUGH THE AIR.

To the Editor of the SCIENTIFIC AMERICAN:

In view of the admirable though sensational flight of M. Bleriot across the English Channel during the past fortnight, and in further view of the reported apathy of those wonderful American aeroplanists, the Wright brothers, toward attempting any similar flight, it may be of interest to your readers who are interested in aerostatics to know that the first flight through the air across the English Channel was successfully accomplished by an American in company with a Frenchman.

My authority for this statement is Wise's "Aeronautics," published by John Wise in 1850.

This rare and interesting volume, on page 54, chapter vi, contains this statement:

"The most remarkable aerial voyage that was made soon after the discovery of aerostatic machinery was accomplished by M. Blanchard, in company with Dr. Jefferies, an American physician, who was at the time residing in England. On the 7th of January, 1785, in a clear frosty day, the balloon was launched from the cliff of Dover, and after a somewhat perilous adventure they crossed the Channel in something less than three hours. The balloon after its release rose slowly and majestically in the air; they passed over several ships and enjoyed a grand prospect of the numerous objects below them. They soon, however, found themselves beginning to descend, which put them to the necessity of throwing over half their ballast, when they were carried one-third way across the Channel. When they got about half way across, they found themselves descending again, upon which they threw over the balance of their sand; also some books they had with them. All this failed to overcome the gravitating power of the balloon. They next commenced throwing overboard their apparatus—cords, grapples, and bottles. An empty bottle seemed to emit smoke as it descended, and when it struck the water, the shock of the concussion was sensibly felt by the aeronauts. Still, their machine continued to descend, when they next betook themselves to throwing off their clothing; but having now nearly reached the French coast, the balloon began to ascend again and arose to a considerable height, without compelling them to dispense with much of their apparel. They passed over the highlands between Cape Blanc and Calais, and landed near the edge of the forest of Guinnes, not far beyond Calais. The magistrates of the town treated the aerial travelers with the utmost kindness and hospitality. The King of France made M. Blanchard a present of 12,000 livres, as a token of appreciation of the aeronaut's perseverance and skill in the newly-discovered art."

With apologies for my intrusion upon your time, but with the hope that the contribution may be of some general interest. P. W. A. FITZSIMMONS,

Member Michigan Aero Club.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the SCIENTIFIC AMERICAN:

As to the problem which vexes Mr. Venning and Mr. Constable, concerning the number of a man's ancestors, allow me to state that their difficulty arises from a false sociologic assumption.

They assume that a man must have had four grandparents. This is not so. He may have had only two. For a long period in human society all daughters of one family were the wives of all sons of the family indiscriminately. This "consanguine group" is an established fact in sociology. All races, at one time or another, passed through it. As long as it lasted, one's ancestors, no matter how far back he traced them, would still be only two.

Hence one can have had 2^x ancestors x generations ago only if we make the x so small that it falls within the time since the consanguine group was outgrown. That time is only a petty fraction of the time man has been on earth. To establish a rule on what holds true during that fraction, and seek to apply it to the ages that went before, is false reasoning.

In present society, however, consanguineous marriages having been pretty well eliminated, the 2^x rule does hold true. Considering the little corner of time covered by present institutions, John Brown, x generations ago, had 2^x ancestors. No doubt about it.

The difficulty in reconciling this mathematical fact with our ordinary conceptions of the matter comes from the implied thought: Each of us, far enough back, would have had millions of ancestors, at this rate. Since there are many millions of us to-day, the earth would once have been so thickly crowded as to be simply uninhabitable, which we know was not so.

This difficulty vanishes at once when we remember that such a state of affairs could only exist if every pair of parents gave birth to only one offspring, and each man's ancestors were thus his, and his alone. But since the majority of parents produce many more than one child, this Simon-pure possession of our ancestors all to ourselves is an impossible thing. Our ancestors are all inter-owned by the race; each of our forebears is the forebear of a host of others also. And when each man counts up his own individually, those "own" have also been counted up as "theirs" by hundreds or thousands of others, and any attempted total based on these countings can be nothing but a reduplicated monstrosity.

Thus it is true that for modern non-consanguineous times, a man had 2^x ancestors x generations ago. But the rule holds good only for those times, and within those times the enormous totals urged in disproof of the rule are seen to be purely fictitious.

New York, N. Y. SOLON DE LEON, A. B.

THE LONG ISLAND PORTAL OF THE PENNSYLVANIA SUB-RIVER TUNNELS.

Although the immense improvements undertaken by the Pennsylvania Railway in bringing its lines under the rivers east and west of Manhattan to a station in the heart of New York city have aroused a great deal of popular interest, especially on such epoch-making occasions as the meeting of tunnel headings under the Hudson and East Rivers and the recent placing of the last stone of the immense terminal station, there is one section of the work of considerable engineering interest which has received very little attention from the press.

This is the section just west of the Sunnyside yard on Long Island, where the tunnels emerge from the ground, and the point of especial interest is the crossing of one tunnel over another.

The object of this cross-over is to bring both east-bound tracks to the same side of the station at Sunnyside, no other point being available for such a cross-over without unnecessary complication of trackage at one of the stations.

From the point where it diverges from the present main line near Harrison, N. J., the Pennsylvania's road to New York is a double-track line, one track being carried in each of the two tubes under the Hudson to the terminal station at 33rd Street. One track and tunnel are used exclusively for west-bound and the other for east-bound traffic, but on entering the station each track spreads out fanwise.

The handsome terminal building appears so large from the outside, with its half a million cubic feet of granite—1,140 carloads—27,000 tons of steel, and 15,000,000 bricks, that it is a little difficult to realize that much the greater part of the station proper is underground. The underground area of the station is about 28 acres, and includes 16 miles of standing room for trains on 21 different tracks, adjacent to over 4 miles of passenger platforms.

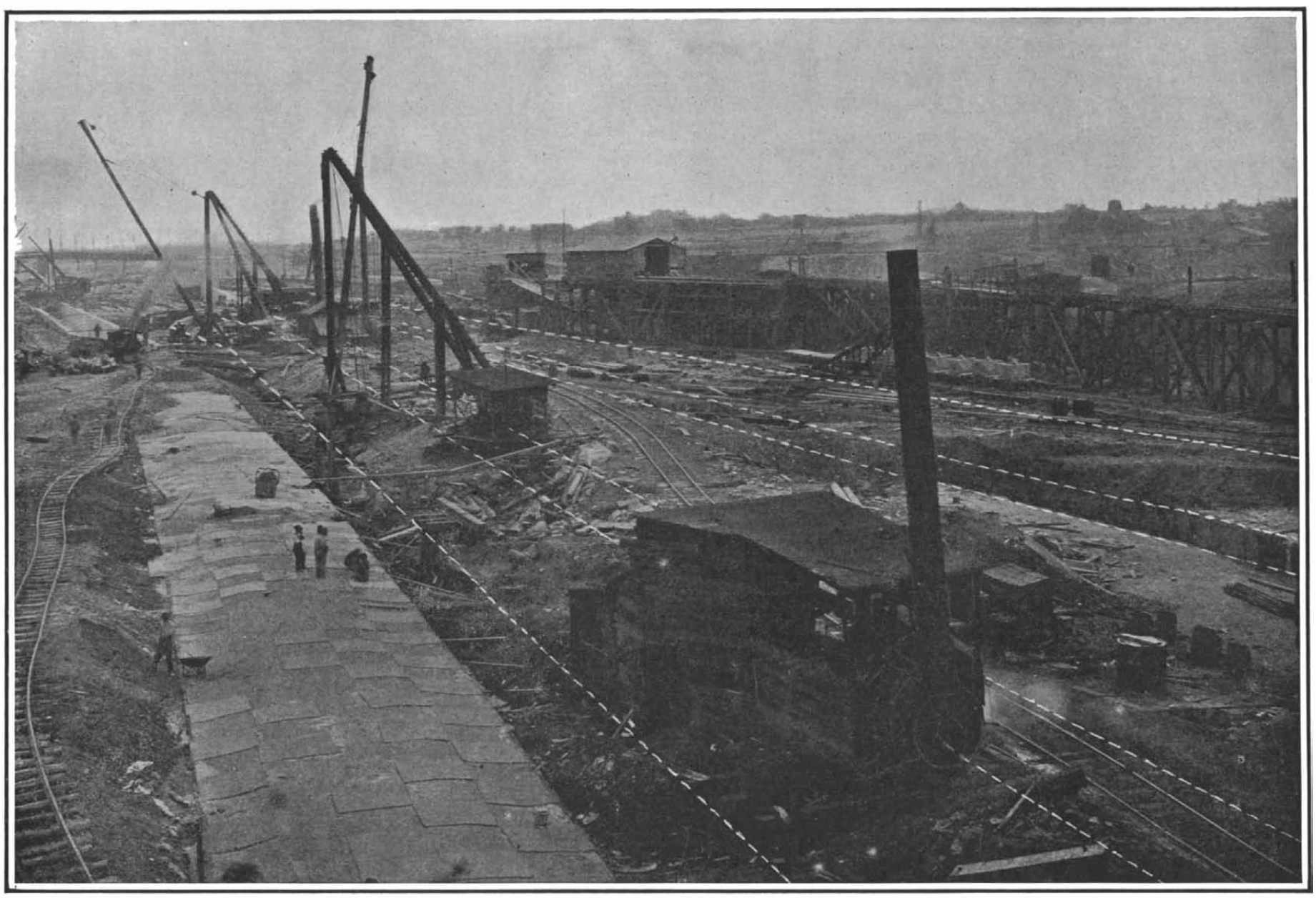
From the station eastward the tracks converge again into first 6 and then 4 tracks, carried in two wide tunnels underground and four single-track tunnels under the East River.

