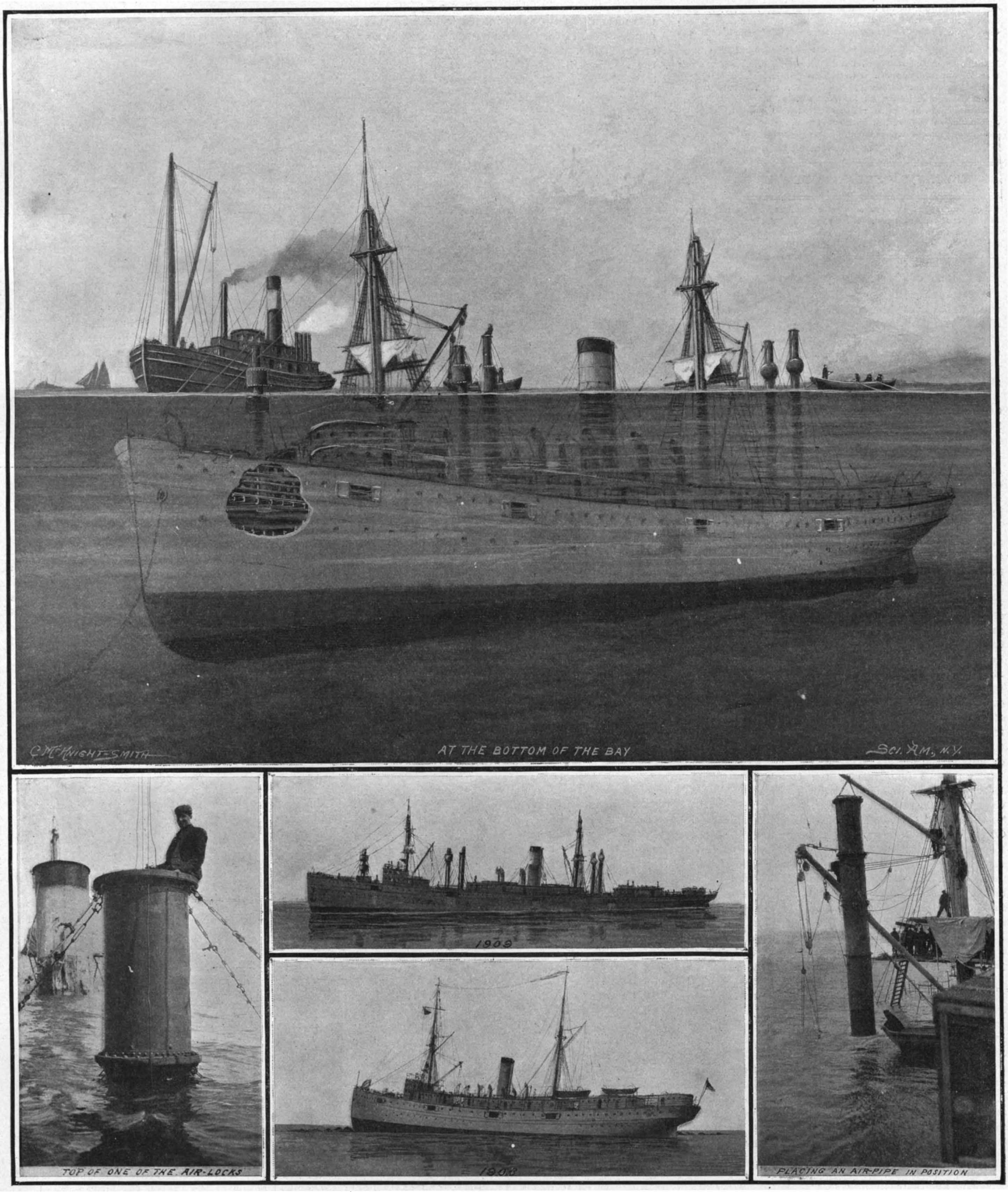
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1909, by Munn & Co.]

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI.—No. 22. ESTABLISHED 1845. NEW YORK, NOVEMBER 27, 1909. [10 CENTS A COPY $3.00 A YEAR.



The old method of salvage was to close the rents in the hull and pump out the water. By the new method the ship is rid of water by forcing compressed air into the holds and displacing the water.

SALVAGE OF THE U. S. S. "YANKEE" BY COMPRESSED AIR.—[See page 388.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

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

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

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

MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, NOVEMBER 27th, 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.

PRESENT CONDITIONS ON THE PANAMA CANAL.

A careful reading of the Annual Report of the Isthmian Canal Commission, now before us, warrants the statement that, save for some extensive and troublesome slides in the Culebra cut, the whole of this great work of engineering and administration is prosecuted without mishap, and with every prospect of its completion by the year 1915.

During the year the designs for the upper locks at Gatun and the locks at Pedro Miguel were completed. The locks are built in pairs, separated by a solid wall 60 feet thick; they are 110 feet in width, and have 1,000 feet of usable length. They will be emptied and filled through lateral culverts under the floors, connecting with large longitudinal culverts in the side and center walls operated by Stoney valves. In all plans for the canal, it has been laid down as a fundamental feature of design that at each pair of locks there must always be two barriers separating the high level from the level next below. The extra or collision barrier consists of a set of hinged, vertical, mitering gates, and a massive chain barrier controlled by capstans in the walls. As over 95 per cent of the vessels of the world are less than 600 feet long, intermediate gates have been introduced, dividing the lock chambers into two parts, suited to vessels 550 and 350 feet in length respectively. The intermediate gates are also protected by a chain barrier. An emergency dam, which will cut off the flow of water in the event of a gate being carried away, will be provided at the head of the locks. The design consists of a swing bridge, from which girders, supporting specially designed wickets, are lowered, the bottom of the girders resting on sills at the bottom of the lock.

The various materials of the foundations for the locks have been tested by trial loads, and found to have sufficient resistance to carry safely the greatest loads that will be brought upon them by the structures. Curtain walls will be built to stop any underflow; and to prevent the concrete floors being lifted by the pressure of any water which might gather below them, they are being thickened and anchored down to the underlying sandstone by the old rails left from the French administration. The plant for the rock crushing and the mixing of the concrete is installed and in successful operation. Concrete laying has commenced, and by the last of October 41,236 cubic yards had been put in place.

Reference is made in the report to the sensational rumors of bad slides which were sent out at one time from Panama. They were occasioned by a subsidence of no consequence whatever, which occurred to one of the rock fills at the toe of the Gatun dam. It is admitted that the most practical question in the construction of the dam is the sliding of the material underneath and in the body of the dam. The question of its sliding depends upon the slope of its outer face; and since the dam, which has a height of 115 feet above sea level, has more than a mile of horizontal thickness at its base, the Report is certainly justified in stating that the stability of this great work goes far beyond the limits of what would be considered sufficient and safe in any less important structure. The excavation for the spillway in the center of the dam is completed, and the channel below the dam, 960 feet long and 285 feet wide, is being concreted.

The dredging fleet has removed from the channel between the Gatun dam and deep water in the Caribbean Sea, a total of over 6,000,000 cubic yards, and at the present time some three miles of the channel from deep water (41 feet at mean tide) have been completed. Limon Bay, through which the entrance to the canal will be made, is exposed to strong winds and heavy seas. To protect the entrance channel, two breakwaters, one 10,000 and the other 3,500 feet in length, are to be built.

In the central division, including the basin at Gatun Lake and the great Culebra cut, progress has been very satisfactory. Although the Report covers the year only up to June 30th, we may add that on October 23rd, when 39,022,299 cubic yards had been excavated, the work that remained to be done in the Culebra cut when the Americans took over the work was half completed. Including the work done by the French, this means that two-thirds of the whole work has been done. Slides in the Culebra cut continue to be a source of annoyance. One of these measures 2,700 feet along the cut, and involves about 27 acres of moving material. Already 677,000 yards have been removed, and as much more is still in motion. There are smaller slides which bring up the total amount of material in motion to 1,000,000 cubic yards. These slides will necessitate easier slopes to the cut at the points where they occur, and will add to the total yardage; otherwise they will have no effect upon the canal.

In the Pacific division, the locks at Pedro Miguel are founded on durable rock of such excellent character that a part of it will be left in place to form the separating wall between the lock chambers. The excavation for the locks is practically complete. The West dam is being constructed of rock and earth with puddled clay as a center, and the material underlying the dam is impervious. At Miraflores about one-half of the excavation for the lock has been completed, and the general plans for the dams have been approved.

Excellent progress has been made on the entrance channel on the Pacific, from which during the year 8,475,931 cubic yards was removed. The channel has been carried to full depth for about five miles from deep water.

Due mainly to the great increase in the dimensions both of the prism of the canal and of the locks, and to the higher cost of labor and materials, the estimate of the total cost of the completed work shows an increase over the original estimate of nearly fifty per cent. The total cost of engineering and construction will be $297,766,000, and if the purchase price and the cost of sanitation and civil government be added, the total final cost will be brought up to $375,201,000.

THE TRIALS OF THE BATTLESHIP "NORTH DAKOTA."

The government acceptance trials of the battleship "North Dakota," of which we gave a preliminary account in our issue of November 13th, have now been successfully completed, with results which are gratifying alike to the Navy Department and the builders of the ship.

When the question of installing turbines in place of reciprocating engines in the new warships of our navy first came up for discussion, the attitude of the Bureau of Steam Engineering was decidedly conservative. The Department felt that sufficient experience was not available with the turbine, at least under battleship conditions, to warrant its immediate adoption at the time it was proposed. Ultimately, however, it was decided to install the Curtis turbine in one of the two battleships authorized by Congress in March, 1907, and to equip the sister ship with standard marine reciprocating engines.

Now that the trials both of the "Delaware" and the "North Dakota" have been completed, it is possible to make a reliable comparison of the two types of engine, and it is gratifying to know that on every point of comparison, except those of water consumption and propeller efficiency, the turbine has shown its superiority. In the standardization trial the "North Dakota" ran her fastest mile at a speed of 22.25 knots, and made an average speed for the five runs of 21.83 knots. She showed a maximum horse-power for one mile of 35,150. In these trials she exceeded the mean speed of the "Delaware" by 0.39 knot, and her turbines developed over 5,000 more horse-power. The results of the three hours' full-power trial, and the runs for twenty-four hours respectively at 19 knots and 12 knots, as herewith given, are highly satisfactory. Aside from the fact that she attained a full-power speed of 21.64 knots against the contract requirement of 21 knots, the most satisfactory feature is the remarkably low coal consumption of the ship, particularly at low speed—for one of the most serious charges formerly made against the turbine was that of its extravagance in coal consumption under low-speed conditions. The coal per horse-power per hour for the total horse-power worked out at 1.68 pounds at full speed; at 19 knots speed it was 1.58 pounds; and at 12 knots it was 2.34 pounds. The coal per horse-power per hour of an equivalent indicated horse-power (the power was taken by torsionmeter from the propeller shaft) works out for the three speeds, respectively, as 1.55, 1.46, and 2.15 pounds per horse-power per hour. With the ship at her maximum displacement, the steaming radius of the "North Dakota" would therefore be 3,000 knots at 21½ knots, 4,600 knots at 19 knots, and 9,000 knots at 12 knots speed. Compared with the reciprocating-engine-driven "Delaware," the turbine-driven "North Dakota" required only 295 as against 315 tons of coal per twenty-four hours on the 19-knot trial, and 105 as against 111 tons on the 12-knot trial.

OFFICIAL TRIALS OF THE "NORTH DAKOTA."

	3 hours of full power trial.	24-hour trial at 19 knots.	24-hour trial at 12 knots.
Actual average speed	21.64	19.24	12.05
Revolutions per minute.....	280.4	231.9	143.2
Shaft H.P. of main turbines.	31,400	16,710	3,800
I.H.P. of engineer's auxiliaries	1,100	660	400
Water rate of main turbines only	13.6	14.2	20.5
Water rate for all engineer's purposes based on total H.P.....	13.96	15.29	22.3
Coal used, pounds per hour	54,400	27,550	9,820
Coal used, tons per 24 hrs.,	583	295.3	105
Coal per hour per shaft H.P. of turbines	1.74	1.65	2.58
Coal per hour per shaft for total H.P.	1.68	1.58	2.34
Coal per hour per shaft of equiv. I.H.P.*	1.55	1.46	2.15

Based on 8 per cent friction for reciprocating engine.

	Specified in Contract.	Actual.	Saving, Per Cent.
3 hours of full-power trial..	15.1	13.96	7.5
24-hour 19-knot trial.....	16.1	15.29	5.0
24-hour 12-knot trial.....	23.2	22.3	3.9

The "North Dakota" is driven by two Curtis turbines, the pitch diameter of whose moving buckets is 144 inches. There are nine stages for going ahead and two for going astern. The shaft diameter is 30 inches, and the bearings at each end of the turbine are 21 inches in diameter by 42 inches long. The steam, superheated fifty degrees, enters the steam chest at a pressure of 280 pounds absolute. Here it passes through twenty nozzles, where it is expanded and acquires a velocity of 2,000 feet per second, its pressure falling to 75 pounds absolute. It then passes through another set of nozzles between the first and second stage, where it acquires a velocity of 1,070 feet per second, leaving the blades with a velocity of 155 feet per second. The pressure in the second stage is 49.4 pounds absolute. From the second to the eighth stage the entrance velocity of the steam remains at 1,070 feet per second, and the exit velocity at 155 feet per second. The pressure, however, drops from 75 pounds in the first stage to one pound absolute in the ninth stage, at which pressure it passes to the condenser, where a vacuum of 28½ inches is maintained. It can thus be seen that as the steam traverses the successive stages, there is a continual drop in pressure, the energy of the steam being delivered to the moving blades in the form of impact, the velocity of which is developed by expanding the steam in series of nozzles forming the entrance to each stage. The number of nozzles increases from 20 in the first stage to 360 at the sixth stage. The buckets in the first stage are 1¼ inches in length, and they increase to a length of 12 inches in the last stage.

In the two stages of the reverse turbine, it has proved possible to develop about 60 per cent of the power that can be developed on the go-ahead turbines, and thus the objection which has been raised against the turbine that it provides insufficient maneuvering power may be considered to be pretty well met. In this connection it may be mentioned that in the trials of the Japanese cruiser "Ibuki," which is equipped with turbines of this type, when the ship was steaming at 20 knots, it was possible in reversing to stop the starboard turbine in 32 seconds, the port turbine in 25 seconds, and bring the vessel to absolute rest in two minutes.

The ancient Romans commonly wrote with a metal point (stylus) on wooden tablets covered with wax (tabulae), but permanent records were written on parchment with a reed pen and liquid pigment, or ink. At Haltem in Westphalia, near the site of the Aluso fortress erected by Drusus in the year 11 B. C., was recently found a bronze vessel containing a dried black mass, which Prof. Kassner has decided to be Roman ink. The mass was found to consist chiefly of soot and tannate of iron. It also contained smaller quantities of ferric oxide, copper oxide, clay, magnesia, gypsum, phosphoric acid, carbonic acid, alkalies, and sand. These ingredients probably represent chiefly accidental impurities which have found their way into the old inkstand, but some of them may be due to the chemical action of the ink on the bronze vessel. The presence of an aromatic substance suggests that the ink was imported from Italy, where the use of perfumed ink was common.

ELECTRICITY.

The Electrical Show which was opened last week in Boston was the first of its kind in New England. It was the result of co-operative action on the part of a number of large manufacturers. Unlike other exhibitions, there were no articles for sale. The decorations were unusually artistic, and the exhibition was an unqualified success.

The first single-phase electric railway in Norway has recently been built, connecting Thamshaven and Lokken. It derives its current from a hydraulic generating plant near Thamshaven, which generates three-phase current at 15,000 volts. This is converted into single-phase current at 6,000 volts for use on the electric railway. The line was built for the purpose of developing ore deposits in the region and for the convenience of tourists.

A novel electric arc lamp has recently been designed, in which the carbons are formed out of plastic material in the lamp itself. The lamp is provided with two receptacles in which the plastic material is placed, and this is fed through tubes to form the two electrodes of the arc. The ends of the electrodes are baked by means of electric heating coils, and the process is a continuous one. The gas generated as the material is heated is utilized to press the material into the electrode-forming tubes.

It is customary in Europe to place a netting under high-tension lines at railroads and important street crossings. As a further protection at such points, an inventor has recently devised a safety suspension in which the line is divided into three parts at the crossings and supported on three insulators, any one of which will bear the entire weight of the line at that point in case the others should be fused or broken. The German Post Office Department has approved of this system, and permits its use at crossings.

Governor's Island, New York, is to be provided with an electric fire-fighting plant. Heretofore there has been no apparatus for fighting fire except that carried by the small ferryboat that plies between the island and the Battery. Not long ago a fire took place while the boat was on its way to Manhattan, and before its return much damage was done. This demonstrated the necessity of providing the island with a fire engine of its own. The equipment that is to be installed consists of a turbine pump throwing a four-inch stream and operated by an electric motor.

The Canadian government has been petitioned to allow a Canadian power company to build a dam across the St. Lawrence River near Cornwall. This concern is associated with an American company. It is their plan to dam the South Sault channel at first, to obtain 65,000 to 70,000 horse-power. Later it is expected that a dam will be built across the main channel. This dam would not interfere with the Cornwall Canal. However, the plans provide for the building of a lock, through which at a single lift of 40 feet vessels could pass the rapids.

The work of extending the electric zone of the New York Central Railroad as far as North White Plains is proceeding quite rapidly, and it is expected that by the first of the year it will be in full operation. The temporary terminal at Wakefield, where steam and electric locomotives are interchanged, will then be abandoned. A new sub-station is being erected at Tuckahoe, and another one at White Plains. Each will be equipped with three 1,000-kilowatt rotary converters and nine single-phase transformers of 375 kilowatts capacity each.

Working on the theory that earthquakes are preceded by an electro-magnetic disturbance, an Italian scientist has devised an instrument which gives warning that an earthquake is about to occur a few minutes before the disturbance is felt. With this instrument the inventor, Padre Maccioni, received warning of two earthquake shocks that occurred about ten miles from his laboratory four minutes before the earth waves affected the seismograph. The instrument is connected to a clock, and is so arranged as to record the time elapsing between the arrival of the electro-magnetic wave and the seismic waves.

One of the drawbacks to using Roentgen rays to photograph living subjects has been the fact that a time exposure was required. In order to overcome this difficulty, a German inventor has devised an induction coil which produces one sudden and very intense spark, and this makes it possible to take an instantaneous radiogram. The effect is produced by using a fuse in place of the interrupter in the primary circuit, and this is melted when the proper intensity of the current is reached, thus very suddenly breaking the circuit and producing an intense discharge. The exposure is from 1/50 to 1/120 of a second; and as it is a simple matter to replace the fuse, a large number of exposures can be made in the course of an hour. The fuse consists of a small silver or copper wire.

SCIENCE.

The United States Geological Survey reports that in 1908 California produced $18,761,559 in gold, 1,647,278 ounces of silver valued at $873,057, and 706 ounces of refined platinum valued at $13,414. This platinum was all produced at placer mines in Butte, Humboldt, Siskiyou, Trinity, Calaveras, Sacramento, and Del Norte counties, three-fourths of it having been mined in Butte County.

On the suggestion of Prof. Tissot, of France, an international commission has been organized for the purpose of transmitting wireless time signals from stations suitably located on coasts and islands to vessels navigating all waters. The establishment of this system would make the determination of longitude at sea very accurate and independent of the errors of the chronometer, which, indeed, would become superfluous. For transmitting the time signals Tissot recommends the wave length of 1,800 meters, or about 5,900 feet, which is used at the Eiffel tower station.

Eusapia Paladino, the Italian spiritualistic medium, who recently arrived in this country, has given some evidence of her powers. The phenomena of her first *séance* were the familiar physical phenomena of spiritualism. That is, they consisted of table rappings and levitations. Although considerable skepticism prevails as to the honesty of the medium, it must be admitted that she has not been latterly detected in fraud. Many years ago she was caught in petty tricks, which have by no means thrown her into discredit, because they seemed to have been due to involuntary actions in the trance condition. Whether or not her more recent performances are genuine, we are not prepared to state. Certain it is, that her performances should be studied with scientific care.

Last year a small lot of shelled corn of a kind new to this country was sent to the Department of Agriculture from Shanghai. It proved to have qualities that may make it valuable in breeding a corn adapted to the hot and dry conditions of the Southwest. The plants raised in the test averaged less than six feet in height, with an average of twelve green leaves at the time of tasseling. The ears averaged 5½ inches in length and 4 1/3 inches in greatest circumference, with sixteen to eighteen rows of small grains. On the upper part of the plant the leaves are all on one side of the stalk, instead of being arranged in two rows on opposite sides. Besides this, the upper leaves stand erect instead of drooping, and the tips of the leaves are therefore above the top of the tassel. The silks of the ear are produced at the point where the leaf blade is joined to the leaf sheath, and they appear before there is any sign of an ear except a slight swelling.

It is not an uncommon thing for corrosion and oxidation of bright steel objects to be caused by the presence of injurious substances in paper. This may be due either to free acids or chlorine compounds, or more frequently, especially in the case of hard-sized paper, to the excessive use of aluminium sulphate, which is gradually dissociated by atmospheric influences. Another drawback associated with certain kinds of paper is the blackening (due to formation of sulphide) which it produces on articles of silver or copper. Owing to the growing use of paper of wood pulp prepared by digestion with sulphur compounds this blackening action is more prevalent now than formerly. In fact, it is asserted by Herr Klemm, in a recent investigation of this subject, that most, if not all, unbleached wood pulps of the sulphite and sulphate class contain traces of sulphur compounds that have a blackening action upon silver or copper; and that even bleached pulps may contain minute quantities of similar substances. Unbleached pulps prepared by the caustic soda process and mechanical wood pulps, however, are generally free from these sulphur compounds.