To bring the east-bound and west-bound tracks into their natural alternate order as the 21 tracks converge leaving the station would obviously cause a great complication of trackage, and the same would apply to an only slightly less extent at the Sunnyside yard. A cross-over could not conveniently be made in rock tunneling, and less so under the river, so the place selected as most convenient was the "cut and cover" sections between Avenue A and Sunnyside.

The tunnels are now complete all the way from Bergen Hill, N. J., under both rivers and Manhattan Island to Avenue A, Long Island City, and the section including Sunnyside yard and the "cut and cover" concrete tunnels for several hundred feet west of it is also practically complete. The latter is shown in one of our illustrations, the position of the completed portions of the tunnels being shown in dotted lines, and the retaining walls of the cuts where the tunnels emerge being visible in the distance on the left of the picture. Along the left side of the picture is the brick-covered concrete top of the A or northernmost of the four river tunnels, which is now complete all the way to the Manhattan terminal. The next section westward, where the cross-over is being made, is shown in our other illustration. On the left in the distance, where clouds of steam may be seen arising, drilling is still in progress for further excavation of rock to make room for D tunnel (the southernmost of the four), the completed part of which is hidden by the massive shoring supporting the ground under the Long Island Railroad tracks seen in the picture. The material excavated here is hoisted by the numerous cranes shown and used to bury A tunnel on the right of the picture. High in the middle the concrete lining of C tunnel may be seen, having been carried up to that level at a gradient of 1.9 per cent from the bulkhead line, below which, in the river, all four tubes are at the same level, the other three rising to the point shown at only 1.22 to 1.26 per cent.

View looking west at Pennsylvania Railroad tunnels as they near the surface in Long Island City.

This view shows the point where C tunnel crosses over B near the Long Island portal.



View looking east from same point; Sunnyside yard in the distance.

On the left is seen the brick-covered concrete top of one completed tunnel; dotted lines show position of completed portions of the others, to be joined to those shown in course of construction in other view.

THE LONG ISLAND PORTAL OF THE PENNSYLVANIA SUB-RIVER TUNNELS.

Low in the foreground may be seen the entrance to B tunnel, which has now crossed under C to assume the relative position occupied farther back along the line by C tunnel.

Immediately behind the pile of earth on the right of the picture is the portal of the Steinway Belmont tunnels, leading under the river to the New York Central station.

An idea of the massive nature of the work may be formed from the size and number of the shores required to hold up the outer forms of the upper tunnel.

The work is being covered up as fast as completed, and about a year from now, as passengers are carried through the tunnels, they will probably be unconscious even of the difference of gradient between tunnels B and C, and there will be no evidence on the surface of the immense work here shown of carrying one tunnel over the other.

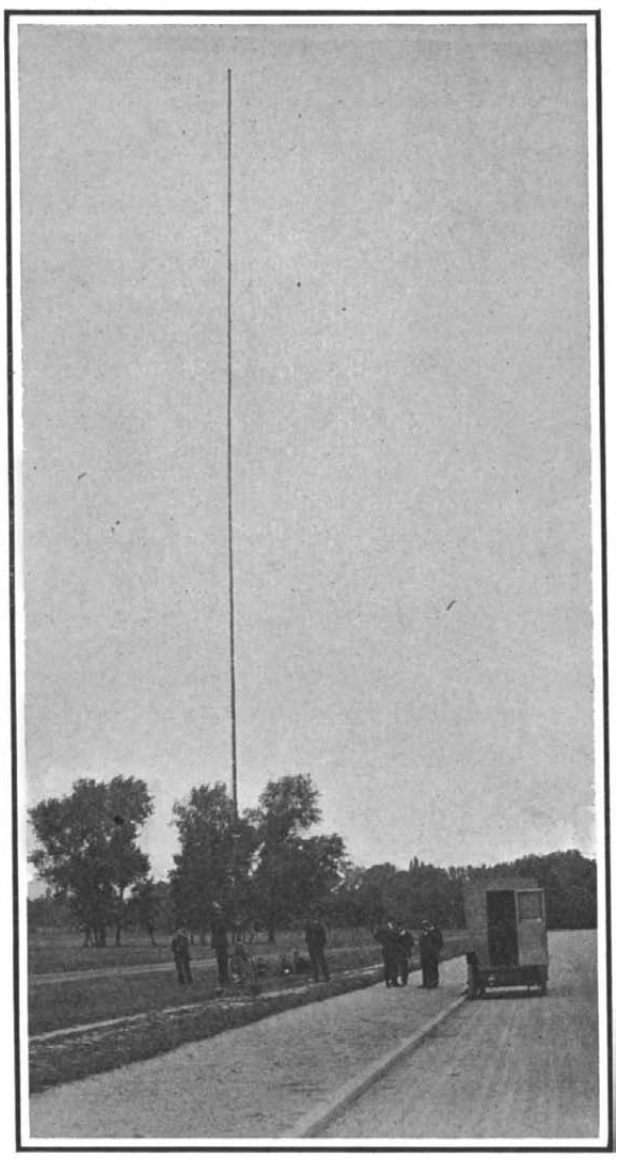
AN AUTOMOBILE WIRELESS TELEGRAPH STATION.

The officers of the telegraph corps of the French army have been experimenting with an automobile wireless telegraph station. Externally, the vehicle resembles a limousine of the ordinary type. The wireless apparatus is not conspicuously visible through the glass windows. The mast, its base, and the winch by which it is raised are carried on the roof of the car and covered with an awning. The car, all parts of which are movable, is divided into two compartments. The forward compartment contains the sparking coil and other dangerous instruments, the rear compartment contains a 5-horse-power dynamo, the receivers, the operating key, and a comfortable seat.

The car and apparatus weigh 6,160 pounds. The weight is increased to 7,260 pounds by the addition of the crew of six men, with their baggage. The car is driven by a motor of 22 horse-power, and can maintain a speed of 26 miles per hour on a level road, and more than 6 miles per hour in ascending a grade of 14 per cent.

The antenna is set up very easily and rapidly, owing to the ingenious telescopic construction of the mast, which, when lowered, consists of a number of concentric metal tubes about ten feet in length. The central and smallest tube incloses a steel wire about ⅛ inch in diameter, coiled very closely into a helix, so that it resembles a strongly compressed spiral spring, or the wire wrapping of a rubber hose. The wire, similarly coiled, is extended into the base of the mast, where it is gripped by two pairs of wheels which are operated by cranks and gearing. By this mechanism the wire is forced upward, carrying with it the central tube, which, when extended to its full height, draws after it the second tube, which in like manner draws out the third tube, and so on. Although the elevation of the smaller tubes leaves the lower part of the wire inclosed in larger tubes which allow it to bend slightly it remains sufficiently stiff to keep all the tubes practically vertical.

The mast, with its aluminium support, weighs about 400 pounds. The telescoped mast is first screwed to its base and then raised to a vertical position by four men. A few seconds' work at the cranks then extends it to a height of 66 feet. The five wires of the antenna are attached to the top of the mast. Four of these wires, each about 160 feet long, are distributed at equal angular distances around the mast and are attached to the ground by other wires, insulated from them, so that the lower ends of the antenna wires are about 26 feet above the ground. The fifth antenna wire is connected with each of the others and is ex-



The mast fully extended.

tended, through a hole in one of the glass windows of the car, to the apparatus inside. The mast is also anchored to the ground by stays, attached below the summit. When the antenna has been set up the motor is geared to the dynamo, only 3 horse-power being usually employed.

The station can be made ready for operation in six minutes. Its normal radius of action exceeds 90 miles. As two men suffice to operate it, continuous service can be assured by dividing the crew of six men into three watches of eight hours each.

The French army already possesses wireless stations drawn by horses. Each station comprises two wagons, one of which carries twelve men and a gasoline motor. It takes half an hour to set up one of these stations and the radius of action is only about 60 miles. Nevertheless, the stations are superior to those of the German army, the installation of which occupies 45 minutes, with a greater number of men. The French army is the only one that possesses an automobile wireless station.

The installation of wireless stations on dirigible balloons has been contemplated, but the problem presents an almost insuperable difficulty. The highly-charged antenna, by its inductive action on the wires by which the car is suspended from the balloon, would cause sparks which might ignite the hydrogen which escapes from the staunchest of gas bags. The danger could be diminished by substituting non-metallic ropes for the steel wires, but even the ropes would become conductors when wet.

This danger does not exist in the case of aeroplanes. It is estimated by experts that the total weight of an aerial wireless station need not greatly exceed 100 pounds. The station could be operated by one man, in addition to the aeronaut. The day—apparently not very distant—when an aeroplane shall carry the weight of three men will soon be followed by the combination of those two present marvels—wireless telegraphy and mechanical flight.

Making Briquettes.

Briquette making formed the subject of a paper recently read before the South Wales Institute of Engineers by Prof. W. Galloway. Small coal, as is well known, cannot be burned so economically in the furnaces of boilers in its original state as when in the form of briquettes. Briquettes made exclusively with anthracite coal burn too slowly, and it is advisable to mix a certain proportion of bituminous coal to overcome this objection. Up to the present, no kind of agglomerating material other than pitch or resin, or a mixture of these, has given satisfactory results. Briquettes made with resin alone become soft and lose their shape in the fire; those having a mixture of 4 per cent of pitch and 1½ per cent of resin give better results. It is of interest to note that the total output in the United Kingdom in 1906 amounted to 1,513,220 tons, while Germany produced 14,500,851 tons of this fuel in the same year. The paper contains full descriptions and drawings of the mixing and drying machinery and presses required for briquette making, together with estimates of labor required and costs. For example, at an English works making 102¼ tons of briquettes per day of ten hours, the total cost, including labor, materials, fuel and stores, interest and depreciation, works out to 9s. 7.45d. per ton.

The linking of India and Ceylon by railway is again under discussion. There is said to be no serious engineering difficulty connected with the bridging of the Paumben Channel, nor at the south end of the line, for the island of Mannar is already practically attached to Ceylon. But between the southern end of the island of Rameswaram and the northern end of the island of Mannar there is a distance of about 38 miles, marked by an almost continuous coral reef, either covered with shallow water or rising above the level of the sea in numerous coral islets—the "stepping-stones" of Adam's Bridge—to be bridged.

An automobile wireless telegraph station.

Erecting the telescoping mast.

AN AUTOMOBILE WIRELESS TELEGRAPH STATION.

THE HEAVENS IN SEPTEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

IN the present month the event of the greatest astronomical interest is the very favorable opposition of Mars, which occurs on the 24th. All through September the planet is very near us—from 36 to 37 million miles, and is better placed for telescopic study than it has been for us since 1892.

Oppositions of Mars are frequent enough—about once every two years and two months; but as its orbit is by no means circular, its distance from the sun may vary from 128 to 154 millions of miles. Taking the earth's distance from the sun as 93 millions, the distance between the two planets, when in line with the sun, may vary all the way from 35 to 61 millions of miles.

At the present time conditions are almost ideally favorable. Two years ago, it is true, Mars was almost as near us as he is now; but then he appeared so far south in the heavens that he could hardly be observed in our latitude, while in England, as one of the Greenwich observers aptly said, "he hardly rose above the tree tops." This year he is almost on the equator, and it will not be necessary, as it was then, to go far south to observe him at a proper altitude.

Being so near us, he appears unusually large in the telescope, and very bright to the naked eye, fairly rivaling Jupiter, and surpassing all else in sight, so that one has but to look at the sky to find him.

Of course this good opportunity will not be lost by those astronomers who make a study of planetary detail. What they may discover we will know later; at present it may be worth while to speak a little of the conditions under which the work must be done.

Mars at his best looks only about 1/75 as big as the moon (with the same magnifying power). On account of the unsteadiness of our atmosphere (which makes everything seen through it appear to dance about and be more or less blurred) it is only under very favorable circumstances that a magnifying power much greater than 1,000 diameters can be used. That is, it is only on these rare occasions that we can see Mars as well with a great telescope as we can see the moon with a good binocular or spy-glass, magnifying 13 times. Under ordinary conditions the "bad seeing" would make it impossible to see anything like as much on Mars with the big instrument as can be seen on the moon with the small one.

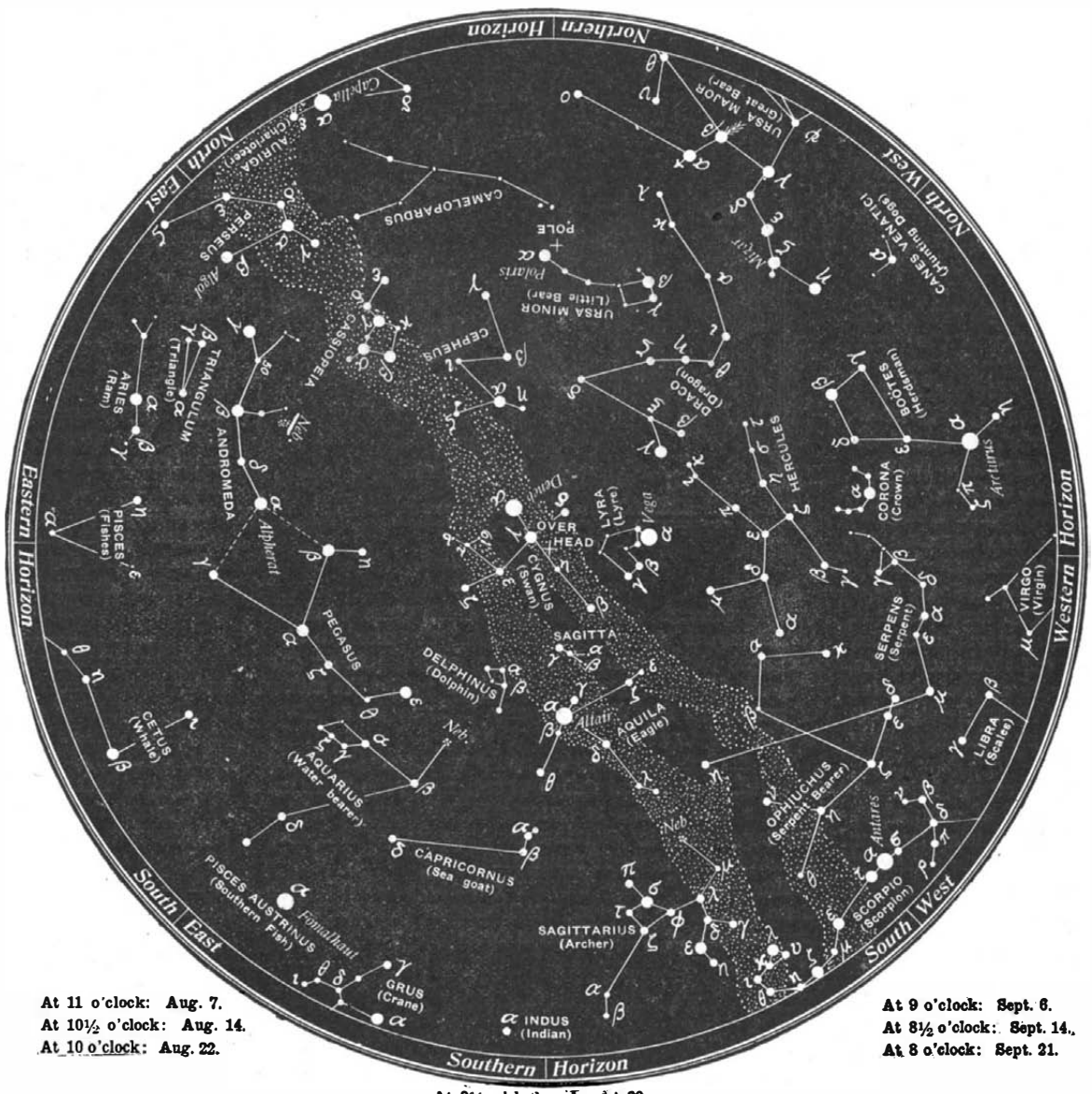
The same difficulty affects photography. The image of Mars, with the same telescope, is only 1/75 as big as the moon's; but the grain of the plate is of the same size. If we try to enlarge the planet's image by auxiliary lenses, we lengthen the exposure time, so that the image is blurred by bad seeing. The remarkable results obtained at the Lowell Observatory were gained by a judicious choice of enlarging power, combined with a very favorable climate and great manipulative skill.

Even if our air was, by a miracle, quite steady, there is a limit to what we can see on Mars. No telescope, however perfect, can make the image of a star a mere luminous point, as geometrically it ought to be. This arises not from the character of the lenses, mirrors, etc., but from the very nature of light. Knowing that light consists of wave-like vibrations, it is possible to show (by methods too technical to be briefly explained) that the image of a star seen through a round opening, like that of a telescope, will not be a sharp point, but a small disk of light, fading away gradually at the edge, and surrounded by much fainter rings of light. Similarly, the image of a straight line is not a similar line, but a streak of definite width, bordered by much fainter streaks. The larger the aperture of the telescope. the smaller will be these spurious images. By stopping down our lens to one-half its size, we make them twice as big, and so on.

Their actual size is very small. With the great Yerkes telescope the spurious disk of a star is about 1/2400 of an inch in diameter. But on the image of Mars at its nearest, this corresponds to nearly 20 miles on the planet's surface.

Nothing much smaller than this can be seen clearly with any existing telescope, even under ideal conditions. A narrower black line would seem blurred out into a gray fuzzy streak—much like a photograph out of focus, as regards appearance, though quite different optically—and a black dot into a faint gray patch.

It is of course one of the first duties of an observer to learn to recognize these spurious images, and distinguish them from real ones, and also to attempt the more difficult task of seizing the moments of good seeing, between the disturbances of the image due to our atmosphere. But the fact remains that we cannot see clearly anything less than 20 miles across upon Mars (or anything much less than 50 miles, except with a very few instruments) and that therefore any visible evidences of life or of intelligent construction on the planet would have to be on an enormous scale.



At 11 o'clock: Aug. 7.
At 10½ o'clock: Aug. 14.
At 10 o'clock: Aug. 22.
At 9½ o'clock: August 29.
At 9 o'clock: Sept. 6.
At 8½ o'clock: Sept. 14.
At 8 o'clock: Sept. 21.

NIGHT SKY: AUGUST AND SEPTEMBER

THE HEAVENS.

Right overhead at our hour of observation is Cygnus, one of the finest of the constellations. Our initial letter shows the figure of the Swan, flying southward along the Milky Way, with the star β marking its head, the line $\zeta\ \varepsilon\ \gamma\ \delta\ \varkappa$ (the last not on the map) its widespread wings, and with α, the brightest of all, in the midst of its body.

Two or three stars in it deserve special attention. α is notable because the most careful measures of its parallax fail to give a sensible result. This star, though apparently one of the brightest in the heavens, is at a literally immeasurable distance. Its real magnitude must be exceedingly great.

β is a fine wide double, yellow and blue, also at a very great distance.