Capt. Roald Amundsen, the discoverer of the Northwest Passage, arrived in the United States recently. Capt. Amundsen has come here to make preparations for an expedition to the Arctic which he calculated would keep him away from civilization probably more than five years. His primary object will be to explore the ocean depths of the region, to study the currents and temperatures and the character of the ocean bottoms. He will start from San Francisco in July, 1911, in the 400-ton gasoline auxiliary schooner "Fram," which was used by Nansen in his trip to the North. The Norwegian government has put up $20,000 for the expedition and there have been many private subscriptions from well-to-do Scandinavians interested in polar exploration and desirous of having their own people win the glory of discovery. Capt. Amundsen says his calculations in regard to the drift of the "Gjoa" were verified by events, and that he believes that the "Fram" will take the course that he is confident the drift will force her to take. He can assist in making that course pretty nearly across the pole by the use of his gasoline engine at periods when the pack will permit him to steer.

AERONAUTICS.

On October 23d, M. Bleriot made two flights with his monoplane of 22½ and 17 minutes duration at Vienna. After the first flight he was presented to the Austrian Emperor, who was greatly interested in his machine. From Vienna M. Bleriot went to Bucharest, and made some flights before the King of Roumania.

Recognizing that in order to see flights by the daring French aviators substantial cash inducements must be offered, the people of Los Angeles, Cal., have raised $50,000 for prizes to be competed for by leading aviators of France and America at an aviation meeting to be held on the Pacific coast in January. Paulhan, Delagrange, and several other of the French aviators have agreed to compete, according to cable dispatches.

Before leaving New York for their home in Dayton, Ohio, a few days ago, Orville and Wilbur Wright entered the French consul's office in New York late one afternoon and received from France's representative crosses and diplomas of the Legion of Honor. Not until several days later did Miss Katharine Wright accidentally discover in one of her elder brother's pockets the decoration that is so much prized and sought after by distinguished men here and abroad. So engrossed was he in business relative to his aeroplanes that he had forgotten to mention it to his sister.

The flying of model aeroplanes for prizes, which has been done almost weekly for some time past at the meetings of the Aeronautic Society, has been taken up by quite a number of boys in New York city, who have made some excellent records at this interesting and instructive sport. Contests are held weekly under the auspices of the West Side Y. M. C. A., where Wilbur R. Kimball, E.E., is giving a course of lectures upon aeronautics. Cups have been given as prizes by Mr. Louis R. Adams and by Mr. Wilson Marshall, whose 12-year-old son, Wilson Marshall, Jr., has won two legs of the Adams trophy with a biplane model of the Wright type. Propelled by a rubber band motor, this model, the planes of which are about 3 feet long, covered 64 feet 9 inches in its longest flight.

Although Farman and Paulhan have quite frequently taken their wives on flights in their Farman biplanes, neither of these ladies has essayed to fly alone. It has remained for the Baroness de la Roche to become the first aviatress. After receiving several lessons from M. Chateau, the instructor employed by the Voisin Frères at Chalons, the Baroness made a short initial flight of about 300 yards. The following day this titled lady flew twice around the parade ground—a distance of about 4 miles—in a rather gusty wind. After the first few turns she was able to fly the machine without any trouble whatever, and seemed to have the biplane under perfect control. This flight gave a good demonstration of fairly good automatic stability secured in the Voisin machine by the use of vertical partitions between the main surfaces and in the tail. In America a Curtiss biplane is reported to have been sold to a wealthy lady in Florida.

The "Parseval III." airship, which has been at the Frankfort Aeronautical Exposition the past summer, made a grand tour above south Germany from October 12th to 16th, in the course of which it passed over Nuremberg, Augsburg, München, and Stuttgart. The 135 kilometers (83.8 miles) from Nuremberg to Augsburg *via* Treuchtlingen, Mannheim, and Donauwörth was covered in 3¾ hours at an average speed of 22 1-3 miles an hour. On the return journey in a straight line on October 14th, however, the airship is said to have covered about 37 miles in an hour. This very much greater speed on the return journey was perhaps due to more favorable conditions and to the forcing of the airship at its limit of speed throughout the shorter distance. That its speed is superior to that of the "Zeppelin" has been testified to by a well-known American aviator who took a trip in the latter last summer and said that the "Parseval" readily passed it; although the "Zeppelin" airship made but 25 miles an hour according to his timing.

Herr Hans Grade, the first German aviator to fly successfully with a monoplane of his own invention, and whose machine was shown in flight in our issue of October 23rd, has at last won the Lanz prize of $10,000 for the first kilometer flight by a German-built and piloted aeroplane. After first performing the required flight in 3 minutes 31 seconds above the Mars field at Bork on October 17th (besides which he made three other flights of 6 minutes 20 seconds, 48 seconds, and 2 minutes 20 seconds on the same day), Herr Grade took his monoplane to the aviation field at Johannisthal (where the flight for the prize was required to be made) and won the prize in short order on the 30th ultimo. The following day he made three flights of 3¾, 14½, and 5 minutes' duration respectively, and a fourth flight in which he made one circuit of the field. The motor used by Herr Grade is a 4-cylinder, V-type, air-cooled motor of his own invention, which develops 24 horse-power and weighs 77 pounds. It makes 1,200 to 1,400 revolutions per minute and carries the propeller upon its crankshaft.

SALVAGE OF THE UNITED STATES CRUISER "YANKEE" BY COMPRESSED AIR.

The present attempt to raise the United States auxiliary cruiser "Yankee" is the first application to a United States warship of the method of salvage by compressed air used by Mr. John Arbuckle. The system has already proved its efficiency in the case of the raising of the steamship "Bavarian," of 12,000 tons, after she had run upon the rocks in the St. Lawrence River.

In both the old system and the new, the raising of a sunken vessel is accomplished by removing sufficient water from the hull of the ship to give the necessary buoyancy for flotation. Under both methods, the space within the ship that is rid of this water is filled with air; but there is this important difference, that under the ordinary method the air is at atmospheric pressure, whereas under the Arbuckle method it is under a pressure equal to the depth of the hold or compartment from which the water is driven out.

In raising ships, it has been customary to send down divers who, by means of patches of plating, plugs, wooden caissons, cement, etc., attempted to patch up the hole in the hull, and render the ship fairly tight. When these repairs had been completed, powerful pumps were installed upon the ship, or upon wrecking vessels moored alongside, and sufficient water was pumped out to lift the ship off the rocks and enable her to be towed to the nearest drydock.

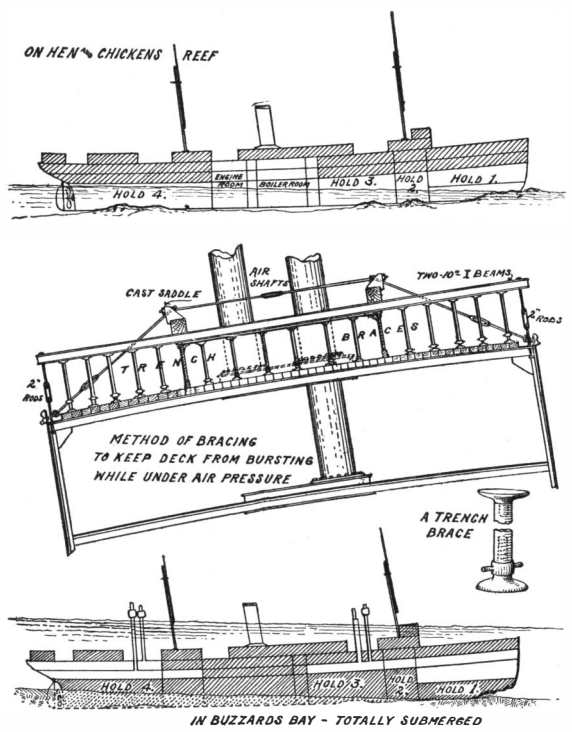
It frequently happened, however, that the perforations of the hull were so many or of such extent, sometimes large portions of the bottom being torn entirely away, that salvage by the pumping method was practically impossible. This was due largely to the fact that the patchwork—plugs, canvas, cement, and what-not—was exposed to an inward pressure corresponding to the depth of the injured portion of the ship below water, which pressure was so great as to exceed the resisting strength of the temporary repairs.

It occurred to Arbuckle a few years ago that there was no reason why the compressed-air method, as used in driving tunnels below the East and Hudson rivers, should not prove effective in the salvage of sunken ships; for, if the mud, silt, and water can be held from entering the open end of a tunnel by opposing against it an air pressure equal to the water pressure at that level, it seemed probable that the water could be expelled through the perforated bottom of a ship, and held permanently at the level of this perforation, by the same use of compressed air.

Although it necessitates some exceedingly difficult engineering work and the exercise of considerable ingenuity, the method by which the compressed air is used for freeing the ship of water is simple and easily understood. No attempt is made to close the perforations in the bottom of the hull, but great care is taken to render airtight the sides and roof of the various holds and compartments. Air-supply pipes are led into the various compartments, and compressed air is forced in and the water gradually expelled through the bottom, until the level of the water in the various holds has been driven down to the highest point at which the hull has been perforated. It is evident that as long as the air pressure is maintained, the water cannot re-enter. By estimating the capacity of the compartments thus treated, and knowing the weight of the vessel, it is possible to free the ship of the exact amount of water to bring her to the surface and make her float at some predetermined draft.

The "Yankee" is one of four merchant ships built between 1890 and 1892, which were purchased during the war with Spain and transformed into auxiliary cruisers. Latterly she has served as a torpedo supply ship. She is 392 feet long, 48 feet 4 inches in breadth, and draws 20 feet of water on a displacement of 6,225 tons.

In the autumn of 1908 she was run upon the Hen and Chickens Reef at the entrance to Buzzard's Bay and badly wrecked, holds 1, 2, 3, and 4 being badly perforated, as shown in the accompanying diagram. The Navy Department endeavored to float the ship by the customary method of closing the holds and pumping, but failing to get her off, they abandoned their efforts, and called for bids by private wrecking companies. The condition of the ship was generally considered to be hopeless, and John Arbuckle was the only bidder. Operations were commenced on October 21st, 1908. The berth deck throughout the whole length of the ship was made thoroughly watertight, and the water was driven out of holds 1, 2, 3, and 4 by compressed air, the engine and boiler rooms being emptied by pumping. The vessel was floated after forty-five days of operations, and was being towed into New Bedford when, unfortunately, the weather became very boisterous, and a tug, in going alongside the "Yankee," was driven against the portholes of the room containing the air-compressing machinery and



In the two diagrams of the "Yankee" the portions of the ship from which the water was expelled are shown in white.

RAISING THE "YANKEE" BY COMPRESSED AIR.

stove them in, and the water flooded the compartment and stopped the compressors. The vessel slowly sank at a point one mile east of the Dumplings in Buzzard's Bay at the entrance to New Bedford Harbor, and lay in the position shown in our various engravings. The bow of the vessel was a few feet below the water, but the stern lay thirty feet below the surface.

In the new salvage operations, it was decided to leave the lower holds, the engine and boiler rooms, and the greater part of the gun deck full of water, and lift the ship by expelling the water from the upper portion of hold No. 1, from the whole of the berth deck, and from the after portion of the gun deck. Reference to the engravings will explain the conditions of flotation, the unwatered areas being shown in white. The first step was to make special steel hatches, fasten them securely in place and calk them thoroughly watertight. The gun deck being of steel, was sufficiently watertight in itself, but the after portion of the spar deck, being of wood and having comparatively little resisting strength against the upward pressure of the air, it became necessary to reinforce it strongly. This was done by placing above the spar deck and upon the deck house a series of 10-inch I beams arranged in pairs, which extended the full width of the vessel. At its outer ends each pair of beams was anchored down to the waterway at the side of the ship by 2-inch iron rods set up with turnbuckles. Upon the beams, immediately over the side walls of the deck house, two 12 x 12 timbers were placed parallel with the axis of the ship. Upon the outer edges of these beams were set special cast-iron angle blocks, which were tied together with 2½-inch rods. From each angle block on each side of the deck house a pair of 1½-inch truss rods was carried down and made fast to eyebolts which passed through the side plating of the ship and were held in place by nuts. Between the under side of the I beam and the spar deck was placed a number of trench braces, which were set up until they bore snugly against the spar deck, thereby serving to transfer the upward pressure of the air to the system of trussed I beams as above described.

The special steel hatches were provided with openings to which were coupled five large steel airshafts, which extended above the surface of the water and were provided at their upper ends with air locks. The wrecking plant consists of a large schooner, which is fitted up with living accommodations for the men; a big wrecking steamer, upon which is installed a compressor plant capable of delivering 5,000 cubic feet of free air per minute; a number of ship's boats, and a steam tug which makes regular trips between New Bedford and the scene of the wreck, two miles out in Buzzard's Bay. The difficulties of the work are greatly enhanced by the exposed position of the wreck, and there are necessarily many days when it is impossible to do any work.

These remarkable salvage operations have made excellent progress. The sections of the ship to be unwatered have been made airtight, the truss bridging over the spar deck is completed, and it is expected that very shortly, as soon as a favorable conjunction of wind and tides is presented, the "Yankee" will be brought to the surface and towed into drydock. Considering the great depth of water in which the ship lies, her salvage will be one of the most remarkable feats of its kind in the history of wrecking operations.

A GASOLINE ENGINE FOR CORN HUSKING.

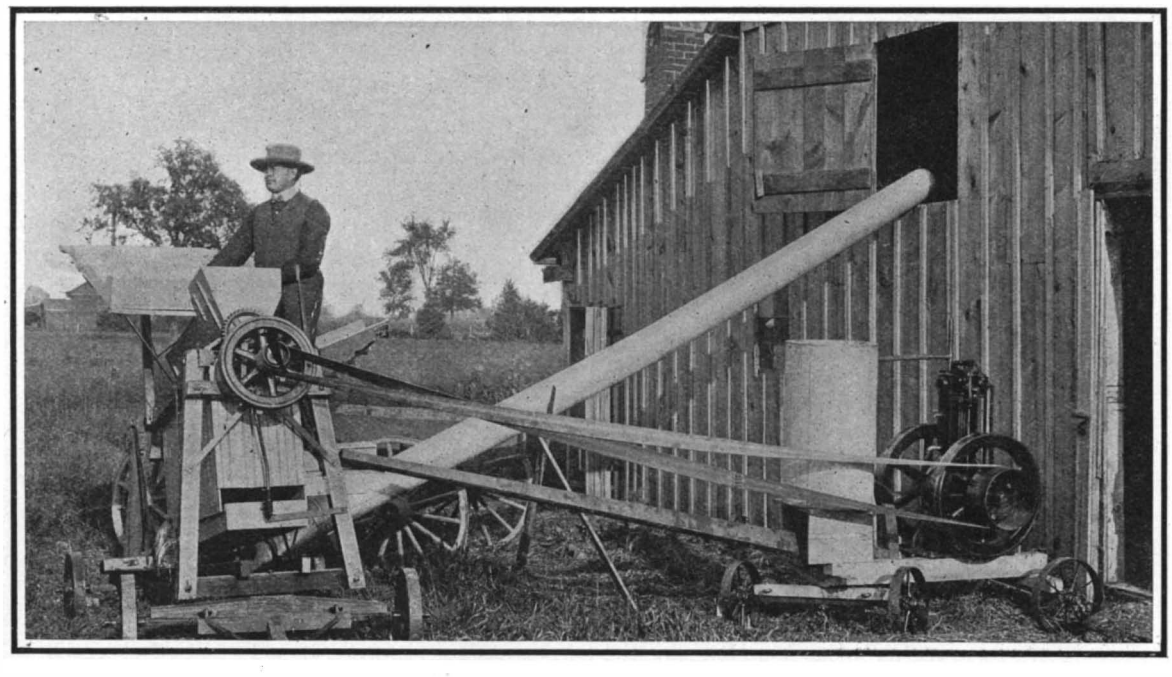
BY FRANK C. PERKINS.

At slight expense, by the development of the gasoline motor, the farmer is now enabled with modern labor-saving devices to do many times the amount of work formerly possible. The accompanying illustration shows the use of a small portable gasoline engine mounted on a simple four-wheeled truck in operation just outside of the barn, driving a corn husker by belt transmission.

Thousands of acres of corn are not cut up, but husked from the stalk, thus entailing an entire loss, except for the fertilizing value and a small amount of feed.

With a motor-driven husker located at the barn, it is a simple matter to "jerk" the stalk corn, a process which is speedier than husking, and to shovel it into the machine by which the ears are husked. The husks are blown to the mow or barge, made of wire fencing. They can afterward be baled and sold at a good price to mattress manufacturers, the husk alone netting a good profit, while the feeding or fertilizing value of the stalks is not materially lessened.

For operating the husking machine, only a four to six horse-power gasoline engine is required, while it is stated that hundreds of bushels of corn have been husked by a machine of this type with only a three-horse-power engine under favorable conditions. In central Ohio a four-roll machine has been able to husk 250 bushels in a day, requiring four teams and one extra man, besides the three men that operate the machine, with a cash outlay of twenty-five dollars per day. It is stated that one of these small husking machines operated by a light gasoline engine will handle the same 250 bushels at less than half the expense, or $11.50. This motor-driven husker is of the two-roll type, the rolls being four feet in length and large in diameter. It runs at high speed, thereby greatly increasing the capacity, which is about 20 bushels per hour, under normal conditions, but has been operated at over 30 bushels without difficulty. It is stated that the average run is from 7 to 10 shocks (12 hills square) per hour. The shredder head is composed of knives strung on a shaft 11/16 inch in diameter, held in position so that only one knife strikes at a time. The knives strike with a shear cut each 2½ inches on the stalk, leaving the blades in good condition.



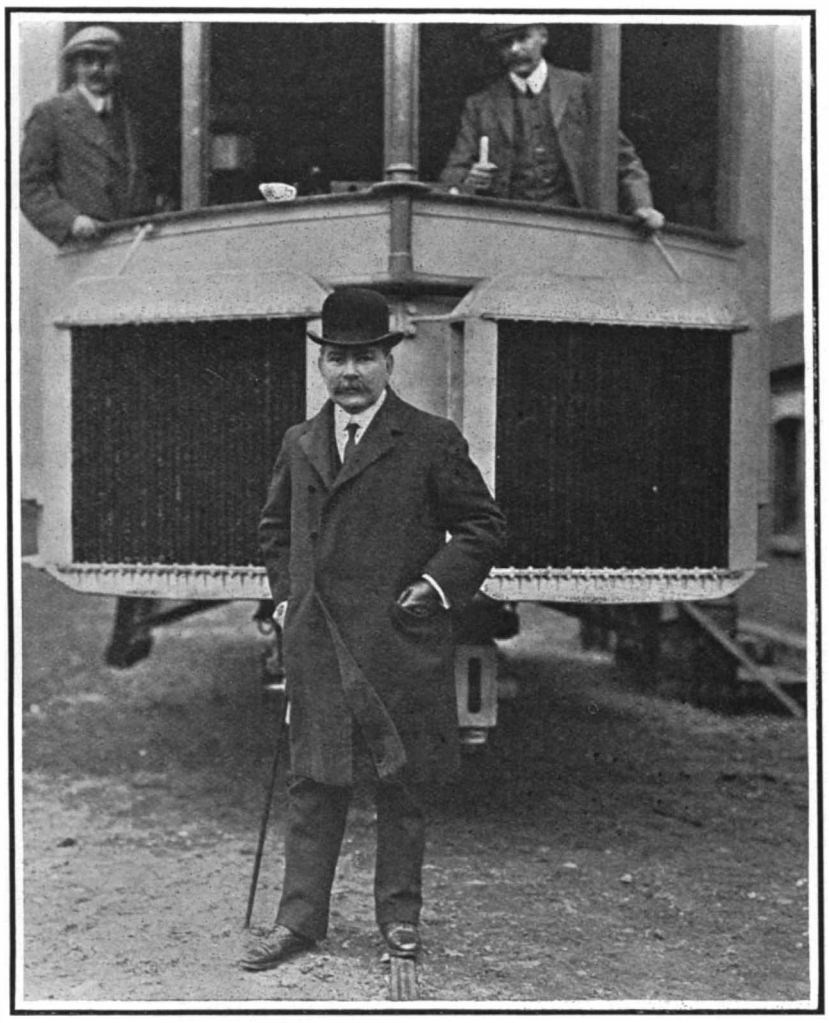
A GASOLINE ENGINE FOR CORN HUSKING.

The blower is arranged at the rear of the machine, so that all the stover must pass over the screen. About 16 feet of 9-inch pipe is connected to the machine. A bevel gear is used for driving the corn elevator, which

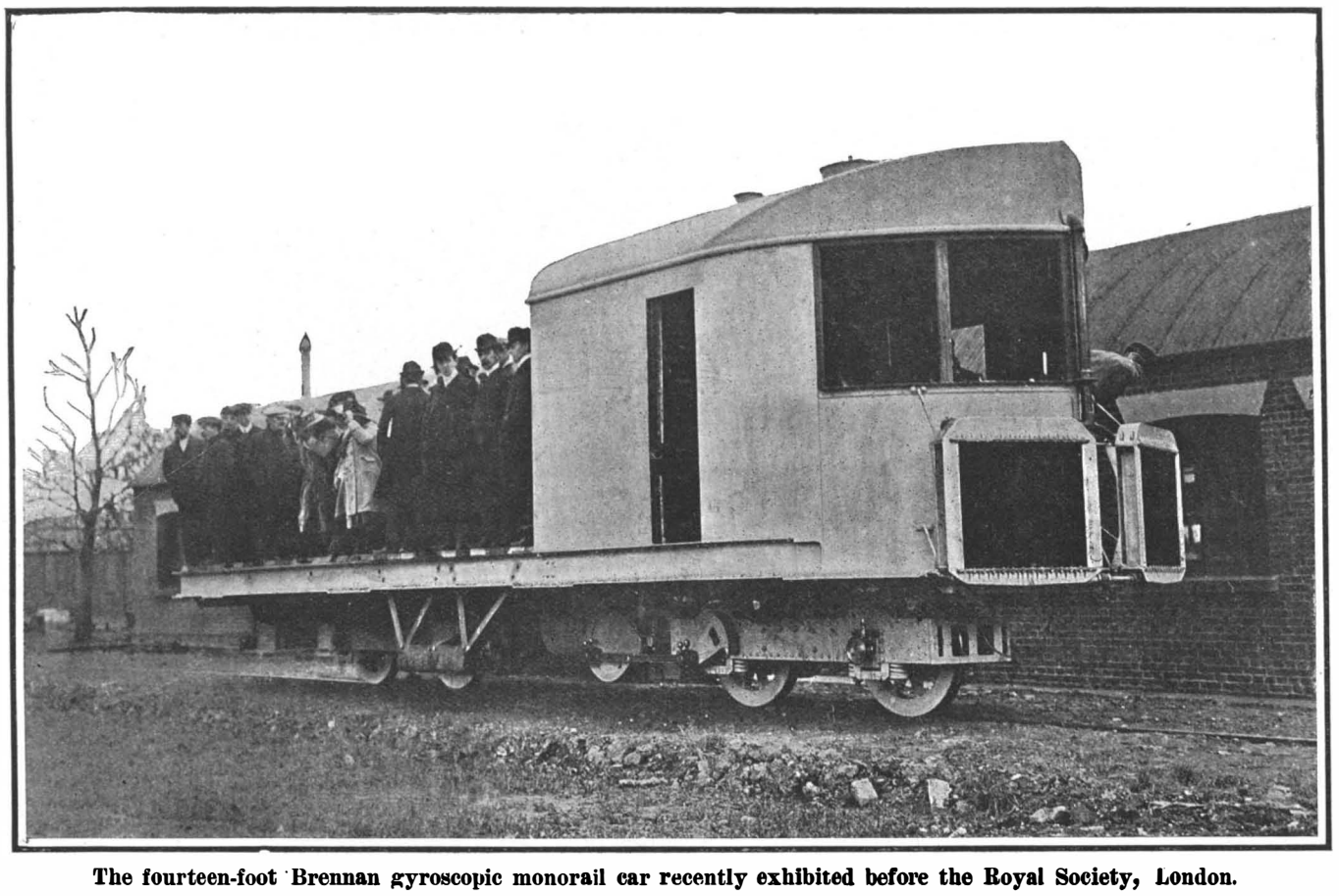
is so constructed that the receptacle for receiving the corn is out of the way, in driving up to the machine with a load. The power is disengaged as well as the rolls by the simple movement of a lever attached to a spiral plug.