Most interesting of all is the small star 61 Cygni (marked on the map) which is just easily visible to the naked eye. This is the first star whose distance was measured (by Bessel in 1838). Numerous recent measures have determined its parallax and distance with an uncertainty probably less than five per cent. Its distance from us is 10½ light years, or 62 millions of millions of miles. At this distance the sun would look about as bright as the pole star now does to us. 61 Cygni appears to the eye only about 1/10 as bright as this. As it is a double star, neither of the two can be 1/10 as bright as our sun. They are in slow relative motion, which in the last century has shown very little curvature; but it is pretty certain that they are really moving in a vast orbit, whose circuit may occupy a thousand years or more.

West of the zenith, and high up, is the brilliant steel-blue Vega, and in the south is Altair, which is about one-half as bright. Above the latter are the small groups of Delphinus and Lagretta, and below are Capricornus, with its familiar double stars, and Sagittarius. Scorpio is setting in the southwest, and Ophiuchus is above it. Hercules and Corona are below Vega, and Arcturus lower still, almost due west. The Great Bear is low in the northwest, with the Little Bear and Dragon above her.

In the northeast Cepheus is high above the pole, Cassiopeia below, then Perseus, and lastly Auriga, which is just beginning to rise. In the east is the great square of Pegasus, with Andromeda on the left and Aquarius on the right.

The solitary star in the southeast is Fomalhaut. The very bright object a little south of east is Mars, and the fainter one about half way between this and Aries is Saturn.

THE PLANETS.

Mercury is evening star all through the month, and is visible in the first half of it, setting about 7:20 P. M. on the 1st, and 7 P. M. on the 15th. He is at his greatest elongation on the 17th, when he is 26 deg. east of the sun; but being also some 11 deg. south of it, he is not very favorably placed.

Venus is evening star, setting about 8 P. M. on the 1st, and is moving rapidly southward, so that on the 30th, though farther from the sun, she sets at about 7:20.

Mars is in Pisces, and comes to opposition on the 24th. He is visible all night long, and is exceedingly conspicuous. During the month he moves slowly westward among the stars, and at its end he is quite near the "first point of Aries," from which longitudes and right ascensions are measured, being about 4½ deg. south of it.

Jupiter is in conjunction with the sun on the 18th, and practically invisible all through the month.

Saturn is in Pisces, and rises about 7:30 P. M. on the 15th, so that he is observable most of the night.

Uranus is in Sagittarius and crosses the meridian at 7:37 P. M. on the 15th.

Neptune is in the constellation Gemini, and rises a little after midnight.

THE MOON.

Last quarter occurs at 3 P. M. on the 6th, new moon at 10 A. M. on the 14th, first quarter at 1 P. M. on the 22nd, and full moon at 8 A. M. on the 29th. The moon is nearest us on the 1st and again on the 29th, and remotest on the 16th.

On the evening of the 1st she is in conjunction with Mars, and as seen from the eastern United States, passes right over him, hiding him for nearly an hour. This will be a most interesting affair to watch.

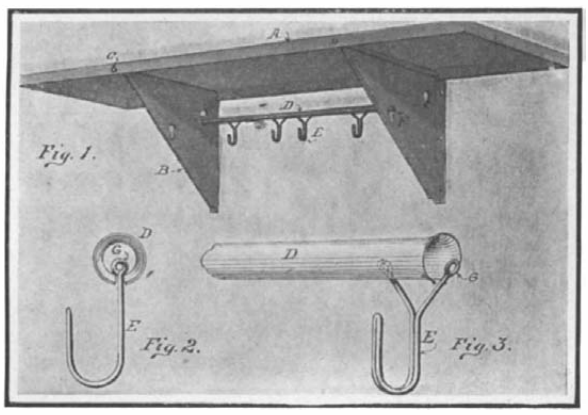
As seen from Washington, Mars disappears at the eastern side of the moon at 8:42 P. M., and reappears almost at the opposite point, at 9:39. These times will be earlier for places west of Washington, and later for those east of it, *after allowance is made for the difference between standard and Washington time.*

The moon is also in conjunction with Saturn on the 2nd, Neptune on the 9th, Jupiter on the 14th, Mercury on the 16th, Venus on the 17th, Uranus on the 23rd, Mars again on the 28th, and Saturn on the 30th; but these are of less interest, though the second conjunction with Mars is close, and an occultation is visible in South America.

Patent Department

SHEET-METAL SHELF.

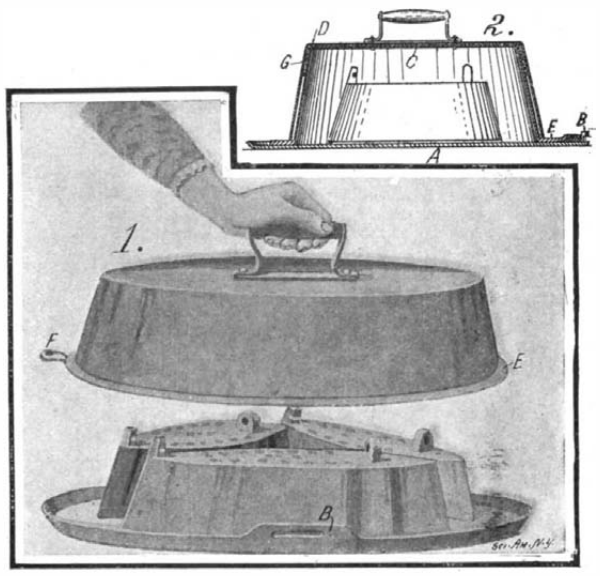
Pictured in the accompanying engraving is a shelf formed of sheet metal, which is so arranged that it may quickly be attached to a wall or other support, and as quickly detached and folded compactly for storage or transportation. The shelf proper consists



of a sheet-metal piece *A*, provided with depending flanges. The brackets *B* are pivoted on pins *C*, which are journaled in the flanges of the shelf. The brackets are also provided with flanges at the rear end, with holes for screws, with which the shelf is attached to the support. The brackets also support a pair of bars *D*, from which hangers *E* are suspended. The end of each bar is flanged outwardly, as indicated in Figs. 2 and 3. The brackets *B* are formed with openings *F*, shaped like a keyhole, that is, with an enlargement above to admit the flanged ends of the bar *D*, and a constricted portion for the body of bar, which is kept from slipping out by the flanged ends. The hangers *E* are formed of a single length of wire, bent double, as shown to the best advantage in Fig. 3. The ends of the hangers are formed with rings *G*. The bars *D*, which are hollow, are slotted lengthwise, and the ends of the hangers are introduced into this slot, while the rings *G* prevent them from slipping out. Either one or both bars may be used, and the hangers provide convenient support for various articles. It will be evident that the device may be folded up in a moment's time, the brackets lying within the flanges of the shelf *A*, so that the device occupies a minimum space. The inventor of this device is A. Dahl of 302 West 144th Street, New York city.

SAD-IRON HEATER AND RECEPTACLE.

When heating sad-irons on oil and gas stoves, there is danger of the irons becoming coated with soot, owing to their direct contact with the flames. In order to overcome this difficulty, the sad-iron heater illustrated in the accompanying engraving has been designed. It consists, in general, of a plate or tray adapted to rest on the stove, and a cover formed with a double wall in which insulating material is placed. In this way the flames are prevented from touching the irons, while the cover prevents the escape of the heat from the inside, and thereby accelerates the heat-

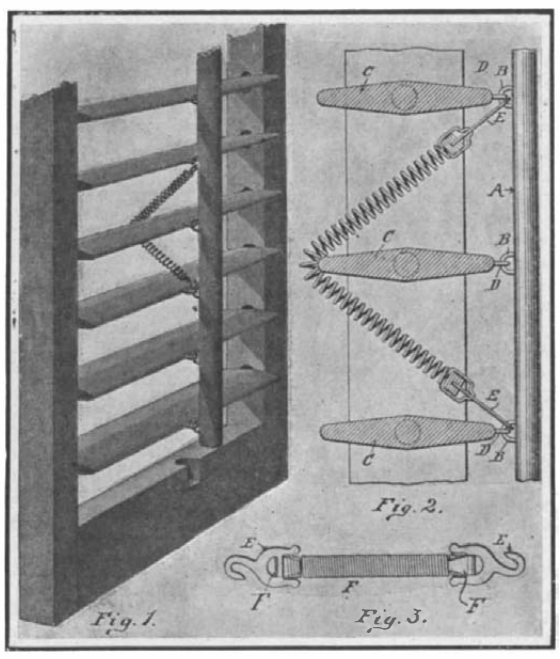


SAD-IRON HEATER AND RECEPTACLE.

ing of the irons. In the engraving, the tray is indicated by the letter *A*. The rim of the tray has an extension *B* at one side, formed with a slot. The construction of the cover is clearly shown in the sectional view. It comprises an inside wall *C*, and an exterior wall *D*. The wall *C* is formed with a flange *E*, at the lower edge, on which the edge of wall *D* rests. At one side, the flange *E* is extended to form a tongue *F*. Between the two walls of the cover, a layer of asbestos *G* is placed. This layer is placed only at the top of the cover, leaving an air space between the two walls at the sides, as shown. The handle of the cover is attached thereto by means of bolts, which pass through to the interior wall *C*, and serve to clamp the two walls together. When the device is not in use, the tongue *F* is slipped through the slot in the extension *B*, and the whole device may then be hung on a hook passing through an opening in the tongue. The inventor of this improved sad-iron heater is Mr. Frederick W. Wantzel of Rossmere, Lancaster, Pa.

SLAT ADJUSTER FOR WINDOW BLINDS.