THE GYROSCOPIC MONO-RAILROAD.

In the spring of 1907, Mr. Louis Brennan, inventor of the Brennan torpedo, exhibited before the Royal Society of England a small car which traveled on a single rail or cableway, and kept its equilibrium perfectly even while rounding curves and when its load was shifted from one side to the other. This feat, an apparent defiance of the laws of gravity, aroused a great deal of interest, and it was predicted that it marked a revolution in railroad practice. The car was kept in equilibrium by means of a pair of wheels, that were rotated at high speed in opposite directions. The gyroscopic effect of these rotating masses prevented the car from toppling over, in the same way that a top is kept from falling while spinning at high speed. Since the first exhibition of the gyroscopic car, Mr. Brennan has been at work developing details, which would permit of using the same principle on a much larger car suitable for carrying heavy loads. A couple of weeks ago Mr. Brennan's invention, now reduced to practical dimensions, was again exhibited before the Royal Society. The car was 14 feet long, 13 feet high, and 10 feet wide. weighing 22 tons. Carrying a load of 40 passengers, the car traveled on a single rail around a circular track 220 yards in circumference. The balance was perfectly kept by means of two gyroscopes weighing three-quarters of a ton each and revolving at a speed of 3,000 revolutions per minute. The wheels were incased and ran in a vacuum, so as to reduce friction to a minimum. A gasoline engine was used, to keep the gyroscopes spinning and also to propel the car. The car was subjected to the severest of tests, the passengers suddenly shifting from one side to the other in their endeavor to destroy the equilibrium, but the gyroscope wheels responded to the slightest disturbance, and restored the balance at once. One of the difficulties encountered in a car of this type is the precessional action accompanying the gyroscopic motion. This, however, was overcome by means of friction devices. The advantage of using a monorail is that the cost of construction is considerably less; but in addition to this there is the fact that a slight deviation from a true line would result in no damage, whereas when two parallel tracks are used they must both be kept perfectly parallel and in perfect alignment, otherwise the car will run off the track or will rock violently if one side dips below the other. In other words, a double-rail track is more difficult to keep in repair than two monorails, for the reason that the two rails are interdependent, and variation in one must not take place without a corresponding variation in the other. In rounding curves there is always danger of spreading the tracks where a double-rail track is used, while with the monorail line, should the side thrust be sufficient to shift the rail, there would be no tendency for the car wheels to leave the track. As yet the details of Mr. Brennan's latest model have not come to hand, but we expect in an early issue to give our readers a more complete description of this interesting type of railway.



Mr. Louis Brennan standing in front of his gyroscopic monorail car.



The fourteen-foot Brennan gyroscopic monorail car recently exhibited before the Royal Society, London.

THE GYROSCOPIC MONO-RAILROAD.

The Chemistry of Soldering Agents.

BY A. LIPPMANN.

The following summarizes the results of two years' practical experiments with soldering agents, chiefly those of the "soft" type which are suitable for electrical work, where it is necessary for the security of the service to keep within definite limits the resistance introduced and the heat generated at the points of junction. The requirements of mechanical strength, however, demand that the surfaces of contact of the wires shall be sufficiently extended to satisfy the condition of low electrical resistance, and when we consider that ordinary tin and lead solder has a specific resistance 10 or 12 times that of copper, it becomes evident that the chief function of the solder is not to conduct electricity but to protect and maintain the contacts of wire, and to preserve the copper surfaces from oxidation.

There is a traditional belief that hydrochloric acid and other acid soldering liquids should not be used in electrical work, because acid left on the joint by a careless workman may, especially during the passage of a current, give rise to secondary electrolytic actions which will in time destroy the connection. Investigation of many imperfectly soldered joints, however, has failed to indicate any injurious effect due to acids, and has revealed causes of very different character. In most cases of large wires traversed by strong currents, insufficient contact had caused overheating of the joint and fusion of the solder. In some instances the trouble was attributable to the formation of electric arcs between wires which were not held closely together by the solder.

No injury due to the employment of acids could be detected even in resistance coils. With the fine wire used in these coils injuries are far more likely to be caused by careless handling (overheating or burning during the operation of soldering) than by acids.

These considerations lead me to form a lower estimate of the injurious action of acid soldering liquids than is commonly entertained. The investigation in question was undertaken primarily to settle a dispute concerning the relative safety of two soldering liquids, of which one contained ammonium chloride and the other zinc chloride. The difficulty of deciding the question had been increased by the circumstance that an injurious action had been attributed to the hydrochloric acid contained in both soldering agents.

The first requirement for making a good connection by soldering is the presence of absolutely clean metal surfaces. If diluted hydrochloric acid is employed as a soldering liquid a good connection can be made between surfaces not originally quite clean. Many coppersmiths use dilute hydrochloric acid exclusively in fine art work. Experience shows that no injurious after effect need be feared if the soldered joints are well washed with water. The notion that hydrochloric acid is difficult to remove is disproved by the great volatility of the acid. Ammonium chloride (sal ammoniac) is inferior as a flux to hydrochloric acid, and also to zinc chloride and zinc ammonium chloride.

I made experiments in soldering with a preparation of ammonium chloride, to which ammonia was added, drop by drop. The efficiency of the soldering liquid visibly diminished as the proportion of ammonia increased. Soda lye, added to neutralization, made the liquid entirely unfit for use. Hence I attributed the good effect of ammonium chloride to the hydrochloric acid which is gradually separated in the operation of soldering. Experiment showed, however, that ammonium chloride does exert an injurious action on copper. When a mixture of ammonium chloride solution with glycerin was employed in soldering heavy copper cables to each other or to sockets, it was found almost impossible to prevent the liquid from penetrating between the wires of the cable. I examined many such joints two weeks, three weeks, and six months after soldering. In two weeks the wires of the core had become covered with a thick green coating of copper salt. I at first attributed the formation of this salt exclusively to the action of free hydrochloric acid, but Samter has shown that ammonium salts possess a remarkable power of forming complex combinations with copper.

Zinc chloride, zinc ammonium chloride and soldering soaps containing these salts may be regarded as the standard soldering agents. Zinc

(*Concluded on page 399.*)

Census of Dirigibles and Aeroplanes.

The well-known explorer and sportsman, the Prince Scipio Borghese, has presented to the Chamber of Deputies of Italy a tabulated statement showing the number of dirigibles and aeroplanes in existence in the world on September 30th. The former number 36; the latter, 76. In addition, 68 dirigibles are in course of construction. The number of machines first cited are divided among the different countries as follows:

	Dirigibles.	Aeroplanes.
France	9	27
United States	7	17
Germany	10	6
England	3	6
Belgium	1	5
Italy	3	2
Austria	..	5
Japan	1	3
Russia	2	1
Switzerland	..	2
Spain	..	2

The dirigibles are divided as follows into military and private ones:

	Military.	Private.
Germany	7	3
France	4	5
United States	2	5
England	2	1
Italy	1	2
Russia	2	..
Belgium	..	1
Japan	1	..

The census of dirigibles under construction is as follows:

	Military.	Private.
Germany	8	7
France	5	10
United States	4	7
England	4	1
Italy	2	3
Russia	4	..
Japan	2	1
Belgium	1	2
Austria	1	2
Spain	2	..
Switzerland	1	1

The number of aeroplanes which are known to exist are parceled among the different nations as follows:

France	27	Japan	3
United States	17	Switzerland	2
Germany	6	Italy	2
England	6	Spain	2
Austria	5	Russia	1
Belgium	5		

France, which possesses more than-one-third of the aeroplanes in existence, is therefore considerably farther advanced than the other nations in this respect.

The Life of the Infinitely Small.

A few years ago Prof. Metchnikoff ingeniously projected upon the screen the struggle of the red and the white corpuscles in the blood. The spectacle was highly entertaining, but unfortunately lasted but a few seconds, for which reason the application of the process was exceedingly limited.

Thanks to a new apparatus recently devised by Dr. Comandon, and exhibited before the Academy of Sciences by Prof. Dastre, the moving-picture machine is made to give an enlarged view of the small microbes in activity. Briefly stated, Comandon has devised a method of employing the ultramicroscope for the purpose of photographing microscopic life on a moving-picture film.

The ultramicroscope, which has been more than once described in the columns of the SCIENTIFIC AMERICAN SUPPLEMENT, is not essentially different from any other microscope, except in the method of lighting the object to be utilized. In an ordinary microscope the light passes through a glass plate which supports the object, and thence travels to the eyepiece. Infinitely small objects are literally drowned in this brilliancy, and are therefore invisible. Their luminous intensity is not sufficiently different from that of the ambient light. With such an ordinary microscope it is impossible to study objects smaller in diameter than one-half a micron—a micron being equal to the thousandth part of a millimeter. The ultramicroscope comprises the same arrangement of lenses as an ordinary microscope. Instead of illuminating the object from below and normally to the plane of the stage, the object is illuminated from the side or obliquely, so that the light rays fall only on the slightly elevated object, and therefore leave everything else in obscurity. This result is obtained by a simple system of prisms and lenses.

Without entering into technical details, it may be said that with an ordinary microscope the eye is transported into a chamber bathed with sunlight. With the ultramicroscope the eye is transported to a dark room traversed by a single ray of light, so that it renders visible dust particles which otherwise would be invisible if the room were regularly illuminated. Hence the ultramicroscope renders it possible to distinguish microscopic objects measuring not more than 1/100th of a micron in diameter, or 1/100,000th of a millimeter.

Comandon has succeeded in combining the ultramicroscope with the moving-picture machine to register upon a photographic film the life history of many infinitely small microbes. Among the more interesting films which were thrown upon the screen during Dr. Dastre's discourse before the Academy was one showing the struggles of the white and the red corpuscles in the blood. The red corpuscles appeared as black globules outlined with white, and the white corpuscles appeared as white splashes. The picture of the corpuscles filed past at the rate of 960 a minute, each having been taken in about 1/32nd part of a second. The moving picture film views appeared on the screen magnified from 10,000 to 20,000 diameters. An inch seen under these conditions would seem about as high as a six-story house. The ultramicroscope moving-picture machine will undoubtedly render excellent service in biology, because it will register certain phenomena which at present cannot be studied.

It may be stated without in the least detracting from the work of Dr. Comandon that similar results have been already obtained by an English naturalist, Mr. Mark Duncan. Furthermore, Mlle. Cheroton (the collaborator of Prof. Franck of the College de France) and M. Vies have also chromophotographically studied the segmentation of sea urchins' eggs in the biological laboratory of Rocsoff.

Ephemeris of Halley's Comet.

A letter has been received at Harvard Observatory from Father G. M. Searle, C.S.P., of New York, giving the following "Continued Ephemeris of Halley's Comet. T assumed to be Apr. 19 d. 692 G. M. T."

EPHEMERIS.

Gr. Mean Noon. 1909.	R. A. (1909.0) h. m. s.	Dec. Deg. Min.	Log.Δ	Br. (Sept. 11=1.)
December 1	4 27 54	+ 15 53.8		
December 3	4 19 47	+ 15 43.3	0.160	12
December 5	4 11 24	+ 15 31.7		
December 7	4 2 50	+ 15 19.0	0.148	13
December 9	3 54 8	+ 15 5.0		
December 11	3 45 20	+ 14 49.5	0.139	14
December 13	3 36 28	+ 14 33.2		
December 15	3 27 35	+ 14 15.9	0.134	15
December 17	3 18 45	+ 13 57.8		
December 19	3 10 1	+ 13 39.0	0.132	16
December 21	3 1 25	+ 13 19.7		
December 23	2 52 58	+ 13 0.1	0.134	17
December 25	2 44 45	+ 12 40.4		
December 27	2 36 48	+ 12 20.6	0.138	17
December 29	2 29 7	+ 12 1.0		
December 31	2 21 41	+ 11 41.9	0.145	18

Pseudo Blood Oranges.

It sometimes happens that a physician leaves absentmindedly in the tissues of his patient one of those fine needles which terminate the Pravaz syringe, be it by some wrong manipulation, or because of some awkward movement by the patient.

In such a case the treatment is very simple. One simply says nothing about it, and the patient does not notice it. The accident is of no consequence; the needle is not absorbed—of this there is no doubt—but proceeds leisurely through the tissues to some other point of the body.

Unfortunately it is not so much that trouble may arise by this behavior of Pravaz needles, and that pain may be caused thereby, as it is that they may be brought about *secundum artem*. We find an example in the Presse Medicale.

Blood oranges are often, it appears, "faked," at least in northern climes, where they command a higher price than the ordinary orange.

In order to transform these latter into blood oranges, certain "manufacturers" inject into the orange, through the rind, with the aid of a syringe provided with a fine needle, a solution of red aniline dye mixed with a saccharine solution. Now, recently, in St. Petersburg, a lady bought from a fruit merchant a dozen of these pseudo blood oranges. She gave one to her little daughter, but was distracted to find on putting the first piece into her mouth that she was attacked by a sharp pain in the region of the pharynx and spat blood. A physician being hurriedly called diagnosed the pain and hemorrhage as having been caused by a fragment of a needle which had lodged in the mucous membrane of the pharynx. When this fragment was extracted it proved to be a point of a Pravaz needle, in the eye of which was found a small remaining portion of aniline color.

On returning to the orange dealer, he revealed that the "dodge" is often resorted to in manufacturing blood oranges.—Cosmos.

Wireless Telegraphy in the Antarctic.

The new expedition which is being fitted out in England to go to the South Pole, it is proposed to maintain in communication with the civilized world during the entire course of its exploration. Wireless telegraph apparatus will be installed on the "Nimrod," the ship of the expedition, which will serve as a base, and other apparatus will be carried by the different exploring parties, so that they can remain always in communication, more or less directly, with New Zealand.

Uranium in the United States.

Uranium is found commercially in only two minerals in the United States, pitchblende and carnotite. Pitchblende, which is widely known because of its use as an ore of radium, occurs in quantity in the United States only in Gilpin County, Colo., where there are four mines that produce it. Carnotite occurs as a bright yellow powder in sandstones in Utah and Colorado.

Uranium minerals are radioactive, and their radioactivity may be tested by their effect upon a photographic plate, which will show shadows of metallic objects placed between it and a specimen of uranium mineral.

Uranium has not yet been put to many practical uses. It is said to be used in steel making in Germany. Uranium salts are used in iridescent glass and in pottery glazes, and uranium compounds are employed in chemistry and in medicine. A number of the uranium salts are violent poisons. Uranium and uranium salts were imported into the United States in 1908 to the value of $7,145, according to F. L. Hess, of the United States Geological Survey, whose report on uranium and other rare metals is published by the Survey as an advance chapter from "Mineral Resources of the United States, calendar year 1908."

Serviceability and Cleanliness of Alcohol.

Where the restrictions placed on the use of denatured alcohol are less stringent than those placed on the use of gasoline, or where safety and cleanliness are important requisites, the advantages to be gained by the use of alcohol engines in place of gasoline engines may overbalance a considerable increase in the fuel expense, especially if the cost of fuel is but a small portion of the total expense involved. Denatured alcohol will, however, probably not be much used for power purposes until it becomes as cheap as gasoline and until the equality of gasoline and alcohol engines in respect to adaptability to service required and quantity of fuel consumed per brake horse-power becomes more generally realized.

In regard to general cleanliness, such as absence of smoke and disagreeable odor, alcohol has many advantages over gasoline or kerosene as a fuel. The exhaust from an alcohol engine is never clouded with black or grayish smoke, as is the exhaust of a gasoline or kerosene engine when the combustion of the fuel is incomplete, and it is seldom, if ever, clouded with bluish smoke when a cylinder oil of too low a fire test is used or an excessive amount supplied. The odor of denatured alcohol and the exhaust gases from an alcohol engine are also not likely to be as obnoxious as the odor of gasoline and its products of combustion.

Wireless Telegraphy in Airships.

The German airship "'Gross II." is provided with wireless telegraphic apparatus. According to newspaper accounts, good results have also been obtained with wireless apparatus on the "Zeppelin III." This announcement is especially gratifying, because doubts had been expressed concerning the advisability of attempting wireless communication with Zeppelin airships, on account of the danger of fire. The Zeppelin airship, unlike those of Parseval and Gross, has a metallic skeleton which is a good electrical conductor, and it is also exposed to the danger of an accumulation of an explosive mixture of gases in the space between the gas bags and the outer skin.

The Current Supplement.

An interesting aerial cableway and ore-handling plant in New Caledonia is described in the opening article of the current SUPPLEMENT, No. 1769. The desirability of fitting the farm dwelling with good plumbing fixtures and of installing a modern lighting system and economical heating appliances, is pointed out in an excellent article on the subject entitled "Heating the Farm House." Some simple practical inventions are enumerated—among them an automatic vulcanizer for automobile tires, a wrench with interchangeable disks, a wrench with tube for operating in corners, a dragon-fly boomerang, and washing machines. A short but interesting article is that which describes a box with a secret drawer and recesses. The Paris correspondent of the SCIENTIFIC AMERICAN contributes a description of Berjonneau's system of telephotography. Machines for making cordage are described and illustrated. The development of the gas engine is historically traced. Those interested in the return of Halley's comet will find in the current SUPPLEMENT a good ephemeris which gives the position of the comet up to December 26th. Copper-clad steel is a metallurgical novelty which is described at some length. Modern railroad-bed construction and track-grading machinery is described by F. C. Perkins. Victor de Beauclair writes on ballooning over the Alps. Alfred Russel Wallace, Darwin's coworker in the field of evolution, writes on the world of life as visualized and interpreted by Darwin. The Engineering, Electrical, and Trade Notes are published as usual.

Correspondence.

A PROBLEM IN ARRANGING NUMBERS.

To the Editor of the SCIENTIFIC AMERICAN:

For quite a long time your correspondence column contained a lot of matter on magic squares. Recently a problem came to my notice which is somewhat different from magic squares, but which must surely be solved by a system. The problem is to arrange the numbers from 1 to 15 in seven different combinations of five rows and three numbers in each row, so that no two numbers will be in the same row more than once. Of course, it is quite apparent that any number can be combined with seven different pairs, but by what system can this or any similar problem be solved? HERMAN S. RIEDERER, Ph.D.

New York city.

CONTROLLING STEAMSHIP ENGINES FROM THE BRIDGE.

To the Editor of the SCIENTIFIC AMERICAN:

I noticed in a recent issue the suggestion by some reader of letting the engineers on ocean-going vessels, and in fact all large steamers, see where they are going, and judge the speed for themselves, as when making a landing.

In this connection I would say that besides the troubles mentioned by you, there would be the even more serious one of having two men, each thinking separately, and each figuring on what to do without knowing what the other will do. For example, in case of an apparently impending collision, the pilot sees that by making a quick turn he can avoid it. The engineer sees the situation, and not figuring on the possibility of steering away, backs his engine. The result would be the vessel would not answer her helm quick enough, with disastrous results.

Now, there is a system of control on a large number of motor boats, in fact on motor boats up to and including 75-footers, called "one-man control," which is nothing more or less than bringing the engine controls to the steering wheel, as on an automobile.

Steering, a very delicate operation, is done by steam. Why, with a similar apparatus, cannot a large vessel be made a "one-man control" boat? There is no great mechanical difficulty to it. And what is more, a steam engine could be entirely controlled by one lever, whereas a gasoline motor takes three—reverse gear, spark, and throttle.

I would like to hear what others have to say on this subject. H. SUSSMAN.

New York city.

Some Curious Number Puzzles.

BY J. F. SPRINGER.

There are many curious things about numbers. Some of these afford the basis for puzzling games. To the uninitiated the results have a more or less wonderful appearance. In the following article it is proposed to instance and explain certain of these puzzles. The first is somewhat similar to a puzzle published by Mr. W. W. R. Ball. The others are new and appear now for the first time.

To begin with—there is the puzzle of the reversed digits. A person is requested to select a number having in it an odd number of digits. He is next asked to reverse the order of the figures, thus producing a second number. Now he is directed to subtract the one number from the other and multiply the result by any number he pleases, cutting off any naughts at the end. Upon obtaining this he is to cross out the final two figures and tell you the resulting number. He will probably be surprised to have you tell him the figures which he crossed out. You do this by annexing two naughts at the end of the number he tells, divide by 99 and note the remainder. This remainder subtracted from 99 yields the number crossed out by him.

Thus suppose the number chosen to be 58463 (an odd number of digits). Reversing this, we have 36485. Subtracting one from the other, we obtain, 21978. Multiplying this by 23 (any number will do), we get 505494. Crossing out the final two digits (94) we are supposed to be told the result—5054. To this we annex two naughts—505400. Dividing by 99 we get for remainder 5. Subtracting this from 99, we get the crossed-out number 94.