The ordinary window blinds are not provided with any means for holding the slats open or closed, other than the friction of the slats themselves. When the slats work loose they are apt to close or open of their own weight or under action of the wind, and in stormy weather they are quite apt to rattle. This difficulty is overcome by using a device such as illustrated in the accompanying engraving. In the sectional view, Fig. 2, the slat rod is indicated at *A*. It is provided with the usual staples *B*, to which the slats *C* are secured by means of hooks or staples *D*. The slat adjuster consists of a coil spring, which passes over the end of one of the slats *C*, and is attached at each end to the staples *B* by means of hooks *E*. The tension of this spring is made adjustable by means of a U-shaped clip *F*, which is provided with fingers that engage the coils of the spring, as shown in Fig. 3. The hooks *E* are caught under the clips, and are free to adjust themselves to the various positions of the spring as the slats are moved to open or closed position. If desired, an ordinary coil spring terminating in a hook at each end may be used, as indicated in Fig. 1, but

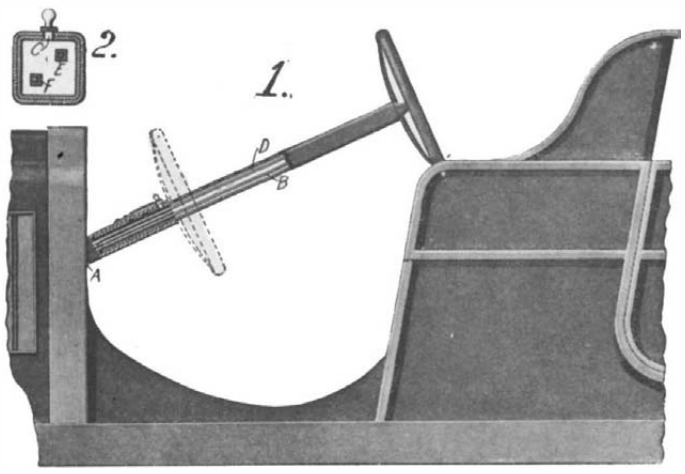


SLAT ADJUSTER FOR WINDOW BLINDS.

the adjustable spring is preferred, as it may be fitted to slats of different sizes, and the tension may be regulated to a nicety. With the adjuster in place, the slat bar is held tightly against the slats, preventing it from rattling, and the springs also prevent the slats from moving up or down after they have been set in a certain position. The inventor of this device is Mr. Ernst W. F. Herrmann, 314 Pas Hondo Street, San Antonio, Texas.

TELESCOPIC STEERING GEAR.

The most suitable position for the steering wheel of an automobile is to have the wheel close to the chauffeur's seat, and on an axis that lies at about twenty-three degrees from the horizontal, or even less. Unfortunately, with the steering wheel in this position, it is awkward for the driver of the machine to get into or out of the seat. Furthermore, the steering column acts as a bar to prevent occupants of the automobile from mounting or alighting from the machine on the chauffeur's side. To overcome these objections and yet keep the steering wheel at the most suitable angle, a telescoping type of steering column has recently been devised. As shown in the accompanying engraving, the steering column comprises two hollow members of approximately rectangular form (see Fig. 2), the member *A* being connected to the steering gear in the usual manner, while the member *B*, which carries the steering wheel, is arranged to slide within the member *A*. It is not essential that the two members be of rectangular form, but any other form will do, hexagonal, for instance, or oval, which will do away with the necessity of keying one to the other. In Fig. 1 the position of the wheel when the steering column is telescoped is indicated by dotted lines. The steering column may be extended to any degree desired by the driver of the machine, and locked in this position by a spring-pressed pin *C* on the member *A*, which is adapted to enter any of the perforations *D* spaced at regular intervals along the member *B*. Within the member *B* are the connections *E* and *F*, running to the spark device and throttle control. These connections are also of telescope construction, as indicated in Fig. 2. The inven-

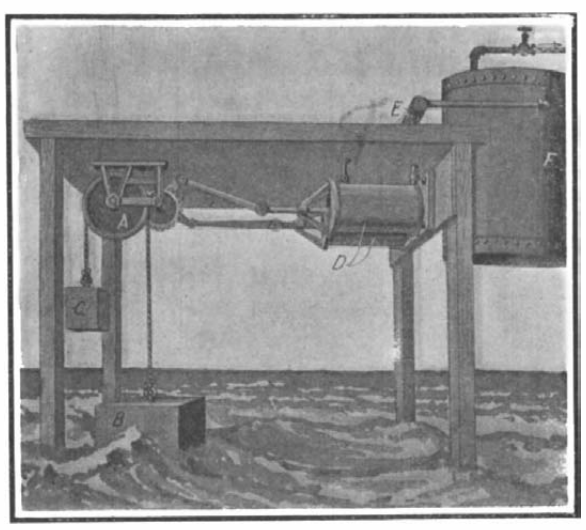


TELESCOPING STEERING GEAR FOR AUTOMOBILES.

tor of this telescoping steering gear is Mr. C. J. Schoening, Box 112, Honolulu, E. H.

WAVE AND GRAVITY MOTOR.

A recent patent describes a new form of wave motor, in which the power of the waves of the sea or ocean is utilized alternately with the power of gravity to operate an air compressor. The compressed air is stored in a reservoir, and may be piped to any point desired, so that the energy of the waves may be utilized at a considerable distance from the ocean. The apparatus comprises a platform built out over the water. A pulley *A* is attached to the under side of the platform, and a rope which passes over this pulley is fastened at one end to a large caisson or float *B*, while the other end carries a counterweight *C*. The float rises and falls under action of the waves, and the weight keeps the rope taut. The pulley is thus rotated back and forth by the action of the rope thereon. The pulley shaft is geared to a crank shaft, which operates the two pistons of the compressor. The two cylinders *D* of the compressor are provided with valve-controlled outlet passages, which communicate with a common pipe *E* connected to the reservoir *F*. The weight and float are so proportioned, that a lowering of the water level causes a lowering of the float and a raising of the weight, while when the water level rises, the weight is sufficiently heavy to cause a positive rotation in the reverse direction of the pulley shaft. Thus, the weight rotates the shaft in one direction by gravity, and the float rotates the shaft in the opposite direction when the waves recede. To simplify the construction, the cylinders *D* are left open at one end, and no inlet valve is provided other than the piston washer. A very simple form of outlet valve is used, consisting of a conical plug, which is lifted by the compression of the air in the cylinders, but is prevented from rising too far by a hooked stem, which engages the lower end of the valve. A patent on this



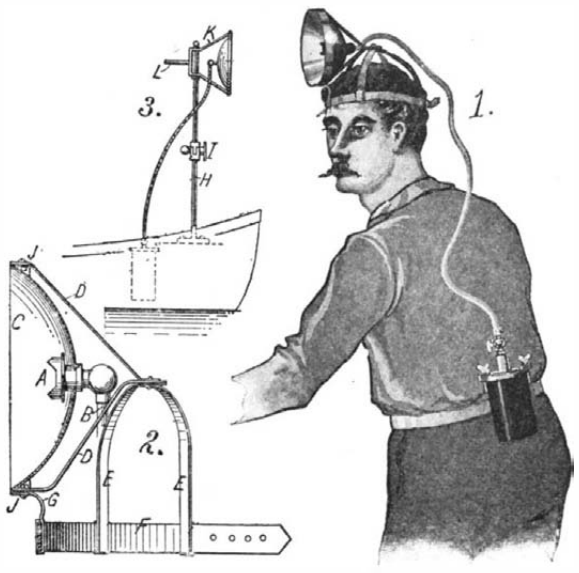
WAVE AND GRAVITY MOTOR.

wave and gravity motor has been secured by Mr. Allen T. Ransom, 44 Scholes Street, Brooklyn, N. Y.

In 1907 the United States produced 166,000,000 barrels of oil, and in 1908, according to unofficial estimates, the total was more. The United States produces 63.12 per cent of the entire oil production of the world.

A PORTABLE LAMP.

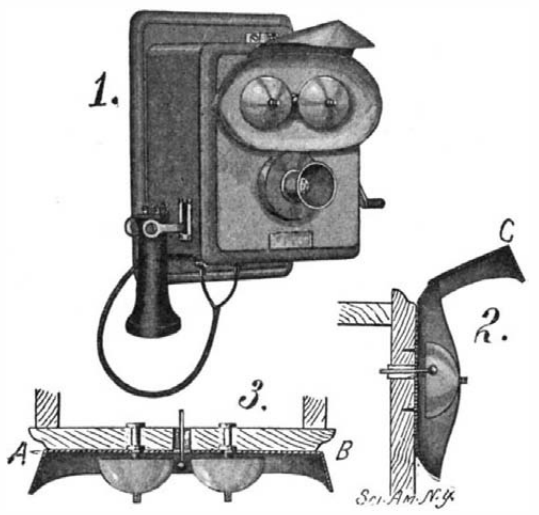
A very convenient form of lamp has recently been devised for the use of campers, hunters, etc. It consists of a portable acetylene gas generator, and a burner arranged within a reflector which is open at the front for the escape of heat. The walls of the reflector are imperforate, to prevent the passage of air through the reflector when the lamp is being moved about or is exposed to the wind. In this way the danger of extinguishing the light is avoided. The accompanying illustration shows in Fig. 1 how the lamp may be attached to the head of a man, while the gas generator is secured to his belt. The details of the head attachment are shown in the sectional view, Fig. 2. The burner *A* is attached to the flexible tube *B*, which runs to the generator. The reflector *C* in which the burner it fitted is provided with a flange along its outer edge, to which the arms *D* are secured. These arms are fastened to a cage *E* provided with a strap *F*, which is strapped about the head of the wearer. As an additional support to the lamp, a small bracket *G* connects the bottom of the reflector directly to the head strap. When it is desired to use this device on a boat or in camp, it is mounted on a stand *H*, as indicated in Fig. 3. This stand is formed of two sections, one of which is hinged upon the other, so that the lamp may be moved laterally. By means of a thumb screw *I*, the two sections may be clamped at any desired position. The lamp is taken out of the head gear by unscrewing the bolts *J*, and it may be then fastened in a bracket *K*, which is swiveled on the upper end of the stand. The swiveling bracket is provided with a handle *L*, which enables one to move the lamp about in any desired direction. The inventor of this portable lamp is Mr. O. A. Loveless of Waters Meet, Mich.



A PORTABLE LIGHT FOR CAMPERS.

RESONATOR FOR TELEPHONES.

Pictured in the accompanying engraving is a device adapted to augment the sound of telephone bells or other signals, so that the signal may be heard in places where there is more or less noise. The device is particularly adapted for use in shops, pumping stations, and the like, where ordinary sounds are not discernible, especially under heavy atmospheric conditions or in damp or rainy weather. The device consists of an elongated dished body formed with sound reflectors at opposite ends, and a similar sound reflector overhanging the center of the body. This device is placed behind the bells of the telephone, and acts to reflect the sound in a definite direction. The reflectors referred to are indicated at *A*, *B*, and *C* in the illustration. It will be observed that they are of conical form, and the reflectors *A* and B serve to catch the sounds which ordinarily travel out in a lateral direction from the telephone, and direct them forward. The reflector *C* serves similarly to collect and reflect the sound waves that pass upward. For convenience in manufacture the reflector *C* is preferably made in a separate piece, but the portion which



RESONATOR FOR TELEPHONES.

extends to the main body is tangent thereto and flattened, in order that a neat joint with the body may be effected. The device is extremely simple, and can readily be attached to a telephone by means of a couple of screws. The form of the reflector can be modified to throw the sound to one side if desired instead of directly forward. The inventor of this resonator is Mr. Patrick E. Finlay of New Orleans, La. (No. 2 St. Louis Pumping Station.)

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTROLYTIC CELL.—J. McPHAIL, Carteret, N. J. The inventor seeks to construct an electrolytic cell in which there may be brought about a complete separation of the products, with a minimum of undesirable by-products, the cell occupying a comparatively small space and being simple and easily handled.

TELEPHONE ATTACHMENT.—B. E. DETRICK, New Albany, Ind. In view in this case is the provision of a construction comprising a bracket, and a frame for carrying the receiver of the telephone, swingingly mounted on the bracket and adapted to rest on the circuit-controlling arm of the telephone when swung to a depressed inoperative position, and release said arm when swung upright in position for use.

Of Interest to Farmers.

DUMPING-VEHICLE.—P. BRAND and C. G. GLASRUD, Sheyenne, N. D. The invention relates more particularly to a vehicle having a running gear of any suitable type, a frame rigidly carried by the rear axle of the vehicle, and a wagon body mounted upon the frame, the rear axle serving as a pivot to permit the body to be tilted so that its contents can be dumped.

INSECTICIDE.—J. W. WOODS, Portland, Ark. The ingredients composing this destroyer are to be thoroughly mingled by agitation, and applied to the plants infested with boll weevil or other insects, by sifting the same over the plant. The compound may also be applied to the infested plants in any other desirable manner.

COMBINED BED-SHEET AND SHELTER-TENT.—F. WHITNEY, Cimarron, New Mex. The sheet is for use by stockmen which may be quickly supported in the form of a shelter tent, the device being so constructed that it can be readily packed for transportation and which is complete in one piece with ropes attached so that it may be adjusted with supports as a tent, or when desired may be used as a bed sheet, the stockman having the complete device in compact form at all times, except the supports, which can readily be obtained.

Of General Interest.

BEER-TAPPER.—R. B. SPIKES, Washington, D. C. The tapper is of that form in which a bung casing is screwed into the head of the barrel and is provided with separate ports, through one of which compressed air is admitted to the barrel, while beer is drawn out through the other. With this form a detachable coupling bearing separate tube connections, for the air and beer, is arranged to be turned into the casing and in the movement to operate a valve which simultaneously opens or closes the air and beer ports.

METAL-DEPOSITING APPARATUS.—J. K. REYNARD, East Elmhurst, N. Y. It has been found that the distinctness of the sound produced by phonograph records is much increased by depositing upon the wax a fine layer or film of metal previous to electro-plating. The metal preferably used is gold. The invention reduces the consumption of gold and preserves a perfect seal for the vacuum chamber in which the depositing operation takes place.

BOX.—W. L. HOWLAND, Cedar Rapids, Iowa. In the present invention the improvement pertains to boxes, and has for its object the provision of a box preferably made of wood which while strong can be easily and cheaply manufactured and may be quickly put together by the user when desired.

METHOD OF TREATING WOOD DURING DISTILLATION.—H. W. DOUGHTY, Amherst, Mass. In this instance the intention is to provide a new and economical method of utilizing the waste from resinous pine wood, in the form of saw-dust, mill-chips, etc., to recover, in commercially valuable forms, the various constituents of such wastes.

CONCRETE-MOLD.—R. N. NEIL, Cozad, Neb. One provision in this case is that for a mold with side members which are connected by spools supported by rods disposed therein, the spools having hollow heads in which the rods are screwed, there being additional threads in recesses in extremities of the heads in which nuts having orifices are adapted to mesh, means in the heads preventing the rotation of heads on bolts which are disposed on the orifices in the nuts.

ENVELOP-FASTENER.—J. E. A. THOLLANDER, Piedmont, Fla. An object here is to provide a fastener which can be applied to any common form of envelop, which prevents the unauthorized opening of the envelop without leaving traces of such an act, which is inexpensive, and which adds but slightly to the weight or bulkiness of the envelop.

Hardware.

SHADE-BRACKET.—H. WITTMANN, Cincinnati, Ohio. In this patent, the invention is an improvement in curtain fixtures and has for an object among others to provide a novel construction by which the brackets may be readily applied and adjusted to suit any suitable length of curtain and then clamped in position.

FOOT-REST FOR SHOE-SHINING STANDS.—G. F. OLIVER and R. ROUSSEAU, Ilion, N. Y. The invention pertains to foot rests such as used at shoe-shining stands for supporting the feet when the shoes are being polished. The object is to provide a rest which will operate to hold the foot rigidly in position and at the same time permit the sides of the shoe to be exposed.

DOOR-LOCK.—G. W. NORTHRUP, Brainerd, Minn. This invention refers to door locks of the class known as mortise locks, which are embedded in a door by forming a recess in the body of the door from the free edge inward. The purpose is to provide a lock of simple construction, and while possessing all the advantages of the mortise lock, may be placed on thin doors, or those of greater thickness.

MITER-BOX.—F. W. MCLEAN, West Monroe, La. The patentee has for his object the provision of a device which is light and compact, and one that will permit the use of an ordinary hand saw by drilling a single hole therein, and with which the full length of the saw will be utilized.

SASH-LOCK.—L. H. GRAU, San Francisco, Cal. The invention may be defined as consisting of a bolt insertable in the overlapping portions of the sash frames at each corner, the bolts passing from the inside through the lower sash into the upper sash, and guard plates movable over the heads of the bolts to prevent the bolts from being punched out from the outside of the window.

Heating and Lighting.

PREHEATING LIGHTING-FIXTURE. — W. N. BEST, SR., New York, N. Y. The invention relates to improvements in fixtures and more particularly to that type in which combustible gas is burned and the products of the combustion of the flame are delivered to the interior of an inverted mantle. The device supports the mantle and permits the gas to be heated to a high temperature before it is burned and before it is delivered to the mantle.

REMOVABLE FURNACE-OVEN. — N. E. STORMS, Minneapolis, Minn. The object here is to provide an oven for removable attachment to a furnace or regular heater, to permit using the oven for baking and other purposes, and without placing the oven and its contents directly over the burning fuel in the fire-box or subjecting the contents of the oven to the action of the obnoxious gases incident to burning of the fuel in the fire-box.

THERMOSTAT.—W. ENTERLINE, Big Run, Pa. Mr. Enterline's invention relates to a thermostat which may be disposed against a boiler and which, while inexpensive to construct, may be readily adjusted to a boiler of any type and will automatically and accurately regulate the supply of gas which is supplied to the burner under the boiler.

Household Utilities.

REGULATING VALVE.—H. C. BENWITZ, Chicago, Ill. The invention is an improvement in regulating valves for the hot and cold water supplies leading to wash stands, bath tubs, and other similar places. The valve includes an actuating-lever or handle which is operable not only to control both the hot and cold water supplies, but also to control the water or outlet.

MEASURING APPARATUS.—R. HOYT, New York, N. Y. The invention pertains to apparatus for measuring various materials, it being particularly useful in connection with packaging-machines in which it is desired that a measure by weight shall be quickly made and with substantial accuracy.

STRAIGHTENING-MACHINE.—E. A. LANE, Fulda, Cal. The invention refers to machines for removing bulges, dishes, dents, and the like from metal, especially from band saws, and relates more particularly to a machine having removable rolls, one of which has an annular concave part spaced inwardly from the edges of the roll whereby the latter has flat parts at each side of the concave part, and a second roll having at each side of the convexed part, flat portions.

CHANGEABLE-SPEED GEARING. — W. SCOTT, Sheridan, Wyo. One object of the improvement is to supply a gearing more especially designed for use in the driving mechanism of automobiles and other machines, and arranged to enable the operator to use any one of four different speeds for driving ahead and a single speed for driving backward.