To understand the underlying reasons is not difficult. Thus, suppose the original number possessed, say, three figures. It can be represented algebraically by the expression $100x + 10y + z$, when x, y, and z represent the several digits. The reversal of this is $100z + 10y + x$. Subtracting one from the other, we get $99x - 99z = 99\ (x - z)$. This is evidently divisible by 99. This divisibility by 99 will still be true if we multiply by any number we please. The number then from which the two figures are to be crossed out after cutting off naughts at the end, is divisible by 99. Cutting off final naughts will not affect divisibility by 99, In crossing out the final two figures, we are not able to take away more than 99, as this is the largest number containing just two digits. Replacing then the two crossed-out figures by naughts, we have a number which lacks something of being divisible by 99 or does not. In either case, what needs to be added to bring the remainder up to 99 is the number crossed out. If the remainder is nanght, then the number crossed out was 99 itself.

Another puzzle where two figures are determined by the performer is the following: A person is asked to select two prime numbers. He is then to add them and square the result. For a moment this is to be set aside. Next, the smaller of the primes is to be taken from the other, and the resulting difference squared. This last result is then to be subtracted from the result laid aside a moment ago. You now request to be told the result. This you divide by 4. You will then obtain a number which can be factored in but one way, yielding two prime numbers. These are the numbers selected at the outset.

To illustrate, suppose the prime numbers selected are 7 and 13. Adding and squaring you get 400. Subtracting and squaring there results 36. Subtracting this last number from 400, you have 364. Dividing this by 4, you obtain 91. This can be factored in but one way—7×13.

To explain the matter algebraically, let x and y represent the two prime numbers. Adding and squaring, we get $(x + y)^2$. Subtracting and squaring, we have $(x - y)^2$. If now we write these expressions out in full and subtract the second from the first, thus

$$(x^2 + 2xy + y^2) - (x^2 - 2xy + y^2)$$

we shall get $4xy$. This is the number told to the performer, corresponding to 396 above. Dividing by 4, we of course get just xy. As both x and y are primes, their product is factorable in just one way—into x and y.

A third puzzle is when a person is requested to select a number. He is then to square it and lay aside for a moment. You then request that he take a number which is one less than the one selected and square this also. He is now to subtract one square number from the other and tell you the result. You then add one to the number he tells you and divide by 2. This will give you the original number.

Again, suppose that instead of subtracting one and then squaring, your friend had been asked to subtract 2 and square. You will then request the two squares to be subtracted the one from the other and the result communicated to you—just as before. You now add 4 and divide by 4, getting for result the number chosen.

Thus in the first case, if the number chosen were 13, the square would be 169. The square of one less than the number $(13 - 1 = 12)$ would be 144. Subtracting, 25 is obtained. This is the number communicated to the performer. Adding 1 and dividing by 2, we get 13—the original number.

In the second case, after squaring 13 and getting 169, we square $13 - 2 = 11$ and get 121. Subtracting this from 169 we obtain 48. Adding 4 and dividing by 4, as directed, we obtain 13.

Algebraically considered, we have for the first case $x^2 = (x - 1)^2$ as the number told to the performer. This is really $2x - 1$. If we call this number N, we have $N = 2x - 1$. Now N is known and we wish to get x.

We have therefore $x^2 \dfrac{N + 1}{2}$

In the second case, we have $x^2 - (x - 2)^2$, which yields $4x - 4$. Putting $N = 4x - 4$, we get

$$x = \frac{N + 4}{4}.$$

Or, to state the puzzle in a more general form, we may request that the number to be subtracted be A, instead of 1 or 2, as before. We have then $x - (x - A)^2$. This gives $2Ax - A^2$. Putting $N = 2Ax - A^2$ and solving for x we get $x = \dfrac{N + A^2}{2A}$. By using a formula such as this we may keep up the mystification by continually changing the number to be subtracted. We have simply to remember that we add to the number told us the square of the number subtracted from the original number and then divide by twice this number (but without squaring). Thus if we tell the person to subtract 7 and then to square the result, at the end when he tells us the result of all his operations, we have simply to add 49 $(= 7^2)$ and divide by $2 \times 7 = 14$.

Again, you request some one to square two consecutive numbers and add the results. You then ask that he double this amount and subtract one. You are then to be told the result. If he has performed his operations correctly, this will be a perfect square. You take the square root. This will be the sum of the original consecutive numbers. By subtracting 1, and dividing by 2, you will determine the smaller. The other one is of course obtained by adding 1.

Thus, suppose your friend selects the consecutive numbers 11 and 12. Squaring and adding, he gets $121 + 144 = 265$. Doubling this and subtracting 1, he obtains 529. This is a perfect square, it is the number he tells you. Taking the square-root, you find it to be 23. Subtracting 1, and dividing by 2, you get 11. The original numbers are therefore 11 and 12.

To explain the matter algebraically, we write $x^2 + (x + 1)^2$ as the sum of the squares of the consecutive numbers. The next operation is expressed thus: $2\ [x^2 + (x + 1)^2] - 1$. This gives $4x^2 + 4x + 1$. This is the number told the performer and should be a perfect square. It is. In fact, it is equal to $(2x + 1)^2$. Subtracting 1 from the square root the result is $2x$. Dividing by 2, the smaller of the two consecutive numbers is obtained.

Still another puzzle consists in the following procedure: You ask the "patient" to select a number of any number of digits. He is then to form with the same digits a second number by rearranging the digits in any way agreeable to himself. These two numbers are then to be subtracted, the one from the other, and the result multiplied by 33. You now request that any naughts that may be at the right-hand end be cut off. He is then to cross out the final pair of digits and tell you the number remaining after this is done. You annex two naughts, divide by 99 and subtract the remainder from 99. The result will be the figures crossed out.

This puzzle depends for its success upon the fact that when two numbers formed of precisely the same digits, but differently arranged, yield, upon the one being subtracted from the other, a new number divisible by 9. Upon multiplying this by 33, it will still be so divisible, and will in addition contain 11 as a factor. In consequence of containing 9 and 11 as factors, it will contain 99 $(= 9 \times 11)$ as a factor. The explanation of the remaining procedure is the same as that given in the case of a preceding puzzle. That two numbers having the same digits, but differently arranged, will yield a number divisible by 9 may be seen by considering the following equations:

$$10000w + 1000x + 10y + z - (10000y + 1000x + 100z + w) = 9999w - 9990y - 99z = 9\ (1111w - 1110y - 11z).$$

To illustrate this puzzle, suppose the number selected is 46309. Rearranging the digits we get, say 60349. Subtracting 46309 from 60349, we get 14040. We now multiply by 33 and get 463320. Observing that this has a naught at the right-hand end we cut it off, obtaining 46332. We now cross out the 32 and get 463 as the number which would be told to the performer. He annexes two naughts and gets 46300. This he divides by 99, obtaining 67 for the remainder. He subtracts this from 99 and gets 32—the number crossed out.

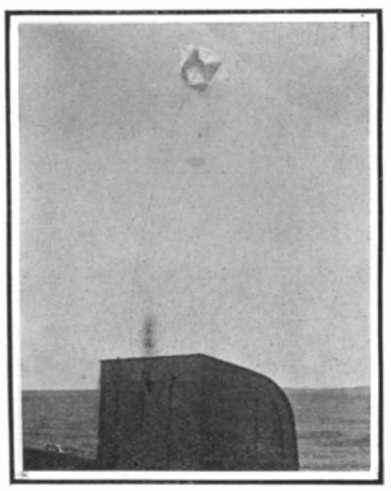
A New Fare Box for Pay-as-You-Enter Cars.

A new fare box for pay-as-you-enter cars has made its appearance in New York. It differs in almost every way from the usual contrivances of its kind. In the first place it not only collects and registers nickels, but gives the conductor access to the cash, after it has been registered, and thus renders it unnecessary for him to fill his pockets with change before he starts out on his trip. In the second place, the new fare box enables the conductor to detect mutilated and counterfeit money; for the coin slides down a glass-covered chute and is therefore visible. If the conductor discovers that it is a counterfeit, the coin is mechanically dropped into a special receptacle and returned to the passenger. If the coin is good, it is registered and caused to drop into a cash drawer. Although it is not likely that a dishonest conductor would attempt to abstract so small a sum as a nickel by turning the box upside down, so that the nickel would run out, an automatic gravity closure has been provided which effectually blocks the chute if the attempt should be made, so that the fare must pass through the apparatus in the regular way. The width of the chute is just large enough to accommodate a good nickel. A larger coin cannot enter, and a smaller coin is mechanically returned by the machine. Each conductor is held responsible for the fares registered. Although he has access to the cash collected, the amount turned in must be the amount recorded. Thus a very simple and effective check is provided, without the necessity of giving the conductor a large amount of small change with which to start his trip. The boxes are made of a special composition of metals and weigh only 10 pounds.

Peat fuel will be used in an electric station being erected in Germany. The new plant is being installed in the region to the southwest of Oldenburg, and it lies in the vicinity of extensive peat fields from which the supply is to be secured. The electric plant is laid out on a large scale, and when completed it will be one of the largest in the country. It is to furnish current over a network of power lines which will cover the entire Duchy of Oldenburg, with a radius of 40 miles. Probably the new station will be completed about the end of next year, and in the meantime measures are being taken to find out about what amount of current will be taken in the various cities and communes within the area.

SOUNDING THE OCEAN OF AIR ABOVE US.

ATMOSPHERIC EXPLORATION.



The science of meteorology has so far progressed, that we know with considerable accuracy the nature, composition, and general properties of the lower air. If meteorology is to become anything like an exact science, in other words, if we are to predict the weather not only of to-morrow, but even of next week, with more accuracy than is now possible, we must have at our disposal data which will enable us to determine the condition of the upper layers as well and their effect upon the lower layers. In the interest of that investigation, we find that the modern meteorologist has been conducting for the last two decades investigations that will sooner or later bring together an enormous mass of facts, which the mind of some master meteorologist will some day whip into scientific correlation.

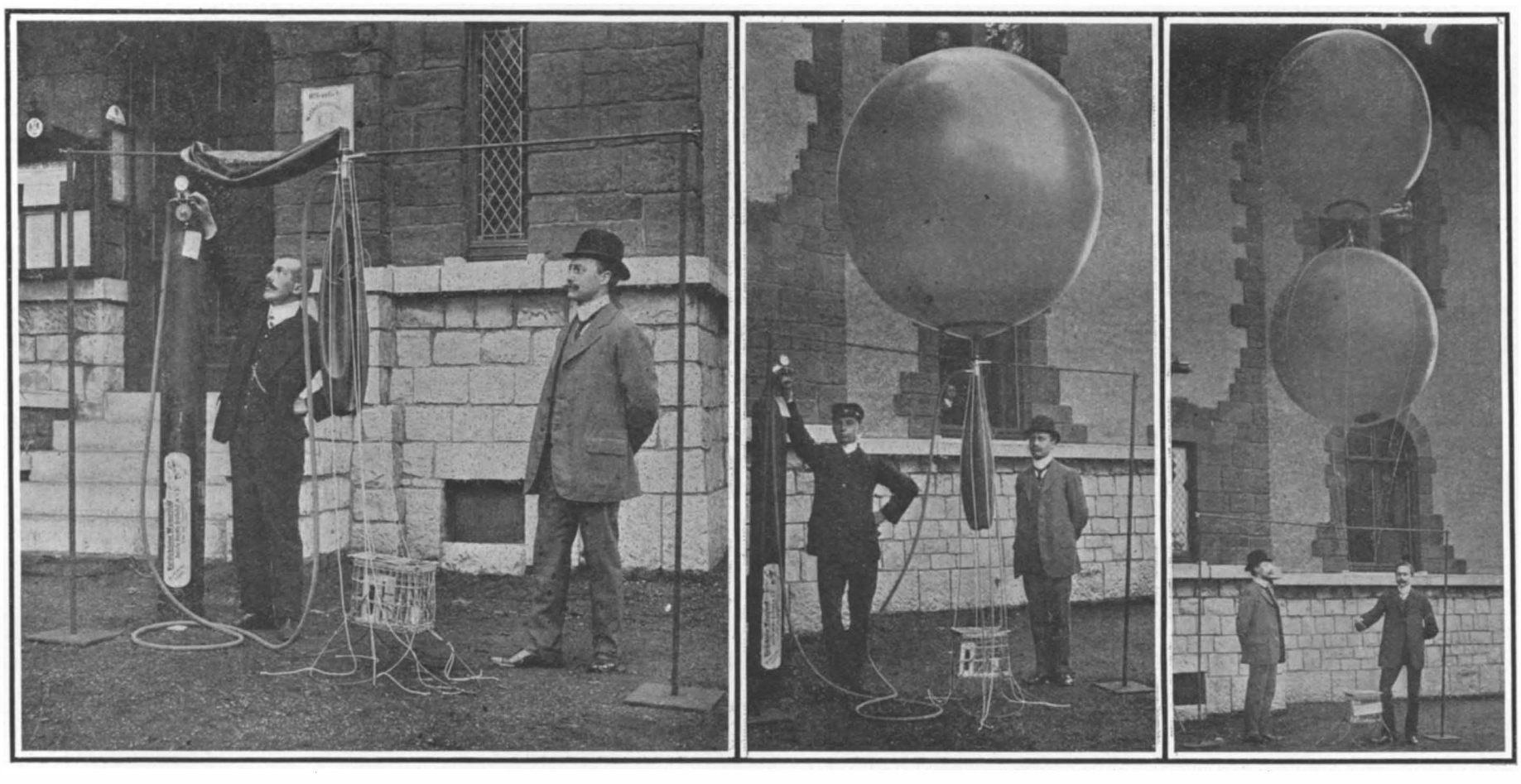
In this effort to discover the physical attributes of the upper layers of the air, barometers, hygrometers, thermometers, and wind gages are employed. The barometer measures the weight of the air; the hygrometer, its moisture; the thermometer, its heat; the wind gage, its velocity. These instruments, all of them well known in meteorological research, have been considerably modified for the study of the upper air, a modification necessary because they must be lifted to great heights by means which make it impossible to employ great weights. Hence it is that they are made of feathery lightness and are ingeniously combined. The combination is usually known as a "meteorograph." Thus the thermometer and barometer are merged into a meteorograph, specifically known as a baromethermograph, a contrivance which is provided with two automatic styles, one of which writes down the pressure of the air and the other its varying temperature. Sometimes the barometer, thermometer, and hygrometer are joined in a single instrument, which notes the humidity as well as the pressure and temperature. The records are made upon clock-driven cylinders covered with lamp black, because no ink has been found which will not freeze in the bitter cold of the upper air. At lower levels special inks and paper can be employed. The construction of these meteorographs has involved not a little ingenuity. Perhaps the men who have contributed most in devising special forms of instruments are Mr. S. P. Fergusson and Mr. H. H. Clayton of the Blue Hill Meteorological Observatory in this country.

Fifty years ago, the experiment was made of intrusting instruments of precision to venturesome balloonists. Because a human being cannot live in the thin air of great altitudes, these experiments sometimes proved fatal. Hence it is that the meteorologist has adopted, in a measure, the methods of the marine biologist. In other words, he sounds the ocean of air at the bottom of which we live.

His sounding methods are dependent upon the employment of kites and free unmanned balloons. By their means it has become possible to elevate the delicate instruments which automatically record the physical condition of the upper air, and to bring to the earth an accurate account of atmospheric happenings many miles above the earth's surface. The men to whom most of the credit for this new means of investigation is due are Prof. A. Lawrence Rotch of the Blue Hill Meteorological Observatory, in this country; Dr. Richard Assmann, of Germany, and Teisserenc de Bort, of France.

The exploration of the upper air by kites has been carried to the greatest perfection by Prof. Rotch. It may safely be said that his study of the lower four miles of air is the most complete that has yet been made. The kites employed by him—and, for that matter, by almost every meteorologist—are of the open box type invented by Mr. Lawrence Hargrave. The kites often measure 9 feet in length. Such is the pull exerted by them, that it is impossible to employ muscular power to control them. For that reason, they are hauled in by engine-driven winches. Devices are employed which register the pull of the kite and the length of the line in use. Often it happens that as much as ten miles of line may be paid out. In spite of the great lifting capacity of such a kite, it could not attain any considerable height if it were held by hemp alone. A cord or rope would necessarily be so heavy and thick, that a kite would be severely taxed in pulling it up. Hence it is common to employ fine music wire, which is both strong and light. The elevation attained by a kite is determined in fair weather by means of theodolites. At night and in hazy weather the meteorograph readings themselves must be depended upon.

Four miles may be considered the maximum height that a kite is capable of attaining. To sound the reaches of air above that level, the free or unmanned balloon is employed, of which the most skillful use has been made by Teisserenc de Bort and by Dr. Richard Assmann. These free balloons are filled with pure hydrogen gas, which expands with increasing elevation. Since the degree of inflation obviously depends upon the height to be attained, considerable care must be taken not to fill the gas bag entirely. If the balloon is to reach a point where the air is one-half as dense as at the level of the sea, the gas bag is filled about one-half. If a height is to be attained at which the air density is one-fourth that at the level of the sea, the bag is filled about one-fourth. It is very evident that for the attainment of very great heights, the balloon's capacity must be great and the construction exceedingly light. This explains why instruments of feathery lightness must be employed. Originally, fairly large paper balloons were employed for the purpose, by Teisserenc de Bort, but the India-rubber balloons of Assmann have now taken their place. These India-rubber balloons vary in diameter from three to five feet. They have reached considerable heights. At the maximum elevation of the balloon, the expansion of the hydrogen gas eventually bursts the bag. In order that the instruments may not be dropped precipitously to the ground, they are checked in their descent by a parachute. Instead of a parachute, a slightly inflated auxiliary balloon may be employed, which does not explode, and which has sufficient buoyancy to prevent a too rapid fall of the instrument. Recently, S. Saul, of Aachen, Germany, has advocated the use of two balloons connected by an aluminium pipe provided with a valve. The weight of this pipe is much less than the netting generally applied to the balloon to carry the basket containing the recording instruments, and is certainly much lighter than a para-



Inflating a Saul double balloon. One balloon inflated. Both inflated.

The Saul double registering balloon.

SOUNDING THE OCEAN OF AIR.

chute. The arrangement is such that when the double balloon reaches its maximum height, the one bursts, and the other, not having sufficient buoyancy to carry the whole weight of the apparatus, sinks slowly to the earth. At the same time it serves to attract the attention of the finder, because it floats a few feet above the ground. The balloons can be filled in the open air, even in windy weather, by one man, whereas special care must be taken with the ordinary system.

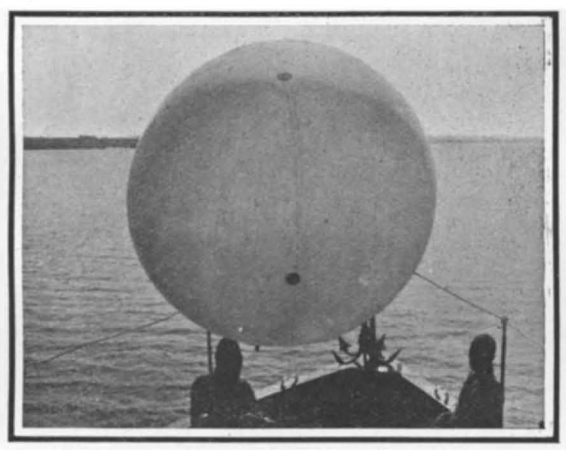
To every basket in which the instruments of a sounding balloon are contained, a printed notice is attached which offers a reward for their return. A very large number of the instruments which drop to the earth thus find their way back to the observatories.

Sounding balloons reach astonishing elevations, and travel at speeds varying from 40 to 80 miles an hour. Although a large number of *ballons-sondes* were dispatched from St. Louis in 1904-7 under the direction of Prof. Rotch, none had been employed in the eastern States until last year. In May and July, 1908, four *ballons-sondes* were launched from Pittsfield, Mass., with special precautions to limit the time they remained in the air and so prevent them from drifting out to sea with the upper westerly wind. Three of the registering instruments have been returned to the Blue Hill Observatory with good records. The first instrument sent up on May 7th was not found for ten months, and the record is very interesting because it gives complete temperature data from the ground up to 17,700 meters, or 11 miles. This is 650 meters higher than the highest ascension from St. Louis, which, by a coincidence, was also the first one to be made there. On May 7th a general storm prevailed, so that the balloon, traveling from the east, was soon lost in the cloud and its subsequent drift could not be followed, but the resultant course was 59 miles from the southwest, as determined by the place where the instrument fell two hours later. A paper balloon will reach its greatest height in about six hours; a rubber balloon, in three hours.