HOISTING-MACHINE. — C. F. DALLMAN, Antigo, Wis. The machine is for use whenever a hoisting drum is desired for raising or lowering loads, power being applied through a shaft, which through its connection with a second shaft rotates the gear wheels at each end of the drum. Mechanism is arranged to operate the drum from a distance, the operation of the drum being the same whether it is manipulated directly by a bar lever or intermediately by the three-armed lever.

HYDRAULIC GOVERNOR.—A. DICKERSON, American Fork, Utah. In this mechanism, which in part is operated upon the same general principle as in the steam governor formerly patented by Mr. Dickerson, the hydraulic piston constitutes an automatic check to the movement of the whole gate mechanism. The gate follows every move of the governor, and if there is any change of pressure of water on the gate, the whole will automatically readjust itself without necessitating a change in the speed of the engine.

MACHINE FOR MAKING MACARONI AND THE LIKE.—J. RIVARA, Natchez, Miss. The aim in this case is to simplify the construction of machines of the pastry class and to adapt the screw, which operates the plunger or piston, to be quickly withdrawn from the cylinder in which dough or other material is pressed to produce macaroni or other product.

YARN-PRINTING MACHINE. — N. COSTIKYAN, Leicester, England. The intention of this inventor is to provide a machine for use in printing warp yarns, especially carpet or pile yarns, according to a predetermined pattern, and arranged to permit printing at one operation as many knots or spaces as desired and in one or more colors.

Machines and Mechanical Devices.

DUMB-WAITER OR ELEVATOR.—C. A. STURM and R. N. FLACK, Portland, Ore. This invention is intended especially to be used where the waiters or cages are operated from a point outside of the cage or waiter. An object is to provide means for indicating to the operator when the car has arrived at the end of its travel up or down.

AUTOMATIC FIREARM.—J. J. REIFGRABER, St. Louis, Mo. In operation when the breech block has reached its rearmost position the cartridges may be fed up from the magazine and the block may then move forward with the barrel and the block latch will adjust in rear of the block and travel therewith and with the barrel forwardly locking the block from any rearward movement until the barrel has again been pushed back in position in which the locking latch may be released to release the block.

SINTERING-MACHINE.—A. B. YOUNG, Salt Lake City, Utah. One of the purposes in view in this improvement is the provision of a device in which finely divided ore may be brought into a conglomerate mass by a sintering process and then may be delivered free from the machine in blocks of convenient size for subsequent treatment in a blast furnace.

MACHINE FOR MAKING CELLULAR BOARDS.—S. M. LANGSTON, Camden, N. J. In the present construction the machine is especially adapted for making asbestos board, and involves mechanism for pasting together two sheets corrugating the combined sheets, heating them to dry the adhesive material and retain the corrugations in permanent form and then securing a third sheet to the crowns of

the corrugations of the double corrugated sheet.

ELEVATOR.—E. C. PORTER, Telluride, Colo. The invention is an elevator for water, slimes, grain, and other fluid matter, and provides a machine which will do a large amount of work with comparatively small power and contains no valves or other parts apt to wear out or get out of order, and which is capable of use at any inclination from vertical to horizontal.

MACHINE FOR MAKING CARTONS.—S. M. LANGSTON, Camden, N. J. This invention pertains to certain improvements in machines for making cartons, and more particularly for making that type of carton in which a strip of sheet material is bent to form a tube and in which the meeting edges are secured together by a strip of tape or the like.

STEAM-HAMMER.—T. E. HOLMES, 8 Oakdale road, Sheffield, England. In this invention the object is to provide improved controlling gear whereby to render a self-acting hammer more perfectly amenable than heretofore to the will of the operator, so that the latter will be enabled to regulate, with greater certainty than hitherto, the frequency, intensity, and length of stroke of individual blows.

VARIABLE-SPEED GEARING.—J. HEIM, Winnipeg, Manitoba, Canada. The principal object in this invention is to provide a plurality of non-rotatable gear members, any one of which may be brought into engagement with a rotatable gear member to cause a rotation of the latter as it moves bodily along the face of the stationary member.

LOOM-TEMPLE.—A. FORTUNA, Manchester, N. H. This invention prevents unequal wearing of the slide bar and tipping even when the bar is already worn. When worn so that there is a tendency of the bur roll to tip downwardly at its outer end a bar is lowered toward a lateral lug to correct tipping after which it is secured by a set screw. Means assist in supporting the torsional pull; and making the leverage of resisting force more nearly equal to that of the opposing force.

DRILL AND CUTTING-MACHINE.—E. A. CUNNINGHAM, Oskaloosa, Iowa. This mechanism includes a rotating bit and is arranged so that the bit is normally free to travel forward slowly as it turns, but is stopped or checked automatically in its forward travel whenever it encounters an obstacle unusually hard to penetrate, yet the bit is free to vel rapidly forward when the boring through the unusually hard obstacle is complete.

AIR-SHIP.—C. J. BERTHEL, Pinetown, N. C. The wings of the aeroplane spread a greater distance transversely to the line of flight than the fore and aft distance. This follows the analogy of the wings of a bird and founded on the principle of physics essential to successful aeroplanes, which secures a short transverse impact of the wings upon the relatively still air whose inertia gives the resultant upward pressure to buoy up the aeroplane and allow quick clearance of the air in the rear.

Prime Movers and Their Accessories.

METHOD OF UTILIZING HEAT OF COMBUSTION AND STEAM-POWER IN PRIME MOVERS. — T. SCHTSCHERBAKOFF, Moscow, Russia. In this apparatus an internal combustion chamber is inclosed within a steam boiler so that steam is generated from heat developed in the combustion chamber and the products of direct combustion are conducted through certain controlled passages to the engine cylinder.

Railways and Their Accessories.

SPIKE.—C. D. WALCOTT, Washington, D. C. This spike is one that may be cheaply formed from rolled bars and one that avoids the splitting of the tie and which does not turn or rotate about its longitudinal axis in driving, and which withal possesses a much greater holding effect when sunk into the wooden tie than spikes of ordinary cross-section.

RAILROAD-TIE. — G. WHITAKER, Temple, Texas. This invention is an improvement in railroad ties and fastening and has for an object to provide a simple, novel tie that can be used in connection with the ordinary wooden ties, and can be used on any ordinary ballast, will form in itself a track gage and will facilitate the fastening and releasing of the rails as may be desired.

AUXILIARY COUPLING-HEAD. — P. W. HOGAN, Durand, Mich. The invention is an improvement in heads of the character shown and described in Letters Patent formerly granted to Mr. Hogan, the said coupler head having for its purpose to serve as a substitute for a broken coupler head of the "Master Car Builders" type and is connected to engage the draw-bar of the broken coupler at the rear of the head and project a slight distance in advance thereof.

AUTOMATIC RAILROAD-SWITCH.—I. A. CALL, Salt Lake City. The object here is to provide a switch which may be operated from the train or engine while the same is in motion, or by hand in the usual manner, and a switch of the stub rail type which will not be liable to clog from snow, dirt, or other causes, nor from contraction or expansion of the rails at the switch.

TURN-TABLE. — M. J. LEONARD, Long Branch, N. J. Mr. Leonard's invention comprehends a turntable the upper surface of which always remains at the same level, the descent of the weight thus being independent of the upper level of the table—the weight being raised by the forward movement of the locomotive or other piece of rolling stock to be turned.

CAR-DOOR.—C. W. LEANING, Yankton, S. D. This invention has reference to car doors, and more particularly such as are formed of a number of independently movable sections arranged on guideways and adapted to be moved into operative positions away from the doorway of the car when not in use.

TRACK DEVICE FOR RAILWAY-SIGNALS.—M. M. KANE, Montgomery, Ala. The aim of this inventor is to produce a device which can be operated by a train passing in either direction, and which is constructed in such a way that it can be readily actuated by a switch point so that a signal near a switch may be controlled from the switch through the device to indicate whether the switch is open or closed.

CAR-WHEEL.—I. P. TODD, Middlesboro, Ky. In the present patent the aim is to provide a wheel especially adapted for mining cars, and provided with a detachable hub, which may be removed when worn out, and replaced by a new one, or should the wheel proper be injured it may be replaced by a new one, using the old hub.

AUTOMATIC SIGNAL AND STOPPING DEVICE FOR RAILROAD-TRAINS.—F. J. MILLER, Cincinnati, Ohio. This inventor's purpose is to avoid collisions and his device comprehends the electro-magnetic devices in the roadbed, acting in connection with electro-magnetic devices on engine or car, whereby the entry of a train upon a section of track already occupied, will actuate in the on-coming train a signal and will cause automatic devices to be set into action by which the throttle valve is closed and the train is automatically stopped.

CAR-BRAKE.—H. HOFFMANN, New Rochelle, N. Y. The improvement is on a patent formerly issued to Mr. Hoffmann, and the present invention is particularly applicable where a brake drum is provided upon which a cable or chain is wrapped, the braking force being applied to the brake mechanism through the said chain.

RAIL-FASTENER.—J. ENGEL, Millersburg, Ohio. In operation, the rail can be fastened or loosened with a sledge, and the use of nuts and bolts is avoided. The fastener can be applied to a joint as well as any part of a rail between joints, and the gage of the track can be changed by removing the metal plate fasteners from one side of the rail and placing them on the opposite side. The tie and fastener are thus adapted for use on a curved and straight track.