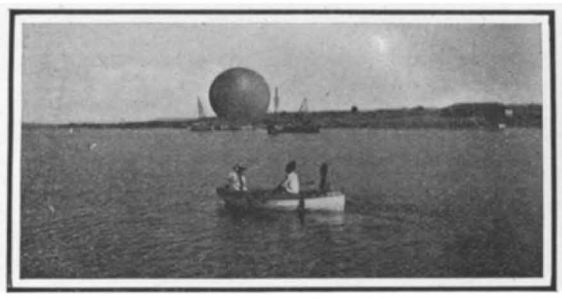
The air-exploring stations of the entire world have banded themselves into an association for the purpose of carrying on a systematic exploration of the upper air, on agreed dates. Thus we find that each year an "international week" of exploration takes place, in addition to the regular work of each observatory. These international weeks may fall in the spring, sum-

(*Continued on page 399.*)

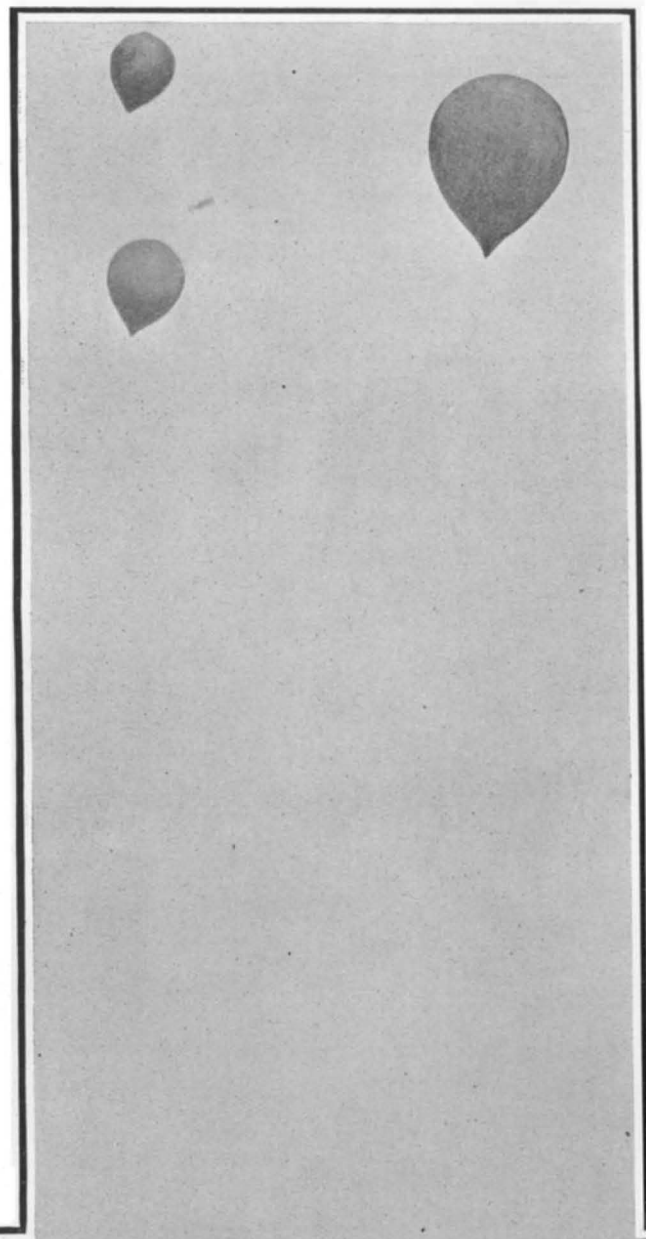
Sending up a pilot balloon.



Preparing for a balloon ascent.



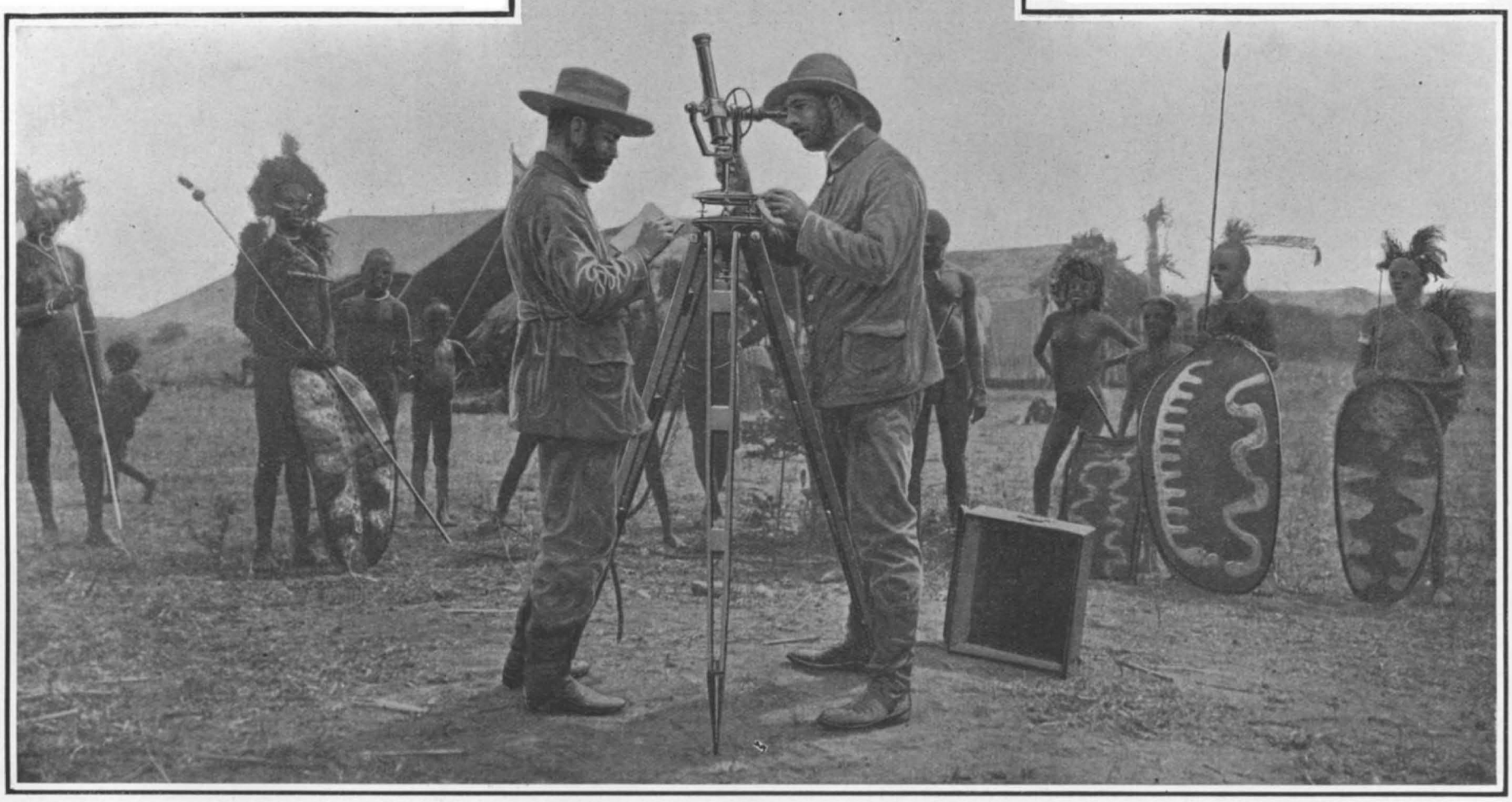
A balloon ascent on Lake Victoria Nyanza.



A kite ascent on Lake Victoria Nyanza.

One of the box kites used.

Controlling a kite with a hand windlass.



Noting the course of pilot balloons with special theodolites. The pilot balloons are liberated to ascertain the direction and velocity of the wind before the liberation of registering balloons.

GERMAN METEOROLOGICAL INVESTIGATIONS IN EAST AFRICA.

A SELF-ACTING MAIL ELEVATOR.

BY THE BERLIN CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The present methods of mail delivery in hotels, apartments, and office buildings are defective in many respects. The letters and parcels are delivered to each lodger of an apartment house by hand, which obviously means waste of time and energy. The system prevalent in some countries of handing all the mail matter to the doorkeeper or porter, to whom is left the care of distributing it to the various addresses, is also objectionable. Nor can the letter boxes installed at the house door be called practical in all respects.

The idea of using the elevator principle for doing away with these drawbacks seems so simple, as to make one wonder that it should not have been long ago carried into practice. As it is, a Berlin engineer, Mr. E. F. Ostrowsky, has been the first to utilize it for the delivery of mail matter. His system is of remarkable ingenuity and simplicity.

One of our views shows a perspective of the mail elevator as designed for three stories of two tenants each. Another view is a lateral section of the elevator. A letter box installed on each staircase landing, and a façade, with a built-in elevator, are also illustrated.

The construction of the apparatus is based on a very simple mechanical principle.

In a narrow vertical shaft moves a frame *A* suspended by a wire rope, one end of which is fastened to the top of the frame *A*, whereas the other end passes over rollers *L*, and sideways, downward, around the drums *G* and over another roller and opening in a board above the drum. The end of the rope is fastened to a coiled spring which is connected with the lower part *B* of the frame *A* and imparting resiliency to the rope.

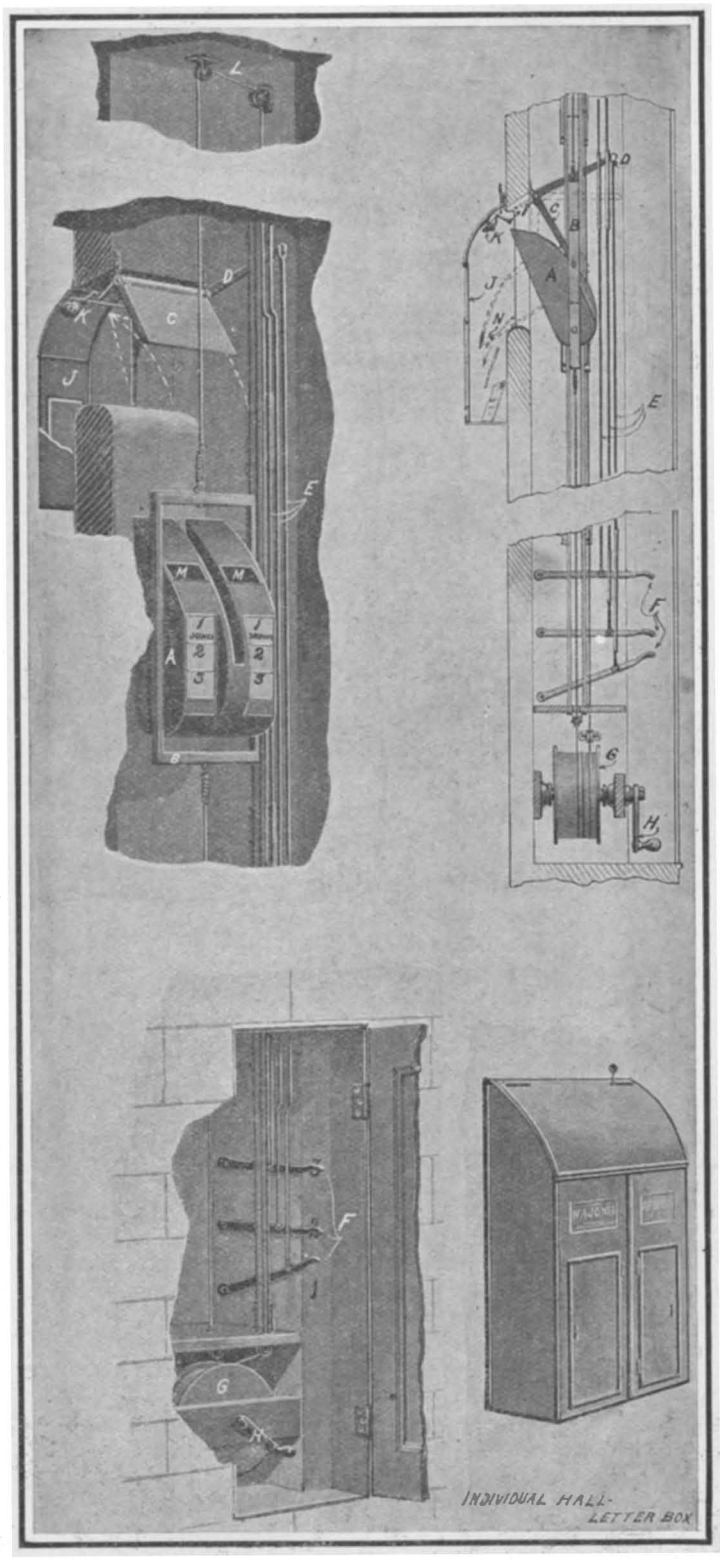
Because of this arrangement, the frame *A* can obviously be moved upward and downward, by means of the crank *H* and the drum *G*.

In the frame *A* a letter box *M* divided into two equal parts is swiveled. The box has two apertures in both the front and back.

The rear wall of the elevator shaft is provided with openings communicating with the backs of letter boxes at the several stories. The openings are provided each with a hinged cover *C* opened by means of the levers F^1, F^2, F^3, connected with vertical rods.

The entire elevator shaft can be built directly into the vestibule floor in the case of new buildings as shown. Its external appearance can be made to resemble a column, in the case of existing houses. After dropping the mail matter into the proper compartment of the letter box *M* provided with special labels for each of the lodgers, according as the addressee lives in the left-hand or right-hand wing of the house, the postman will lift the lever *F*, corresponding to the story in question, thus opening, through the medium of the lever *D*, the gate *C*. When the letter box *M* is lifted by turning the crank *H* at the high speed resulting from the considerable diameter of the pulley, it strikes against the open gate *C*, and, being tilted, pours out its contents automatically into the letter box, arranged on the staircase landing.

As the gate *C* is opened, it strikes against the bell *K*, thus announcing the arrival of the mail. An indicator on the receiving box is employed for the same purpose, the indicator remaining in a visible position until the letter box *M* has been emptied. As the crank is turned backward the letter box is brought down to its original position.



A MAIL DELIVERY SYSTEM FOR APARTMENT HOUSES AND OFFICE BUILDINGS.

At the Fifth International Geographical Congress, held at Bern in 1891, Prof. Albrecht Penck, the well-known geographer, proposed that the enlightened nations who were engaged in making maps of their own territory and of other countries should unite upon a common plan for the preparation of a general map of the world. He suggested that the scale of the map should be 1:1,000,000, or about 16 miles to the inch, and that the separate sheets of the map should be so bounded by meridians and parallels that any two sheets representing adjacent areas should match, except for distortion of projection, no matter by what country either sheet might be made. This proposal led to resolutions and discussions at subsequent geographic congresses and to the preparation of several tentative maps by Germany, France, England, and the United States, in conformity with the general plan proposed by Prof. Penck.

The Russian Minister of War has undertaken to establish, by a succession of wireless telegraph stations, telegraphic communication between St. Petersburg and the far East.

Treatment of Diseases of the Eye by Means of Intermittent X-Rays.

BY DR. A. LEPRINCE.

It is to Cook of New York that we owe a new method of utilizing the Roentgen rays. The field for the usage of these rays seems to be unlimited; apparently, they will eventually prove to be of great therapeutic value for the various diseases of the eye. Possibly, even, if these rays are judiciously applied at the inception of infections which are supposed to be incurable we may thereby avert total loss of eyesight.

Let us first consider the production of intermittent X-rays, or, as they have been called by Dr. David H. Coover, of Denver, U. S. A., "the sparks of Roentgen rays." The apparatus specially in mind consists of a small motor, a condenser, and a movable scale.

My arrangement differs a little from that of Coover. It consists of a clockwork movement actuating a graduated rod provided with a movable screen. The rod is placed behind the localizer, and according to the position of the screen upon the rod, the interruptions follow one another more or less rapidly at the rate of from 50 to 200 per minute.

With the aid of a regulator, one is able to obtain from 40 to 600 sparks per minute. The amperage and the distance of the tube are likewise carefully regulated. Experience has demonstrated that the best results are obtained in ocular affections by a somewhat restricted number of sparks, 75 to 150 per minute, and by removing the eye to a distance of about 37 centimeters from the focus.

It develops that radiant energy possesses four distinct therapeutic properties, namely, sedative, stimulating, irritating, and sloughing functions, each of which corresponds to an electrical, mechanical, chemical, and calorific effect.

With the intermittent rays it has been possible to separate the purely stimulating action from the irritative action, and experience has demonstrated that by thus proceeding, the regenerative action is enhanced.

Cook has established that "the degenerative action of the regenerative and continuous action of the intermittent rays found its demonstration in the treatment of affections of the eye." If a cataract which is almost mature is exposed to *continuous* rays and ephermal stimulations, an improvement of the eyesight is sooner or later followed by a maturation of the cataract, as a consequence of hyper-stimulation or irritation. This fact permits the establishment of a technical rule for the maturation of incomplete cataract. With the "sparks," especially when higher amperage is used, the irritation and the maturation are avoided; and with an incipient cataract the stimulations and regenerating effect are not only invariably obtained with more or less improvement in eyesight, but may be maintained during the entire treatment.

Dr. Coover may not have experimented with incipient cataract, but he has at least observed the regenerative action in other affections of the eye. In a case of serpiginous ulcer of the cornea new cells were rapidly formed, and a cure was effected only by application of the intermittent rays.

In the opaque portions of the cornea, the process of absorption results in a hyperæmia of the blood vessels of the eye, as has been found in all cases which have undergone treatment.

The vessels of the conjunctiva are more congested after each treatment. The hyperæmia persists for several minutes, and if there was previously a peri-corneous injection, it is always enhanced. Examination, by means of the ophthalmoscope, of the ball of the eye, after having been exposed to the rays, always shows an increase in the size of the vessel of the retina, particularly after a case of optical atrophy.

The regeneration is accompanied by diminution of the tension, improvement of the circulation, and increase of the leucocytes. These modifications are noticeable in the muscular, nervous, osseous, vascular, epithelial, and glandular tissues.

The action manifests itself in the eye on the optic nerve, the cornea, the crystalline lens, the charoid, the retina, and the iris. In addition to the local effect, there is found another of a more particularly tonic nature. The cellular metabolism increases, and all the vital processes are stimulated, a condition which is necessary for the treatment of all local degenerations.

This effect, evidently, is totally different from that produced by continuous rays, which have a regenerative effect only during the early stages of their application. This effect is particularly noticeable in the blood. At the start there is an increase in the number of red and white corpuscles, particularly the latter, and later, degeneration sets in, as is indicated by a diminution in the number of these corpuscles.

Some observations have been published regarding the cure of blindness and deafness by prolonged treatment with continuous rays employed for the treatment of cancer having its seat near the eye or the ear.

Prof. Birch-Hirschfeld of Leipzig has reported the anatomical modifications of an eyeball exposed to prolonged radiations during the treatment of a carcinoma (cancer) of the temple by the X-rays. The principal troubles were due to the endothelium and to the vacuolization of the structures of the iris and of the retina. The maeular region was the one most affected, and the seat of a cellular degeneration. There were no symptoms of inflammation. Experiments upon an animal led to the same conclusions. By his experiments with rabbits, Selenkordsky has likewise demonstrated the danger of immoderate or untimely use of continuous X-rays. This degenerative action of X-rays was likewise observed by me some years ago, and treatment of various cases led me to the same results as those of Cook. Having treated with the X-rays a woman forty-five years of age for a leucoma of the cornea complicated by incipient cataract, I was surprised to obtain a very appreciable improvement in the condition of the cornea, and likewise in the condition of the crystalline lens; but, in the measure in which the clearing up of the cornea was effected, an equally rapid development of the cataract occurred, so that it was soon complete and operable. Enlightened by this experience regarding the peculiar effects of continuous rays, I have used more restraint in treating cases by this method, and have never subjected my patients to a repeated treatment with X-rays. The technical details of the process of Cook and Dr. Coover seem to be rational enough, and the observations of the latter lead me to look confidently into the future regarding affections as serious even as optical atrophy.

It seems that in the acute, ulcerous, and irido-

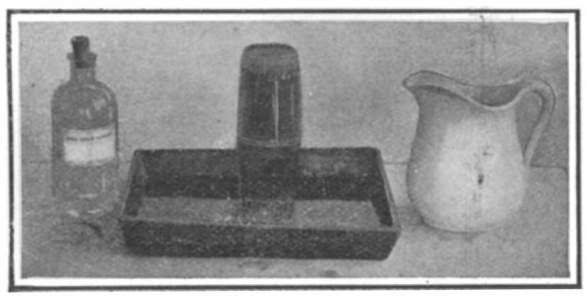
(*Continued on page 401.*)

Handy Man's Workshop

POROSITY OF LIQUIDS.

BY A. R. VAN DER VEER.

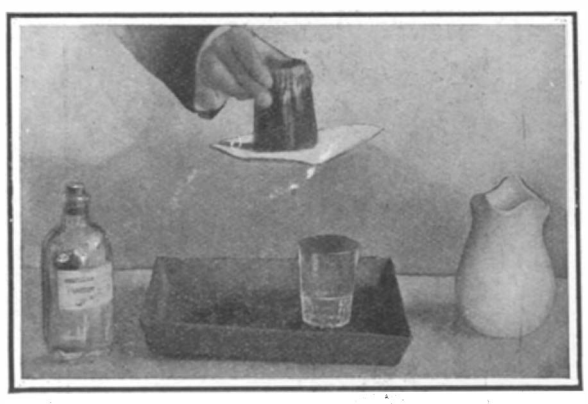
It is rather difficult to imagine liquids as having pores, though this seems to be the case as shown by certain familiar experiments. When a certain amount of powdered sugar is slowly poured into warm water, the water will dissolve the sugar and appear to absorb it without increasing its volume. Similarly, when alcohol is poured into water, the resulting volume



ALCOHOL "SOAKING" INTO WATER.

will be less than the sum of the two volumes.

For instance, if fifty parts of water and fifty parts of alcohol be mixed together, they will make only ninety-four parts. Apparently one of the liquids has entered into the "pores" of the other. This experiment as commonly performed in physics laboratories consists in putting measured quantities of the two liquids together, but the effect would be far more striking were it possible for students to see one of the liquids actually "soaking" into the other. This can be done in the following way: Take two glasses, one filled to the brim with water, and the other with alcohol. In order to show the effect to better advantage, color the alcohol with red ink. The glasses should not be over-full; that is, the surface of the liquid should not bulge above the rim of the glass. When everything is ready, place a sheet of paper over the glass full of alcohol, and with a hand on the paper to keep it down on the rim of the glass invert the tumbler, and the liquid will remain in the glass, owing to the air pressure on the paper. Now place the inverted tumbler over the glass full of water, and carefully draw out the paper. This can be done without spilling a drop of alcohol, and yet as soon as the paper is removed, the alcohol will commence to drop. Owing to the fact that it is colored, it is possible to see the alcohol actually "soaking" into the water, while tiny air bubbles that were formerly contained in the "pores" of the water rise slowly to the top of



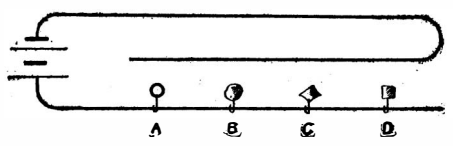
INVERTING THE GLASS FULL OF ALCOHOL.

the tumbler. This will continue for some little time until a considerable air space forms in the top of the tumbler.

PLATING SPOONS AND FORKS AT HOME.

BY A. J. JARMAN.

In the home of every handy man there are generally some forks or spoons that have become somewhat the worse from wear. Every such article if in a moderately good condition is worth replating, and if the work be done at home as much silver can be deposited as one desires, so as to give a coating that will last for years. The following directions will enable any handy man to silverplate his own goods in a very satisfactory manner, with such silver as there happens to be about the house, such as an old silver watch case, a badly worn solid silver spoon or two, or an out-of-date bracelet, in fact any old piece of silver that has no especial use. Of course if this commodity does not exist, it will be necessary to buy an ounce and a half of pure granulated silver at about sixty cents per ounce. Assuming that the old silver mentioned is to be had, proceed as follows: Procure a small stoneware pot of about one or two quarts capacity. Weigh the silver—there should be about two ounces. If there are any iron or steel rivets or rings about the watch case, or any German silver parts, break them off with a pair of pliers. Place the silver in the crock, pour upon this four or five ounces of nitric acid (chemically pure) of a strength known as 38 deg. Place the crock into an enameled tray. Pour some hot water into the tray, to aid the chemical action. Place a sheet of glass upon the pot, or a stoneware lid if it is provided with one, then stand the pot out of doors, because the fumes that are given off are poisonous. In the course of half an hour, all the silver will have become dissolved. Now fill the pot half full of cold water, to dilute the nitrate of silver that has been formed. The liquid will present a bluish green appearance, due to the copper contained in the old silver articles. Take four ounces of hydrochloric acid, and add to it four ounces of water. Then pour this into the silver solution. Stir vigorously while this is being added, with a clean glass strip. The silver will now be thrown down as chloride of silver, in the form of a dense white precipitate. Let this stand for about two hours, to allow the chloride of silver to become precipitated; carefully pour off the clear bluish green liquid, without disturbing the precipitate. Fill the pot again with clean water, stir well, and let it subside again for a couple of hours. Repeat this four times. This operation will free the chloride of silver of the dissolved copper, also the result of chemical decomposition. If pure granulated silver is used proceed in the same way, only in this case there will be no copper impurities to be gotten rid of. Procure a three-gallon crock, with plain upright sides; pour the chloride of silver into this, wash out every scrap of chloride. Pour these washings into the crock, then dissolve half a pound of cyanide of potassium in the jar that the silver was dissolved in. The cyanide must be that known as 99 per cent commercial, three pints of water being used. When completely dissolved, pour this upon the chloride of silver, keeping in reserve



CONNECTIONS FOR AN OBLONG PLATING TANK.

about half a pint of the cyanide solution; stir the mixture with a glass strip; wait a short time, and then, if the chloride has not become completely dissolved, add a little more cyanide solution. When the chloride is completely dissolved add not more than four ounces of the cyanide solution; this will give what is known as free cyanide. Add a quart of water; stir and allow this liquid to stand twenty-four hours. This will allow any dirt, also a small portion of carbon from the cyanide, to subside. Very carefully pour off the clear liquid; drain this off; return the clear liquid to the crock. After rinsing the crock out make the quantity of liquid up to two and a half gallons. This is the silver-plating fluid.

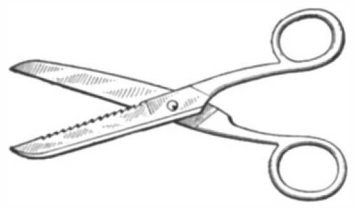
A two-cell Fuller mercury-bichromate battery will be just the thing for plating. Take a stout piece of copper wire, bend it in the form of a ring, so as to extend around the crock of the plating liquid, resting upon two strips of wood; obtain about one ounce and a half of pure silver and solder a piece of No. 16 insulated copper wire to it. Attach this to the carbon of the battery, let it dip into the center of the plating crock; also procure some finer copper wire, No. 22 gage; cut this into strips six inches long. Now take the forks and spoons; file down any badly worn parts, finish them off with some fine emery cloth glued to a flat strip of wood; and boil the lot in a saucepan with some strong washing soda and water to remove all grease. Scrub the fork or spoon with a fine-cut nail brush dipped into pumice powder; also wet the fingers and dip them into the pumice powder, so as to prevent any grease from coming into contact with the article. Scour the article well, twist one of the pieces of fine copper wire around the middle of the spoon, dip this into clean water, then quickly dip again into a solution of nitrate of mercury (one ounce of nitrate of mercury in one gallon of water). Rinse it again quickly in clean water, and place it at once into the plating liquid, suspending it from the ring of copper wire around the crock, which must be connected with the zinc of the battery. About a dozen spoons or forks can be treated in this way; the silver will take to the article at once. The sole use of the nitrate of mercury solution is to insure a perfectly clean surface, in fact chemically clean, which causes the silver to adhere firmly to the article. As soon as six or seven articles have been placed into the plating bath they must be removed and brushed well all over with a brass-wire scratch brush, known as a hand scratch brush, which can be bought, with two rows of brass wire, for 35 cents. The article when so brushed must be returned to the plating bath to receive a further deposit, which may last for an hour or more, according to the quantity of silver it is wished to put on. To determine the quantity deposited first weigh the silver plate, called the anode, when if at the end of one hour the loss has been 120 grains, it will be known that 120 grains has been deposited upon the twelve forks or spoons. The articles must be removed every half hour and be scratch brushed. This will rub down the white burn, as it is called, giving an even, smooth deposit.

When all the articles have been plated and scratch brushed wipe them clean, and burnish them by the use of a small steel burnisher, or, if this cannot be obtained, use a very smooth and bright shoemaker's awl. Hold the article with a clean cloth, dip the awl or burnisher into a little soap and water, stroke this carefully, with moderate pressure, up and down the spoon handle, and blend by continuing the stroking. Then rub carefully over the back of the bowl while the curved part of the awl can be used to rub the inside of the bowl. Of course a little care is necessary not to cut or abrade the deposited silver. Polish the article with a piece of chamois leather dipped into fine rouge, moistened slightly, and finish off with a clean chamois leather, It is important that the circuits through the several articles have the same resistance, otherwise more silver would be deposited on one than on the other. The diagram shows how this is accomplished when an oblong tank is used. The circuits through *A*, *B*, *C*, and *D* are all of the same length.

SCISSORS WITH A SAW-TOOTH.

BY W. J. C.

A very handy tool can be made from an old pair of scissors or shears, as shown in the accompanying sketch. One blade is cut with a set of saw teeth inclined toward the handle. These teeth hold the material fast, and prevent it slipping toward the point of the shears. Rubber sheeting, strips, and all kinds of soft packing can be easily cut with square or inclined ends. It matters not in what position the scissors are held; they will cut without slipping. In using



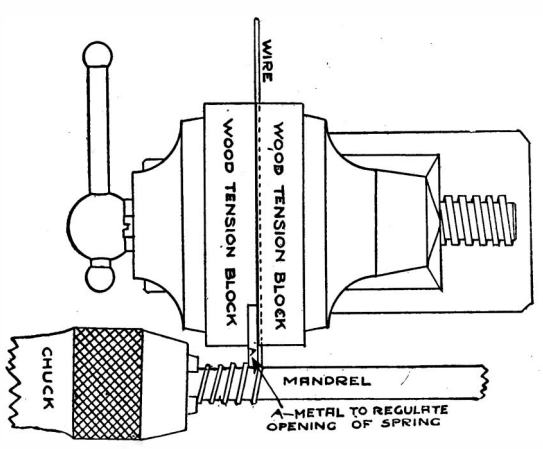
SCISSORS WITH A SAW-TOOTH BLADE.

these scissors for rubber and other slippery goods, the saw-toothed blade should be on the bottom to obtain the best results. Heavy rubber and packing can be cut with less effort, as it is not necessary to hold the scissors against the goods to prevent slipping. The same design of lower blade can be applied to plumbers' and metal-workers' shears with a change in the relative positions of the holding and cutting blades. If the saw-toothed blade is kept on the bottom of the goods, the edge will be left rough; but by reversing the shears, so that the saw teeth come on top, the edge is left just as clean as if no teeth were used. The piece cut off however is rough on the edge. The scissors can be used to cut paper, cloth, or any other material, if the saw teeth are kept on top or bottom, according as it is desired to have the smooth edge on the left or the right-hand piece cut off.

HOW TO WIND AN OPEN SPRING.

BY OTTO KERNER.

An easy way to wind a spring of the compression type will be found in the accompanying illustration. The mandrel on which the spring is wound is selected according to size of spring wanted. In this case the mandrel and the end of the wire were fastened in the chuck of a carpenter's brace. The piece *A* is a narrow strip of metal, the thickness of which regulates the spacing of the coils. If a closed tension spring is wanted, the piece *A* is left out entirely. The wooden tension blocks are clamped with the proper tension in a vise. If no vise can be procured, an ordinary clamp will answer the purpose.



METHOD OF WINDING AN OPEN SPRING.

THE SELF-SMOKING PIPE.

After filling a decanter about two-thirds full of water, close it by means of a cork provided with two apertures. Through one of these pass a short pipe stem and through the other a longer stem that enters the liquid.

To the smaller tube affix a cork provided with two apertures. The apertures may be easily formed by means of a red-hot poker. The lateral aperture serves to fix the pipe. Finally, with the other cork and a bent

THE SELF-SMOKING PIPE.

tube, form a siphon. After the latter has been primed and is once in operation, it will tend to empty the decanter, and the vacuum formed will be immediately filled by the external air flowing in through the pipe. It is then only necessary to light the latter in order to see it "smoke itself" tranquilly as long as any water remains in the decanter.

This experiment is a very interesting one and may easily be performed.

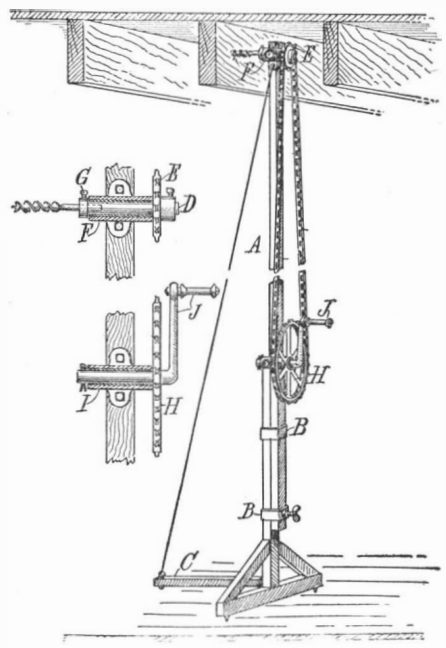
HOME-MADE KNOB AND TUBE BORING MACHINE.

BY R. H. BROCKMANN.

To electricians who install knob and tube wiring, a machine that will bore the overhead beams is a great time and labor saver. The drawing shows a machine for this purpose that can be easily and cheaply made by anyone handy with tools.

The framework *A* is made of hard wood, oak or hickory, firmly put together, and made long enough, so that when fully extended it will reach ordinary high ceilings. The height can be adjusted by means of the sleeves *B* and the thumb-screw. If it is too much bother to make the sleeves *B*, ordinary iron clamps can be used. *C* is a piece of wood fastened to the frame by means of a hinge at one end and a light flexible wire cable at the other, *E*. Points are formed at the bottom of the frame to keep the machine from slipping.

A piece of machinery steel *D* is drilled to form a



HOME-MADE KNOB AND TUBE BORING MACHINE.

socket for the bit. It is turned down to form a shoulder at the socket end and is then held in the ½-inch drop tee *F* while Babbitt metal is poured in to make the bearing. A nine- or ten-tooth bicycle sprocket *E* is mounted on a bushing and fastened to the shaft with a set screw. A set screw *G* is also provided to hold the bit in place. Round-shank bits are intended to be used. The drop tee *F* is then fastened to the frame *A* by means of bolts. The sprocket *H* and crank and pedal *J* of a bicycle are mounted in a ¾-inch drop tee *I* and given a good bearing by pouring Babbitt metal around the axle. A hole is then bored through the other end of the axle and a washer and pin put on. The rat trap or cage part of the pedal is removed; this leaves the central part with the ball bearings, which makes a very good handle. The drop tee *I* is then bolted to the frame *A* and a bicycle chain *J* is fitted onto the sprockets *A* and *K*.

To operate the machine, a bit of the proper size is inserted into the socket. The frame *A* is then extended to the proper height and made fast by means of the thumb screw. The operator then places the machine in position with the bit against the beam, and with his foot bears down the pedal *C*, thus forcing the bit firmly against the beam, while he bores the hole by turning the handle *J*.

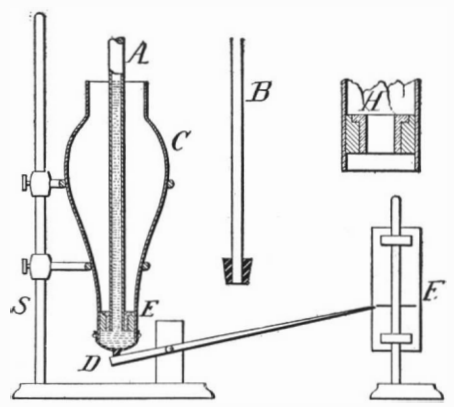
INEXPENSIVE APPARATUS FOR ILLUSTRATING THE "HYDROSTATIC PARADOX."

BY F. R. GORTON.

A simple method for illustrating the "hydrostatic paradox" with inexpensive materials is described below.

In the small end of a large lamp chimney *C* is cemented with paster of Paris or paraffine the neck of a bottle of suitable size to fit a large rubber stopper (see *H* in figure). Across the small end of the chimney is tied a piece of thin sheet rubber *D*. A small glass tube *B* and a larger one *A* are provided with rubber stoppers which fit well in the aperture *H*. The apparatus is mounted firmly on the ring stand *S* as shown in the cut.

In the manipulation, tube *B* is inserted in the inverted chimney and filled with water to the level of the open end of *C*. As the force exerted by the water against the rubber increases, the index rises. The final position of the index is marked by a heavy black line



APPARATUS FOR ILLUSTRATING THE "HYDROSTATIC PARADOX."

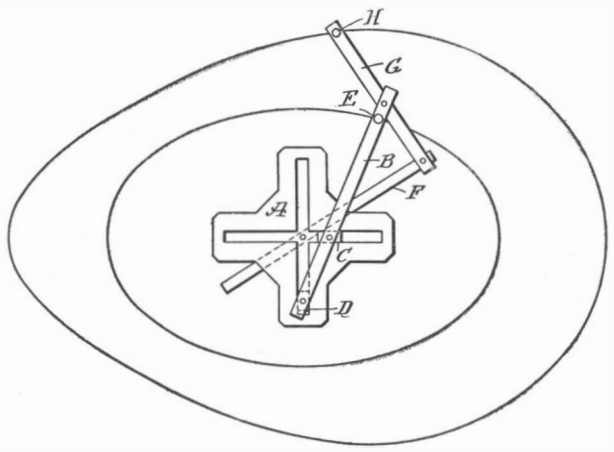
on the cardboard which slides on the vertical rod *F*. Now tube *B* is removed and the larger tube *A* inserted and filled to the same level. The index rises promptly to the height marked by the line on the card *F*. Finally, tube *A* is removed and the chimney is filled to the brim. The index rises to the same point as before.

One of the chief merits of the device is the fact that no water has to be removed from the apparatus during the experiment.—School Science and Mathematics.

DEVICE FOR DRAWING OVOIDS.

BY J. O. BROUILLET.

The instrument illustrated herewith can readily be made by any handy man, and will enable him to draw ellipses of various sizes and ovoids as well. It consists of a sheet-metal piece *A*, in which two slots are cut crossing each other at right angles. A lever *B* is provided with two blocks *C* and *D*, adapted respectively to slide in the slots. A lever *F*, which is fulcrumed at the center of the plate *A*, is connected by means of a lever *G* with the end of the lever *B*. A pencil may be fitted through a hole in the lever *B*, and as this is revolved around the plate *A*, it will trace an oval or elliptical line. At the same time a pencil in the lever *G* will trace an ovoid, as indicated in the drawing.



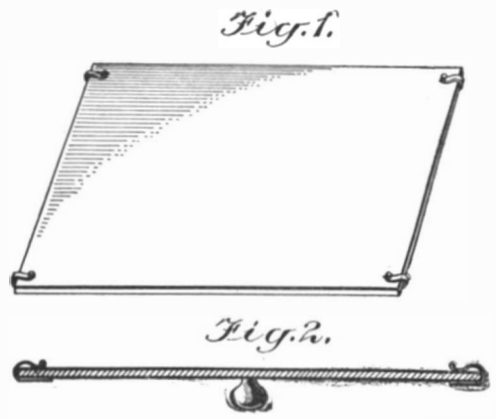
DEVICE FOR DRAWING OVOIDS.

DEVICE FOR WASHING PRINTS.

BY W. AND K. PARKHURST.

The device pictured herewith was devised to prevent prints from becoming torn while being washed. It is especially adapted to washing large prints, such as bromide enlargements, and is of such a simple construction that photographers will probably find it convenient to make several of them and thereby save much delay.

The material necessary is a quarter-inch board of slightly larger dimensions than the photograph to be washed, and four narrow steel springs; segments of a clock spring answer the case admirably. Each spring is clamped on the upper side of the frame, so that it turns over on the other side and securely holds each



DEVICE FOR WASHING PRINTS.

corner of the print. Besides the ease gained in moving the prints about, without injuring them, the photographs are always completely immersed if simply left to soak.

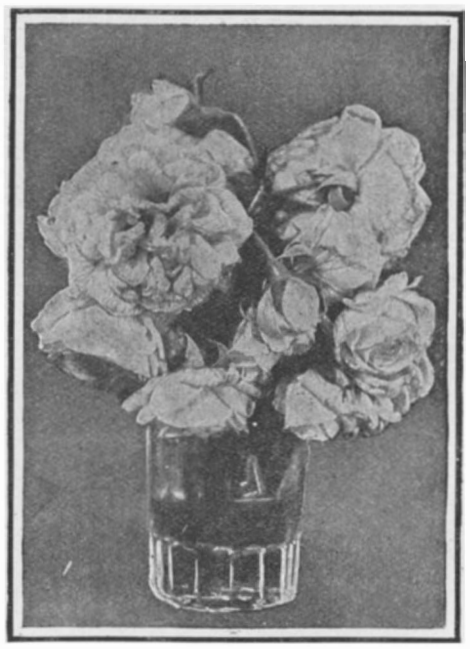
BLUE ROSES.

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

The roses shown in the accompanying figure are white with a delicate and beautiful network of blue veins. Such roses can be obtained in little more than one hour by placing the following solution, instead of water, in the vase in which the cut ends of the stalks are dipping:

Water	100 cubic centimeters.
Aniline methylene blue.	2 grammes.
Potassium nitrate	2 grammes.

School boys know that white roses can be transformed into red flowers by allowing the cut end to remain some time in some kinds of red ink. The writer tried to obtain similar results with a number of aniline dyes and found that while some, like aniline red scarlet, for cotton, readily rise into the vessels of the stalk, others, like aniline methyl green, will not under any circumstances reach the flowers. Some common salts were added to the dyes and one of them, potassium nitrate (saltpeter) was found to exert a powerful influence over the ascent of the dyes, which rise then rapidly and in considerable quantities. The experiment is curious and should be repeated while using the blue liquid; the end of a few stalks being placed in some of the solution to which no saltpeter is added. Aniline methylene blue is not one of the



THE ROSES ARE COVERED WITH A NETWORK OF BLUE VEINS.

dyes which readily ascend in plants and it will be soon noticed that, while the flowers with the stalks dipping into the saltpeter and blue dye solution are covered with the blue network, nothing can still be detected on those whose stalks are allowed to dip in the same liquid but without saltpeter.

Will some botanist suggest an explanation of this influence of saltpeter on the ascent of dyes in stalks and flowers?

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

TROUSERS-STRETCHER.—E. N. HALLETT, Canton, Pa. This stretcher can be folded for packing for the convenience of travelers, the side bars having recesses in which the stretcher members are pivoted, a central rod being provided, which has means for operating the stretcher members, which have means for limiting their movement away from the side bars.

Of Interest to Farmers.

PLOWING-MACHINE.—D. F. KUSTER and G. J. NIEMANN, Washtucna, Wash. This device may be used for disking and throwing the dirt either to the right or left, thus making it possible to go along the side hill, and when the end of the strip is reached the machine may be reversed and retraced along the same side, throwing the dirt down hill.

PLOW.—H. H. JULICH, Mount Hope, Wis. Among the principal objects of this invention is to provide a share which may be readily and quickly detached from the plow and as readily and quickly replaced, thereby permitting the operator to separate the part of the implement which requires sharpening, and to carry the same to the forge or blacksmith shop.

Of General Interest.

HOLDER FOR CONCRETE-REINFORCING.—J. W. REED, Hammond, Ind. The holder is constructed of a single piece of wire, the same being bent to form an eye to embrace the reinforcing bar, with the end portions of the wire extended from the eye to provide nail prongs, the prongs being offset intermediate their length to provide striking faces, said nail prongs arranged to open the eye when spread apart, whereby the eye may be sprung over the bar.

COMBINED HAMMER AND SIGHT.—A. M. POWELL, Valdez, Alaska. This inventor employs a front sight and a hammer provided with an extended portion having a hole through it and also having a notch disposed adjacent to said hole, the notch and hole being in vertical alinement relatively to each other and to the front sight when the barrel and hammer occupy their normal positions, so that either the hole or notch of the hammer sight may be alined with the front sight.

QUOIN.—M. MUCHLER, New York, N. Y. In view in this invention are means that prevent the separation of the wedges either by a relative endwise or lateral movement, and also means including a ratchet bar to automatically lock the wedges against endwise movement in a direction to decrease the thickness of the quoin, the rack bar being movable into and out of operation.

HOLDER AND PROTECTOR FOR MUSICAL-INSTRUMENT STRINGS.—O. J. MÜLLER, New York, N. Y. The aim in this case is to provide a holder for the strings, which will operate not only to retain the string in coiled form but will protect it against injury. The string may be readily inspected without removing it from the holder, and is so secured in place that it may be very readily removed when desired.

DISPLAY BOX AND TRAY.—E. M. LEWIS, Moundsville, W. Va. This combination box and tray is for use in packing goods, intended to be displayed by the retailer, in the original boxes as received from the manufacturer. The invention is inexpensive enough to be applied to the cheapest box and at the same time so complete that it may be used with the most elaborate and costly creation of the box makers' skill.