NUT-LOCK.—W. R. GARNER, Palestine, Texas. The device is a combination nut lock and washer and is especially for use on railway rail joints. In application the nuts should be loosened sufficiently to permit the driving of the depending washer plates between the nuts and the back plate or angle bar. These plates are attached to a top plate and the shoulder springs are also attached at their upper ends to the top plate, but all are detached thence to their lower ends. Mr. Garner has also patented another nut-lock in which the nuts will not only be prevented from turning, but the plates and angle bars will be held tightly in position on the rail joints to prevent the rails from moving or spreading, and the rails going down or dropping in a soft road bed, and nuts prevented from rattling or turning back over the bolts and lost motion of nuts and angle bars will be followed up by the spring washers and spring arms.

Pertaining to Recreation.

DRUM.—A. D. CONVERSE, Winchendon, Mass. In this improved construction, the head is formed with a hoop section at one end of greater diameter than the body of the drum, and the head is also provided with a hoop section which engages with the hoop section of the body and is locked thereto to hold the drum in position.

Pertaining to Vehicles.

AUTOMOBILE FIFTH-WHEEL. — E. A. OLIVER, Richland, Mo. The objects of this invention are first, to provide means by which a cable running from a wheel on the hind axle will be guided onto a wheel on the front axle; second, to reduce the friction of the cable on the guides; third, to provide means by which the front end of the body or springs of the automobile will rest directly over the front axle.

VEHICLE-WHEEL.—W. L. HOWARD, Trenton. N. J. In a prior application Mr. Howard disclosed mechanism for detachably securing tire-carrying rims to wheels, including curved sections moving circumferentially away from each other and radially to grip the rim. The mechanism for spreading apart the gripping sections includes a worm wheel carried by a rotatable rod, the opposite ends of which are provided with threads of opposite pitch. The present invention utilizes substantially the same general features but provides mechanism for spreading the gripping sections and locking them in position.

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

NEW BOOKS, ETC.

THE INTEGRALS OF MECHANICS. By Oliver Clarence Lester, Professor of Physics in the University of Colorado; formerly Instructor of Physics in the Sheffield Scientific School, Yale University. New York: Ginn & Co., 1909. 8vo.; 67 pages; with diagrams; cloth. Price, 80 cents.

The aim of this book is to furnish the conclusion to courses in the integral calculus such as are usually given in colleges and technical schools, and at the same time to provide for the beginning of theoretical mechanics, which usually follows the calculus. The subject-matter is concerned entirely with such applications of the calculus as the calculation of lengths, areas, volumes, densities, centers of mass, moments of inertia, and ellipsoids of inertia. These subjects are treated in great detail, all principles being fully illustrated by examples worked out in the text and by numerous problems set as exercises. Since the ground covered is common to both integral calculus and to theoretical mechanics, the author hopes in this way to save both time and energy; to save time by providing applications of the calculus useful in mechanics; to save energy by treating the purely mathematical parts of mechanics entirely apart from the ideas of force and motion. This method avoids breaks in the continuity of the mechanics course proper, and minimizes the liability of the student to such troublesome confusions as moment of inertia with the moment of a force, or center of gravity with the force of gravity. Whereas the book is intended strictly as a college textbook and has little interest for those unfamiliar with the calculus, it has the additional value of illustrating the practical applications of the latter to those who have commenced its study at college and considered it purely as mental gymnastics.

AZIMUTH. By George L. Hosmer. New York: John Wiley & Sons, 1909. 16mo.; 73 pp. Price, $1.

The purpose of this volume is to present in compact form certain approximate methods of determining the true bearing of a line, together with the necessary rules and tables arranged in a simple manner so that they will be useful to the practical surveyor. It is a handbook rather than a text-book, hence many subjects have been wholly omitted which are ordinarily included in books on Practical Astronomy but which are not essential in learning to make the observations described in this book. In all of the methods here treated the object sought is to secure sufficient accuracy for the purpose of checking the measured angles of a survey with the least expenditure of time. For this reason many approximations have been made and many refinements omitted which simplify the calculations without introducing serious error into the results, and although such a treatment would scarcely be proper in a text-book the gain in simplicity and convenience would seem to justify its use in a book of this character. The methods which are here presented are not new, but have all appeared in one form or another in works on Navigation, Astronomy, and Surveying. Much valuable matter written on this subject is so scattered, however, that it is difficult to find in one small book all that would be needed by the surveyor in making azimuth observations.

SCIENCE AT HOME. Simple Experiments for Young People. By P. Baron Russell. New York: R. F. Fenno & Co., 1909. 16mo.; 183 pages. Price, 75 cents.

The present volume is an attempt to interest young people in simple physical and chemical experiments. The aim of the book is admirable, and the experiments are not beyond the powers of average children.

MISSION FURNITURE. How to Make It. Part I. Chicago: Popular Mechanics Company, 1909. 18mo.; 94 pages. Price, 25 cents.

This little book, which is neatly bound in cloth, belongs to the Popular Mechanics series of twenty-five cent books. It gives a number of illustrations showing how mission furniture can be constructed at home at a small cost. The price is so low the book should have a considerable sale.

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Letter box, house, V. C. Koons 930,484
Line roller, F. Buerkle 930,591
Lighting systems, generator for hydrocarbon, O. J. Seehausen 930,891
Linotype machine, J. R. Rogers 930,693
Liquid conveyer, E. P. Fowler 930,465
Liquid fuel burner, W. M. Simpson 930,568
Load binder, W. Louden 930,397
Locker for hats, etc., G. Schwinn 930,505
Locomotive ash pan, J. A. Kremser 930,866
Locomotive, logging, H. N. Covell 930,354
Locomotive lubricator, E. Blauhorn 930,525
Loom, automatic weft replenishing, E. S. Stimpson 930,631
Loom, weft replenishing, H. W. Smith 930,425
Looms, change gear for mechanical, F. L. Wachtler 930,707
Looms, magazine for automatic weft replenishing, W. S. Southwick 930,812
Lubricator, G. B. Essex 930,462
Magnetic detector, J. Murgas 930,780
Mail bag catching and delivering apparatus, R. H. Hudson 930,964
Mail box, F. C. Bates 930,922
Mail chute, G. P. Burris 930,936
Match igniting composition, L. Stange 930,570
Match telescoping holder, B. H. McDonald. 930,406
Meat chopper, H. C. Sander 930,799
Meat, curing, J. C. Lincoln 930,772
Meat cutter, F. Bartz 930,920, 930,921
Meat holder, C. G. Blair 930,722
Mercuric salts with hexamethylene tetramin, manufacturing soluble compounds of, A. Busch 930,836
Metal bending machine, T. Kardong 930,969
Metal castings, manufacture of, P. Bohin 930,828
Metal fabric, expanded, N. E. Clark 930,350
Metal, producing rods, tubes, wire, etc., direct from molten, A. H. Pehrson 930,490
Metal sawing machine, C. A. Juengst, reissue 13,004
Metal strips in grooves, securing, Parsons & Carnt 930,413
Microtome, W. L. Patterson 930,686
Middlings purifier, L. A. Tator 930,504
Milk cooler, T. E. Dickson 930,358
Milking machines, pulsator for, D. Brown. 930,833
Miter box, C. L. Nystrom 930,684
Mixing machine, J. A. Svenson 930,573
Moistener for brooms and brushes, J. C. O'Donal 930,879
Molding appliance, W. H. Crum 930,844
Mop, floor, J. S. Hoover 930,546
Motor controlling device, electric, C. D. Knight 930,603
Motor driven twisting element for spinning, doubling, and twisting machines, S. Z. de Ferranti 930,850
Motors, operating multistage prime, P. G. Schmidt 930,564
Mower, lawn, E. M. Stapleton 930,428
Mowing machines, swather for, S. A. D. Riley 930,617

Music player action valve, automatic self-adjusting pneumatic, E. B. Hough..... 930,476
Musical instrument, F. X. Audet..... 930,825
Musical instruments, registering and recording means for, B. S. Dean.....930,738, 930,739
Nozzle, M. Warren 930,444
Nurling tool, A. W. Graham 930,662
Nut cracker, H. M. Quackenbush 930,796
Nut lock, W. M. Smith 930,806, 930,808
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Obstetrical pad, M. H. Topping 930,439
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Oil pan and candle holder, T. Cohn..... 930,592
Open welt guide, W. Gibson 930,469
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Parachute, T. L. Zook 930,452
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Pasteurizing and cooling process, J. Willmann 930,910
Peanut feeding mechanism, B. M. Davis... 930,736
Pen, W. von Bolton.....930,930 to 930,932
Phonograph, J. C. Nuernberg 930,683
Photographic prints, compound for the treatment of, C. B. Waite 930,578
Photographing machine, F. M. Holmes..... 930,378
Piano, F. Leola 930,869
Piling, sheet metal, N. E. Marsh 930,487
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Pipe coupling, H. D. Robinson..... 930,692
Pipe coupling, McGrath & Buckbee..... 930,984
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Planter, potato, G. W. Nation..... 930,877
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Plastic composition, J. H. Mills..... 930,777
Plates, apparatus for the manufacture of tin or like, Stiner & Kehring..... 930,501
Plow blade, O. S. Jewett 930,763
Plows, attachment for wheeled, H. Westmeyer 930,447
Pocket knife, V. A. Johnson 930,548
Pole tip, J. Poul 930,795
Porous material, manufacturing a, Senn & Kluger 930,801
Power generating and distributing system, A. C. Eastwood 930,363
Powder grain, smokeless, H. Maxim..... 930,979
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Sewing machine needle thread take-up and controlling device, F. W. Merrick..... 930,980
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Sifting mechanism, N. E. Clark 930,349
Smoke consuming furnace, G. J. Slaline.... 930,423
Smoothing iron, electric, A. O. Whitmore.. 930,638
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Steam and analogous system, low pressure, B. R. Doody 930,650
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