STARTING AND SEPARATING GATE.—R. V. JONES, Seattle, Wash. It is the object in this instance to obviate race starting accidents by providing means for locking each horse in a separate inclosure and starting the horses a sufficient distance apart, in order that they may not trample upon each other, nor allow the jockeys to interfere with one another when the horses start.

METHOD FOR FORMING SHEET-METAL BODIES.—I. N. JONES, Defiance, Ohio. The intention of the inventor is to provide a method for forming the bodies in a very simple and economical manner and without danger of rupturing the sheet metal, and permitting the formation of the regular shaped bodies without the use of expensive machinery.

LABIAL PROTECTING MEANS FOR DRINKING GLASSES, BOWLS, CUPS, SPOONS, AND THE LIKE.—L. JANCEY, 35 Rue des Martyrs, Paris, France. The invention relates to means adapted to prevent the lips from coming in contact with the edge of drinking receptacles. This labial means is substantially constituted by a part of varying shape riding upon the edge of the glass and holding itself on the same, either in virtue of the nature of the substance comprising it or in virtue of its shape or its arrangement.

SAFETY-ENVELOP.—R. HASEL, New York, N. Y. The envelop is of such a character that its various portions possess gummed surfaces, the arrangement of the various gummed surfaces being such that when the envelop is once sealed, the contents cannot be reached except by mutilating several layers of paper, disposed one upon the other and thoroughly bonded together.

BEAN-CHUTE.—R. A. HAENKE and H. O. HAENKE, Mount Pleasant, Mich. The invention relates particularly to the provision of hinged side doors for relieving pressure within the chute and allowing the lateral discharge of the beans as the bin is filled, the doors and spring attachment thereof being so applied as to offer no material obstruction to the withdrawal of the chute from the bin, when it has been filled.

DENTAL TOOTH-CLAMP.—G. A. HARPER, Shreveport, La. In this dental appliance the improvement is in the nature of a clamp for application to a tooth and having means for holding cotton rolls or napkins, such as used by dentists in keeping moisture away from a tooth while filling the latter, and also means for supporting a mirror.

Hardware.

SCALE.—S. C. COOPER, Nunda, N. Y. In this patent the invention refers to measuring instruments, and the intention is to provide a new and improved weighing scale, arranged to permit the minute adjustment of the poise to insure accurate weighing and to allow convenient reading of the result.

SEAL ATTACHMENT FOR LOCKS.—C. H. JOHNSON, Petaluma, Cal. The invention is intended for use especially on locks used on suit cases, trunks, boxes for legal papers, jewel boxes, and the like. By the use of this device a seal may be placed over the lock and the same covered up and protected, so that the lock itself cannot be unlocked without breaking the seal.

Heating and Lighting.

STEAM-GENERATOR.—F. N. TILTON, Hartford, Conn. The object in this case is to provide a new and improved generator having no sharp bends and but few and straight joints between the pipe coils, the latter being arranged to permit ready assembling and to allow convenient access to any one of the coils.

Household Utilities.

SASH HOLDER AND LOCK.—T. KEPHART, Sinnamahoning, Pa. For the purposes of this invention use is made of upper and lower runners fixed on a window frame, and spring lever devices held on the sashes and adapted to engage the runners, to hold the sashes open by frictional contact, the said lever devices and runners having interlocking means for locking the sashes in a closed position.

Machines and Mechanical Devices.

HOISTING APPARATUS.—H. W. BACHELDER, Schenectady, N. Y. Means are in view in this improvement for swinging the boom, comprising two drums driven one from another to rotate in opposite directions, actuating means for the drums, and means for simultaneously connecting the actuating means with one of said drums and disconnecting the actuating means from the other drum.

DRUM BATCH-MIXER.—W. R. TUTTLE, Nunda, N. Y. The object of this invention is to provide a mixer which may be charged and discharged more quickly and thoroughly than those now in use; one which will thoroughly mix and knead concrete and other materials, and one which has its members so constructed and disposed that the greatest strength and efficiency will be obtained.

AUTOMATIC PRESSURE CONTROL.—J. H. SMITH, Rochester, N. Y. In this invention use is made of a cut-off valve located at the hydrant and having its outlet connected with the hose, so that on closing the nozzle gradually or abruptly, a corresponding automatic closing of the cut-off valve takes place, and on opening the nozzle a corresponding opening of the valve is had.

SHAFT-COUPLING.—F. B. RICHARDSON, Slidell, La. This device while joining two shafts together with the utmost security, may be easily stripped from one of the shafts and permit of the latter's withdrawal through a bearing or other constricted place. This is accomplished by constructing the coupling with a split collar and binding the two halves or portions thereof firmly together, when the coupling is assembled by an intermediate ring.

CLAY-GATHERING MACHINE.—C. E. OLDEN, Mason City, Iowa. By use of this device dry clay may be collected without the necessity of digging the same and throwing the clay into wagons by hand. The clay may be scooped up into a proper receptacle and the latter can be emptied by means of levers and an appropriate clutch mechanism, thereby facilitating the unloading process.

PHONOGRAPH.—F. E. HOLMAN, Silverton, Ore. A record surface is provided in this case, of a flexible nature, and having a relatively great length, may be inserted or removed, and in which the bearing members for the cylinder are pivoted to admit the removal or replacement of the record. The record is applicable to the cylinder type, in which the virtual diameter of the record is greatly increased, while the actual is not.

Prime Movers and Their Accessories.

ROTARY ENGINE.—G. SCHULZ, New York, N. Y. The more particular purpose of the inventor is to provide a type of rotary engine in which an explosive charge is first compressed by the immediate and direct action of the engine, and it is then exploded so that advantage is taken of its expansibility.

Railways and Their Accessories.

RAILROAD-TRACK-RAIL HOLDER AND BRACE.—J. T. WEST, Bowling Green, Ky. The holder provides means for securing a rail upon a cross tie, by the lateral insertion of a spike through a depending member of each rail holder into the side of a cross tie whereon the rail is seated. It is adapted for bracing the head of a track rail against laterally-applied strains.

CAR-COUPLING.—W. S. LENNON, Tucson, Ariz. The invention relates to automatically operated car couplers. This automatic coupler may be operated without requiring the brakeman to pass between the cars. The coupler is ice and sleet proof, and it may be easily coupled without excessive jamming when the cars are on a curve.

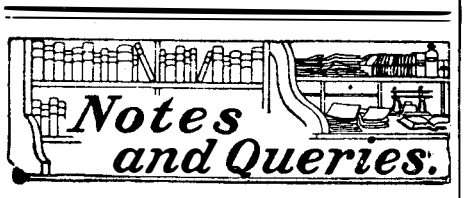
Pertaining to Vehicles.

VEHICLE-WHEEL.—T. HÜBSCHER, Weehawken Heights, N. J. This wheel is designed to offer little resistance to the air. The rim with the tire may be readily detached and replaced, and the wheel presents few parts on which dust and dirt may collect, and the tire bolts, air valve, and other parts of the inside of the wheel are protected from the weather.

COMBINED STEERING AND DRIVING AXLE.—J. W. BUCHAN, Eastman, Ga. In this patent the aim is to furnish a device which combines the features of a steering and driving axle, and which is further provided with means whereby the wheel can be adjusted on the supporting sleeves of the steering knuckles as the bearings become warm.

DUMPING-WAGON.—T. WRIGHT, Jersey City, N. J. The invention pertains to dumping wagons and carts such as used by coal dealers in delivering coal. The object is to produce a wagon having improved mechanism for raising the body into an elevated and inclined position for dumping the load. The means are capable of raising the body to an unusually high elevation.

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.



Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12140) J. C. R. writes: We have in trigonometry minus as well as plus angles. (A minus angle being one generated by a line moving about a point in a clockwise direction.) Also, in regard to functions of plus angles (those angles generated by a line turning about a point in an anti-clockwise direction) we have the following: I. quadrant; sin. and cos. both plus. II. quadrant; sin. plus, cos. minus. III. quadrant; sin. and cos. both minus. IV. quadrant; sin. minus, cos. plus. What I wish to know is, what are the signs of the respective functions of minus angles in the four quadrants, and the reason why? A There are several uses for the signs plus and minus. First to show the nature of a quantity, as positive or negative; second, as signs of the operations of addition and subtraction; third, to denote the direction of motion, as in the case of the angles produced by the rotation of a radius, which you specify; fourth, to indicate the direction in which a quantity is changing or moving, as in denoting north latitude by plus and south latitude by minus; or the degree of the thermometer above zero by plus and below zero by minus. The functions of an angle in trigonometry are similarly denoted. A line drawn upward from a horizontal diameter or to the right of a vertical diameter is plus, while one drawn downward from a horizontal and to the left from a vertical diameter is minus. With this rule or usage in mind there is no difficulty in giving the signs of all the functions in all the quadrants.

(12141) C. D. says: I inclose a clipping concerning the Star of Bethlehem. Similar items have been going the rounds of the papers. What foundation is there for their statements? I can find no such star, nor can I find anything in the reference books concerning the Star of Bethlehem. I had supposed that the so-called Star of Bethlehem was one of our own planets, probably Venus, and must some time have seen a statement to that effect, but I can find no authority for it now. A. There is no star known to astronomers as the "Star of Bethlehem." Nor is there any star known which returns every 500 years. The statements you send us in the clipping are the fanciful emanations of some fantastic brain. It is barely possible that on a hazy night the planet Mars, which has been recently very brilliant in the evening sky, may have been seen to change in brightness and color as the haze passes over it, partly obscuring it. Such performances as the clipping describes cannot possibly have been seen in any heavenly body. There is no scientific knowledge regarding the "Star of Bethlehem," as described in the Bible. The Bible says all that anyone can say about it.

(12142) J. W. says: I am going to construct a wireless, and wish to know the necessary apparatus for a 100-mile wireless sending and receiving apparatus. Would be very grateful for any information regarding same. A. You will find a full description, with drawings and all specifications, for a wireless telegraph outfit to transmit 100 miles, in our SUPPLEMENT No. 1,605, price ten cents.

(12143) J. L. B. says: What chemicals can be compounded that will expand in cold weather and contract in hot weather? What minerals will expand in cold weather and contract in hot weather? A. You will find in Carhart's "University Physics," Vol. 2, page 24, the statement that Rose's metal contracts after the temperature reaches a certain point. This is an alloy composed of bismuth 2 parts, lead 1 part, and tin 1 part. He also states that iodide of silver contracts regularly from 10 deg. C. to 70 deg. C., and that it reaches its point of maximum density at 116 deg. C. These statements we give you as they are given in the book referred to, which we can send you for $1.75 postpaid. Besides these we know no others.

(12144) J. L. B. says: I desire to construct storage cells in Crowfoot jars, using commercial sheet lead 2½ to 3 pounds per square foot. About how many ampere minutes could I expect from each square foot of the oxidized plate if the cell is otherwise properly constructed? Would it be advisable to make the plates rough by deep scratching? What is the best concentration of acid to use? A. You will find in several of our SUPPLEMENTS plans and full descriptions of storage batteries of different forms. We beg to refer you to Nos. 845, 1195, and 1433, which we will send for ten cents each. You should not use smooth sheet lead. The time of forming and the cost will be greatly increased. We cannot tell what ampere minutes you will get per square foot. The composition of the electrolyte is given in the descriptions in the SUPPLEMENTS referred to above.

(12145) A. R. J. says: Kindly describe in your columns the process of making 72 deg. and 76 deg. gasoline. Does it have to be charged with a natural or manufactured gas, or does the product itself contain the gas that makes it suitable for explosive motors? A. Gasoline is produced by the simple distillation of crude petroleum, of which it constitutes about 1.5 per cent. It is the third product to come off at about 140 deg. to 158 deg. F., the only lighter distillates volatilizing at a lower temperature being rhigolene, which comes off at 113 deg., and chymogene, from 113 deg. to 140 deg., of both of which the percentage is extremely small. The next heavier product is benzine or naphtha (which comes off all the way from 158 deg. to 248 deg.). Commercial gasoline, however, contains a good deal of the latter and runs up in gravity to 0.66 or 0.67, true gasoline being from 0.636 to 0.65. Gasoline is not charged with any other gas; the explosive gas used in gasoline engines is a mixture of gasoline and air, gasoline being very volatile, i. e., evaporating rapidly, its vapor being absorbed by air as water is by a sponge, and the mixture being explosive. The mixture of gasoline vapor with air is known as carburetion.

(12146) J. B. says: A train starts from rest and reaches its highest speed, say 60 miles per hour, in 5 minutes. At the end of this time steam is immediately shut off and the train allowed to coast until it comes to rest. How long will it take to come to rest, coasting on a level track, and friction alone retarding it? I maintain that the problem as it stands cannot be answered. Am I correct? A. Your problem is not solvable. Neither the weight of the train nor the coefficient of friction are given. Moreover, the data you give are not concerned in the solution of the problem you state. It matters not how long or by what force the train reaches its velocity. "When steam is shut off, a train has a velocity of 60 miles per hour. In what time will the train come to rest on a level track?" That is all you state toward the problem. It is insufficient. An engineer may assume data, but these are not given in the problem as stated.

(12147) N. P. W. says: Two cylindrical columns of wood, iron, or concrete have the same length and the same diameter and are identical in every respect save that one is hollow while the other is solid. A claims that the hollow column will be stronger (with reference to any force tending to break or buckle it), and B claims that the solid one will be stronger. Will you please oblige a subscriber by explaining in your query column plainly enough for the proverbial "wayfaring man" to understand it, which is right and *why?* A. B is right. The solid column will be the stronger, whether composed of wood, iron, or concrete, or whatsoever material, or whether resisting compression, tension, torsion, or any other strain. A's contention arises from a not uncommon misunderstanding of the well-known rule that a tube is stronger than a solid rod *of the same weight*, i. e., that a rod of one inch diameter will stand less endwise compression or torsion than the *same weight or volume* of metal would stand if made into a hollow column or tube of the same length and, say, two inches outside diameter.

NEW BOOKS, ETC.

A HAND BOOK OF GENERAL INSTRUCTIONS FOR MECHANICS. Containing Useful Rules and Memorandum for Practical Men. New York: D. Van Nostrand Company, 1909. 12mo.; 328 pp. Price, $1.50.

The primary object of the author in writing this book is to give the mechanic, who has not had educational advantages, a text-book explaining established rules for calculating in a clear, simple, and concise way, making him familiar with the various technical terms and their meaning, and to be in general such a course of instruction as to impart in a simple manner the required knowledge to enable him to read understandingly more advanced works. The plan of the book is excellent, and the illustrations and examples are particularly clear. There is hardly anyone who has much occasion to use figures who would not be benefited by a perusal of parts of this book.

PRECIOUS METALS. Comprising Gold, Silver, and Platinum. By T. Kirke Rose, A.R.S.M., D.Sc. New York: D. Van Nostrand Company, 1909. 12mo.; 295 pp. Price, $2.

This is one of the volumes of the "Westminster Series," which has proved such an excellent collection of technical literature. The present volume deals with the methods of treating gold by the wet and dry process. The extraction of silver, the refining and assaying of gold and silver ores, the assay of gold and silver bullion, minting, the manufacture of gold and silver wires, and a valuable chapter on platinum, together with tables on the production of precious metals. There has been room for a good book on gold and silver for some little time. This book seems to fill the niche admirably.

MOTORMAN'S PRACTICAL AIR BRAKE INSTRUCTOR. By George R. Denehie. Chicago: Frederick J. Drake & Co., 1909. 18mo.; 280 pp., leather back.

This is a concise up-to-date treatise on the construction and operation of the different air-brake equipments used in modern electric transportation. The author has been at considerable pains, therefore, to collect, condense, and compile all the latest available information bearing upon this most important subject of handling an electric car or a train of cars safely and at the same time economically. The diagrams and illustrations are particularly clear. Some of them are reproduced in colors. The get-up of the book, however, is not equal to another book on the same subject which we reviewed a short time since.

LIFE OF SIR CHARLES TILSTON BRIGHT. Civil Engineer. By Charles Bright, F.R.S.E. London: Archibald Constable & Co., Ltd. New York: D. Van Nostrand Company, 1908. 8vo.; 478 pp. Price, $4.50.

In this book is incorporated the story of the Atlantic cable and the first telegraph to India and the colonies. In response to a number of suggestions in view of the fiftieth anniversary of the Atlantic cable, Mr. Bright has brought out an abridged edition of the biography of his father, the original work having been written by Sir Charles Bright's brother and by his son. There is probably no branch of engineering which lends itself so readily to a full sight of the world as that of telegraphy. Therefore, the present volume will appeal to the general reader only in a lesser degree than to the engineer, the student, and the historian. Sir Charles Bright was as much a traveler as a scientist, and even when engaged on the most trying cable venture in unhealthy climates, he invariably kept a neatly written record of the day's performance—of what he had seen and learnt—never retiring to bed without attending to his task. The detail to be drawn upon is very large, and the author has certainly made an excellent selection. The story of the Atlantic cable is one of the most romantic in the history of science, and it is gratifying that the biography of the pioneer should be written by his son.

THE LEAD AND ZINC PIGMENTS. By Clifford Dyer Holley, M.S., Ph.D. New York: John Wiley & Sons, 1909. 12mo.; 340 pp.; 85 figures. Price, $3 net.

New pigments have come into use during the last ten years, new processes have been developed for the manufacture of the older pigments, new combinations of pigments have been worked out that have secured results hitherto unattainable. Yet up to the time mentioned above, except for short articles in some of the trade papers, these improvements and innovations remained practically unnoticed. Since public attention has been directed to the paint industry by the enactment of the various State laws regarding the sale of paint materials, several excellent American works have been written on this subject, but the majority of them have been directed more particularly toward the compiling of analytical methods and data than to the manufacture and uses of the various pigments. In this work the author has attempted to record the progress made in the United States in the manufacture of the more important pigments, and hence but little space has been given to European methods and processes except for comparison, as they have been discussed in detail in various English and European works.

MANUAL OF STEAM ENGINEERING. By W. H. Wakeman. New York and Chicago: New York Belting and Packing Company.

Mr. Wakeman's name is familiar to readers of the SCIENTIFIC AMERICAN SUPPLEMENT, as well as to readers of technical journals in general, as the author of many articles on engineering subjects. In this little book he has presented instructions, suggestions, and illustrations for steam engineers concerning the application to modern daily practice of the approved theory of steam engineering. Although the work is issued no doubt as an advertising pamphlet, it is essentially an engineering reference book containing data that are required in everyday practice, arranged in convenient form and with sufficient explanation to render the matter both interesting and instructive.

Legal Notices

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending November 16, 1909,

AND EACH BEARING THAT DATE

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

Acetates, making, H. O. Chute	939,980
Acetylene generating apparatus, A. Davis	940,437
Acetylene generator, J. Zander	940,110
Acid from nickel-chlorid solution, recovering hydrochloric, H. L. Wells	940,293
Acid phosphate and the like, apparatus for handling, J. T. Capers	940,583
Advertisement displaying apparatus, J. T. Roffy	940,281
Advertising card, W. O. Holt	940,316
Air brake, J. W. Hicks	940,314
Air ships and the like, optical instrument for determining the direction of travel of, O. O. Krell	940,329
Alfalfa drier and mill, W. E. Rickey	940,193
Ambulance, J. P. L. Wilson	940,104
Annealing and hardening furnace, W. S. Rockwell	940,280
Arch supporter, adjustable, T. Hughes	940,022
Asbestos covering, sectional, W. J. Moeller	940,265
Ash pan, R. B. Patterson, Sr	940,403
Auger bit, J. W. Caldwell	940,426
Automobile engine, A. S. Krotz	940,031
Automobile wheel drive, T. G. Rowe	940,068
Automobile wind deflector, J. M. Patrick	940,270
Awning fixture, F. O. Berg	940,120
Baking powder tester, F. Kiely	940,258
Bar bender, J. T. Richards	940,360
Battery system, combined primary and secondary, J. H. Gugler	940,008
Bearing, roller side, J. F. O'Connor	940,353
Bearing wheel, roller, A. Wulff	940,106
Bearings of textile machinery, means for protecting roll, J. L. Patterson	940,551
Bed, folding, J. Lyons	940,038
Bed, sofa, L. G. Ihrig	940,321
Beehive, G. R. Sinnickson	940,407
Belt fastener, C. S. Eaton	940,443
Binder or loose sheet holder, temporary, H. F. Bushong	940,508
Binder, temporary, G. H. Moore	940,443
Binder or loose sheet holder, temporary, H. F. Bushong	940,508
Binder, temporary, G. H. Moore	940,345
Binding post, H. E. Leppert	940,335
Binding post, A. Lungen	940,397
Block signaling system, F. F. Brush	939,973
Blow-off pipes, protector for, A. R. Chambers	940,427
Blower, rotary, L. E. Fagan	940,587
Board, apparatus for manufacture of composition, J. Feria	940,449
Boards, manufacturing composition, J. Ferla	940,450
Boat lowering device, life, C. J. Christensen	940,512
Boiler low water signal, J. L. Setzer	940,202
Boiler water circulator, C. C. Eckliff	939,991
Bone black kiln, B. Eba	940,520
Bookbinding, cloth, M. Taprogge	940,287
Boot and shoe separable fastener, J. Jeperson	940,462
Bottle, O. Papp	940,049
Bottle, E. T. Greenfield	940,310
Bottle filling machine, Falls & Williams	940,138
Bottle lock, W. H. Bryan	940,125
Bottle washer, milk, W. W. Haggard	940,011
Bottler's apparatus, G. J. Meyer	940,178
Bottling machine, J. H. Camp	939,978
Bowling alley surfacing machine, G. B. Gonia	940,004
Bowling pin, B. Merklen	940,341
Brake, E. Herold	940,461
Brake beam, H. Ziemss, Jr	940,417
Brick machine, J. J. Mead	940,177
Brick machine, C. M. Starr	940,623
Bridge, J. F. Kaspar	940,326
Brush holder, E. R. Knight	940,393
Buckle, A. Bienenzucht	940,498
Buffing machine, J. J. Heys	940,015
Buggy top support, yielding, C. P. Johnson	940,158
Building block, interlocking, B. Benas	940,227
Burglar alarm, M. Korbel	940,535
Buttonhole machine, H. C. Miller	940,042
Cabinet, C. M. Hutchinson	940,023
Cabinet, light, McClure & Shuman	940,544
Can closure, powder, G. W. Childs	940,128
Can opener, A. C. Lemm	940,396
Cans and the like, machine for washing, J. L. Ranney	940,060
Canceling machine, ticket, Fisk & Seely	940,452
Cant hook, J. B. Snyder	940,207
Car brake, W. J. Stahr	940,373
Car construction, Dunbar & Berg	940,378
Car coupling, emergency, E. Posson	940,553
Car fender, T. J. Killeen	940,464
Car, dump, J. Pearson	940,187
Car fender, Fisk & Smith	940,588
Car frame, E. Posson	940,357
Car, hand, J. Marshall	940,175
Car heating and ventilating apparatus, F. H. Farrington	940,636
Car roof, J. Pearson	940,355
Car step, folding, G. F. Brandau	939,970
Car switch operating mechanism, F. G. Eibel	940,136
Car underframe, railway, E. Possen	940,358
Car wind screen, motor, J. Hodgson	940,529
Cars, grass-cutting attachment for, Clarke & Stream	940,514
Carbureter, J. R. Nye	940,652
Car table, M. B. Samuel	940,283
Caster for gymnasium apparatus, F. Medart	940,606
Casting apparatus, A. Casey	940,302
Cement pot, H. W. Lawson	940,333
Cementitious composition and making same, W. E. Carson	939,977
Chair iron, H. W. Bolens	940,232
Check, barber's account, J. Church	939,979
Chime, electric, J. E. Scovill	940,483
Chimney, ventilating, J. M. McIntosh	940,348
Churn, O. D. Welds	940,099
Cigar end or tuck forming machine, R. Helms	940,248
Cigarette and match box, S. Schendel	940,198
Circuit breaker, automatic magnetic, W. M. Scott	940,647
Clock, R. C. Saloch	940,617
Clock, pendulum actuated, E. W. Vaill, Jr	940,410
Clutch, T. H. Gerrard	940,002
Coating device, G. H. Hardman	940,593
Coin detector, H. T. Werden	940,568
Collapsible box or crate, G. A. Shraud	940,371
Comb, W. Jacobs	940,532
Combustion engine, C. S. Piestrak	940,474
Composition of matter, F. J. Conboy	939,982
Compounds and mixtures, method and apparatus for determining proportions in, L. Taylor	940,217
Concrete block molding machine, C. Colwitz	940,131
Concrete floor construction, reinforced, U. S. G. Athey	940,296
Concrete, means for filling holes with, L. E. Welsh	940,100
Concrete sidewalks, curbs, etc., apparatus for laying, E. L. Ransome	940,061
Concrete slabs, production of hollow reinforced, M. Milankovitch	940,041
Concrete steel construction, W. Mueser	940,399
Concrete structures, mold for making, J. M. Timmons	940,090
Concrete tile mold, B. T. Beckman	939,968
Condenser, steam, R. D. Tomlinson	940,648
Conduits, device for joining parts of, G. M. Wenrle	940,098
Connector, T. A. Hammond	940,012
Cooking shelled peanuts, etc., machine for, C. O. Roe	940,557
Copper-nickel and other metals from copper-nickel matte, separating, H. L. Wells	940,292
Copy holder, F. M. Giddings	940,003
Cotton chopper, N. Robinet	940,279
Cotton picker, W. A. Phipps	940,274
Counting apparatus, automatic, G. F. Richmond	940,066
Coupling. See Car coupling.	
Coupling mechanism, W. D. Leftwich	940,334
Cuff holder, W. S. Arnold	940,225
Culinary utensil, W. Quinby	940,059
Cultivator, W. E. Johnson	940,159
Cup attachment, drinking, D. M. Simpson	940,204
Curb corners, nosing for, W. S. Clifford	940,432
Current collector, G. R. Forster	939,995
Curtain hook, C. H. Maass	940,642
Cycle and bicycle stand, motor, F. C. Hoffer et al	940,250
Dental instrument, S. Quigley	940,058
Dental instrument, O. Neugebauer	940,351
Derailer, J. T. Farrell	940,139
Die, L. Swank	940,214, 940,215
Disinfecting apparatus, P. J. Walsh	940,097
Disk tongue device, J. C. Roath	940,194
Display device, W. Marks	940,263
Distributer, J. W. Le Gore	940,538
Door, A. A. Wheeler et al	940,294
Door fastening device, M. Ritchel	940,362
Door hanger, A. Theyskens	940,088
Door hanger, W. D. Ferris	940,307
Door stop, D. Crockett	940,436
Double acting switch, C. J. Snellman	940,408
Draw box, E. H. Rooney, reissue	13,041
Dressing machine reel, R. Knebel	940,603
Drier, C. E. Geiger	940,144
Drying apparatus for tea, grain, etc., S. C. Davidson	940,237
Drip pan, Menzl & Schwartz	940,040
Driving mechanism, J. J. Walser	940,095
Driving mechanism, variable speed, J. J. Walser	940,096
Driving mechanism, variable speed, H. C. Schroeder	940,201
Driving mechanism, variable speed, J. J. Walser	940,626
Dumping elevator, automatic, G. E. Richmond	940,065
Dust detonations, device for preventing, P. Schuster	940,075
Dust pan, W. E. Ballman	940,422
Dust separating tank, D. Fogarty	940,141
Dye and making same, azin, P. Ott	940,354
Dye and making same, brown vat, Engi & Kappeler	940,586
Easel, E. Oldenbusch	940,472
Educational device, R. M. Vick	940,093
Egg case, foldable metal, A. R. Burleson	940,234
Egg separator, Bayless & Redman	940,119
Egg tester, W. Rigling	940,361
Eggs, mold for making nest, J. M. Southerland	940,208
Elastic fluid engine, C. V. Kerr	940,162
Electric circuits, protective device for, S. R. Bergman	940,578
Electric conductors, safety device for overhead, E. Giraud	940,525
Electric generator, E. T. Kenney	940,392
Electric heater, luminous, Howard & Cousins	940,021
Electric light, incandescent, J. T. Bigger	939,969
Electric machine, dynamo, C. P. Steinmetz	940,210
Electric machine, dynamo, B. A. Behrend	940,632
Electric separator, G. D. Rogers	940,282
Electric switch, O. M. Knoblock	940,328
Electrical receptacle, G. W. Goodridge	940,526
Electricity in moving material, apparatus for neutralizing, W. H. Chapman	940,428
Electricity, means for neutralizing static, W. H. Chapman	940,431
Electricity, neutralizing static, W. H. Chapman	940,429
Electricity, process and apparatus for neutralizing static, W. H. Chapman	940,430
Electrode element for storage batteries, T. A. Edison	940,635
Engine construction, gas or gasolene, C. Herreshoff	940,650
Engine igniting apparatus, explosive, B. F. Stewart	940,374
Engine ignition system, explosion, P. R. Werner	940,376
Engines, silencer for internal combustion, W. L. Tobey	940,290
Engines, spark plug for internal combustion, M. Eyquem	940,448
Engines, under-water exhaust outlet for internal combustion, W. L. Tobey	940,291
Engraving machine, P. J. Meyer	940,179
Eraser cleaning machine, J. A. Jones	940,254
Etching machine, H. Schedler	940,480
Evaporating apparatus, J. Parker	940,473
Excavating apparatus, A. E. Lehmann	940,035
Excavator, drainage, M. G. Bunnell	940,126
Explosive, C. U. Buck	940,580
Explosive grenade, F. M. Hale	940,527
Explosive mixing machine, H. Talley	940,216
Farrier's implement, W. Rawalt	940,478
Faucet, J. Falasco	940,522
Faucet, A. J. Robinson	940,556
Faucet, beer, T. Davis	940,438
Faucet, J. Falasca	940,522
Feed bag, T. Brennan	939,971
Feed mechanism, differential positive, R. Milne	940,342

Home-Made Experimental Apparatus

In addition to the following articles, the **Scientific American Supplement** has published innumerable papers of immense practical value, of which over 17,000 are listed in a carefully prepared catalogue, which will be sent free of charge to any address. Copies of the **Scientific American Supplement** cost 10 cents each.

If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

ELECTRIC LIGHTING FOR AMATEURS. The article tells how a small and simple experimental installation can be set up at home. **Scientific American Supplement 1551.**

AN ELECTRIC CHIME AND HOW IT MAY BE CONSTRUCTED AT HOME, is described in **Scientific American Supplement 1566.**

THE CONSTRUCTION OF AN ELECTRIC THERMOSTAT is explained in **Scientific American Supplement 1566.**

HOW TO MAKE A 100-MILE WIRELESS TELEGRAPH OUTFIT is told by A. Frederick Collins in **Scientific American Supplement 1605.**

A SIMPLE TRANSFORMER FOR AMATEUR'S USE is so plainly described in **Scientific American Supplement 1572** that anyone can make it.

A ⅛-H.-P. ALTERNATING CURRENT DYNAMO. Scientific American Supplement 1558.

THE CONSTRUCTION OF A SIMPLE PHOTOGRAPHIC AND MICRO-PHOTOGRAPHIC APPARATUS is simply explained in **Scientific American Supplement 1574.**

A SIMPLE CAMERA-SHUTTER MADE OUT OF A PASTEBOARD BOX, PINS, AND A RUBBER BAND is the subject of an article in **Scientific American Supplement 1578.**

HOW TO MAKE AN AEROPLANE OR GLIDING MACHINE is explained in **Scientific American Supplement 1582,** with working drawings.

EXPERIMENTS WITH A LAMP CHIMNEY. In this article it is shown how a lamp chimney may serve to indicate the pressure in the interior of a liquid; to explain the meaning of capillary elevation and depression; to serve as a hydraulic tournique, an aspirator, and intermittent siphon; to demonstrate the ascent of liquids in exhaustive tubes; to illustrate the phenomena of the bursting bladder and of the expansive force of gases. **Scientific American Supplement 1583.**

HOW A TANGENT GALVANOMETER CAN BE USED FOR MAKING ELECTRICAL MEASUREMENTS is described in **Scientific American Supplement 1584.**

THE CONSTRUCTION OF AN INDEPENDENT INTERRUPTER. Clear diagrams giving actual dimensions are published. **Scientific American Supplement 1615.**

AN EASILY MADE HIGH FREQUENCY APPARATUS WHICH CAN BE USED TO OBTAIN EITHER D'ARSONVAL OR OUDIN CURRENTS is described in **Scientific American Supplement 1618.** A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil, and all the apparatus required, most of which can be made at home.

SIMPLE WIRELESS TELEGRAPH SYSTEMS are described in **Scientific American Supplements 1363** and **1381.**

THE LOCATION AND ERECTION OF A 100-MILE WIRELESS TELEGRAPH STATION is clearly explained, with the help of diagrams, in **Scientific American Supplement 1622.**

THE INSTALLATION AND ADJUSTMENT OF A 100-MILE WIRELESS TELEGRAPH OUTFIT, illustrated with diagrams, **Scientific American Supplement 1623.**

THE MAKING AND THE USING OF A WIRELESS TELEGRAPH TUNING DEVICE, illustrated with diagrams, **Scientific American Supplement 1624.**

HOW TO MAKE A MAGIC LANTERN, Scientific American Supplement 1546.

THE CONSTRUCTION OF AN EDDY KITE. Scientific American Supplement 1555.

THE DEMAGNETIZATION OF A WATCH is thoroughly described in **Scientific American Supplement 1561.**

HOW A CALORIC OR HOT AIR ENGINE CAN BE MADE AT HOME is well explained, with the help of illustrations, in **Scientific American Supplement 1573.**

THE MAKING OF A RHEOSTAT is outlined in **Scientific American Supplement 1594.**

Good articles on SMALL WATER MOTORS are contained in **Scientific American Supplement 1494, 1049,** and **1406.**

HOW AN ELECTRIC OVEN CAN BE MADE is explained in **Scientific American Supplement 1472.**

THE BUILDING OF A STORAGE BATTERY is described in **Scientific American Supplement 1433.**

A SEWING-MACHINE MOTOR OF SIMPLE DESIGN is described in **Scientific American Supplement 1210.**

A WHEATSTONE BRIDGE, Scientific American Supplement 1595.

Good articles on **INDUCTION COILS** are contained in **Scientific American Supplements 1514, 1522,** and **1527.** Full details are given so that the coils can readily be made by anyone.

HOW TO MAKE A TELEPHONE is described in **Scientific American Supplement 966.**

A MODEL STEAM ENGINE is thoroughly described in **Scientific American Supplement, 1527.**

HOW TO MAKE A THERMOSTAT is explained in **Scientific American Supplements 1561, 1563,** and **1566.**

ANEROID BAROMETERS, Scientific American Supplements 1500 and **1554.**

A WATER BATH, Scientific American Supplement 1464.

A CHEAP LATHE UPON WHICH MUCH VALUABLE WORK CAN BE DONE forms the subject of an article contained in **Scientific American Supplement 1562.**

Each number of the **Scientific American Supplement** costs 10 cents by mail.

Order from your newsdealer or from

MUNN & CO., Inc., 361 Broadway, New York

CHEMISTRY OF SOLDERING AGENTS.

(*Concluded from page 389.*)

chloride preparations are very convenient in use and very reliable, causing the solder to adhere firmly. Even when the surfaces to be joined are greatly oxidized, a good joint can be made by a skillful workman. In order to prevent the possibility of injurious after effects, it is customary to wash the soldered joint with zinc chloride solution. Cable joints made with the aid of zinc chloride were opened and examined after the same intervals of time that were allowed for the joints made with ammonium chloride. Although the zinc chloride also penetrated between the wires the difference in the result was very great. The wires of the core were covered with a dry, wax-like dark green coating, and a substance resembling pitch was found in places where the other ingredients of the zinc chloride soap had been decomposed by overheating, but junctions which had been traversed by strong currents for long periods showed no appreciable increase in resistance.

The assertion that injurious effects are necessarily produced by hydrochloric acid separated by hydrolysis from the hygroscopic zinc chloride was also submitted to the test of experiment. Copper wires less than 1/250 inch in diameter were soldered together and the junctions were covered thickly with the zinc chloride mixture and inserted in an apparatus with which their resistance could be measured while a current was kept flowing through them. In a few days the mixture became moist, but it quickly dried and assumed the wax-like appearance described above. The wires were exposed freely to the air, but observations continued through a long period revealed no deterioration of the joint.

Hence it may be asserted, as the result of exhaustive researches continued for years, that zinc chloride is in every way superior to ammonium chloride as a soldering agent. The inference that ammonium chloride is safe because it is possible to obtain it unmixed with free acid, is a pure delusion, for the injurious action of ammonium chloride on metals is due, not to the comparatively harmless hydrochloric acid, but to the other causes mentioned above.

The extraordinarily good practical effect of zinc chloride preparations, however, still requires explanation.—Zeit. f. Ang. Chemie.

SOUNDING THE OCEAN OF AIR.

(*Continued from page 393.*)

mer, autumn, or winter. Kites and balloons have been sent up from almost every quarter of the earth. Perhaps the most recent of these investigations in an out-of-the-way quarter of the globe is the meteorological expedition to East Africa undertaken by the Royal Prussian Meteorological Observatory. The expedition was conducted by Prof. Berson and Prof. Elias. The chief object was to determine the origin of monsoons, an object which was not altogether attained, but on which much light was thrown. An ultimate aim was the prognosis of the rainy season in East Africa and India. On the coast and from a specially chartered steamer on the lake, *ballons-sondes*, pilot balloons, and kites were sent up. The observations over the equator, in the center of the continent, showed very low temperatures at great heights, as did the expedition of Teisserenc de Bort and Rotch on the equatorial Atlantic, but with the difference that over the African continent there was a trace of the permanent inversion layer. The vertical changes were as follows: adiabatic decrease of temperature to 13,000 meters, between 13,000 and 15,000 meters a small inversion, and above 17,000 meters isothermal conditions. Above the southeast monsoon the wind was south-southwest, and three times a westerly wind was observed between 15,000 and 18,000 meters, above the great equatorial current from the east which is supposed to prevail at all heights.

It was feared that a very large per cent

(*Continued on page 400.*)

of the balloons which fell on land would be lost, because of the nature of the country and the sparseness of the population, but on the contrary an astonishing proportion of them was recovered, owing to the keenness of vision of the natives, to whom a small reward was offered for every one returned.

What has been the result of this international aerial sounding? It has been discovered that all over the earth the air is stratified in three more or less distinct layers. The lowermost of these, the layer in which we live and which extends upward for two miles from the surface of the earth (at which height the freezing point is encountered) is a region of turmoil—warm to-day and cold to-morrow. This is the stratum of capricious winds, cyclones and anti-cyclones, of cool descending currents and warm ascending currents. All our weather forecasting is at present based on what can be learned from the general circulation of the air in this lowermost layer.

Above this first layer, which extends upward for perhaps two miles, begins the second layer, which is about six miles thick, and is less turbulent than the first. In it the air grows steadily colder and drier with increasing height. Temperatures as low as 167 deg. below the Fahrenheit freezing point have been recorded here. Whatever thermal irregularities there may be are caused by temperature changes on the surface of the earth and by the reflection of solar heat from clouds. The wind blows always in the same easterly direction; and the greater the height, the more ferocious is the blast.

The last of all the layers thus discovered lies above this. Originally revealed by Teisserenc de Bort and Dr Richard Assmann almost simultaneously, it was first known as the "isothermal stratum," because its temperature seemed to be stationary. Later, when it was found that the temperature, instead of remaining fixed, gradually increased, it was rechristened the "permanent inversion layer." The height of the inversion layer has not as yet been determined. It must not be supposed that, because its temperature rises, it is much warmer than in the second layer. As a matter of fact, its temperature must be placed somewhere between 122 deg. and 140 deg. below the Fahrenheit freezing point. This permanent inversion layer is puzzling in the extreme. In passing from the second to the permanent inversion layer, the wind is stilled to a breeze, the velocity decreasing from 25 to 80 per cent. The air blows no longer in a steadily easterly direction, but almost as capriciously as it does at the surface of the earth. Dryness, excessive dryness, is another characteristic of the permanent inversion layer. In summer time, the permanent inversion layer begins at a height of about 7½ miles above the earth; the higher it lies, the colder it is; the lower it lies, the warmer it is. There is no bodily shifting up and down of warm and cold masses of air, so that a current ascending from the lower level spreads out when it encounters the permanent inversion layer, just as hot air which strikes the ceiling of a room.

Up to about 10 kilometers the decrease of temperature is almost adiabatic, then in the next 5 kilometers there is usually a rise in temperature of 8 deg. to 10 deg. C., with isothermal conditions up to at least 26 kilometers. The lower zone Teisserenc de Bort calls the "troposphere," and the upper one the "stratosphere." The former is a region of violent atmospheric disturbances, for it has been shown that cyclones do not extend above the cirrus clouds, though anti-cyclones persist to greater heights, and therefore the stratosphere is lowest in the cyclone and highest in the anti-cyclone, and its level sinks from the equator to the poles. The stratosphere is a region of interlaced currents and small vertical movements.

Up to the height of the permanent inversion layer, the temperature falls at an average of one degree C. per 100

(*Concluded on page 401.*)

Feeder, stock, Loop & Newman..... 940,540
Fence post, J. O. Mace..... 940,173
Fender. See Car fender.
Fertilizer distributer, E. C. Galloway..... 940,455
Fertilizer distributer and planter, combined, F. D. Decker..... 940,517
Filling device, J. Papish..... 940,611
Filling machine, F. C. H. Strasburger..... 940,624
Fire escape, A. A. Jahnke..... 940,601
Fire extinguisher apparatus, Read & Campbell..... 940,614
Firearm, magazine, J. Rebman..... 940,191
Fish hook, W. E. Koch..... 940,465
Fishing reels, drag handle for, T. M. Williams..... 940,415
Flat iron, self-heating, Konigsberg & Allen. 940,466
Flower supporter, A. Heim..... 940,153
Flue cutter, J. M. Wenzel..... 940,222
Fluid distributing comb, V. Sartell..... 940,196
Fly book, S. E. Creasey..... 940,132
Folding box, H. L. Gulline.....940,009, 940,010
Folding chair, F. M. Burrowes..... 940,582
Folding table, F. W. Anderson..... 939,963
Frog, hard center, Dotter & Hays..... 940,441
Frog, reversible, Dotter & Hays..... 940,440
Fruit jar, H. B. Burns..... 940,581
Fuel feeder, Harding & Saeger..... 940,313
Furnace, J. R. Fortune..... 939,997
Furnace fire door, J. R. Fortune..... 939,996
Furnaces, rabble for ore roasting, A. V. Leggo..... 940,537
Gage movement frame, Blanchard & Crocker 940,379
Gambrel, hog, C. G. Coultas..... 940,434
Garbage can and rubbish burner, combined, E. D. Smith..... 940,082
Gas and carbureted water-gas, manufacturing mixed coal, W. Thomas..... 940,289
Gas generator, acetylene, Z. A. Ferrel..... 940,384
Gas lighter, F. H. Pomeroy..... 940,276
Gas lighting and extinguishing apparatus, V. C. J. Nightingall..... 940,610
Gas lights from a distance, apparatus for lighting and extinguishing, Nossen & Bergstrom..... 940,046
Gas main stopper, P. Goodman..... 940,458
Gas mantle fixture shock absorbing device, H. E. Woods..... 940,629
Gas producers, vibratory disintegrator for, J. J. Astor..... 940,493
Gas washer, W. Feld..... 940,103
Gases, apparatus for purifying burner, J. B. F. Herreshoff..... 940,596
Gases, purification of burner, J. B. F. Herreshoff..... 940,595
Gasolene engine, J. C. Johnson..... 940,027
Gate, J. E. Mullen..... 940,044
Gate hook, C. L. Smith..... 940,205
Gate operating attachment, J. B. Faulkner.. 940,306
Gear train, double pinion toothed, W. Trewhella..... 940,091
Gearing, H. C. Schroeder..... 940,200
Gearing, friction, J. L. Graham..... 940,006
Glassware, mechanism for producing hollow, C. J. Koenig..... 940,165
Grader, road, Hadley & Smith..... 940,389
Grain drier, P. Provost..... 940,190
Grass crimping apparatus, W. F. Wyman... 940,630
Grate, revolving, A. L. Wilson..... 940,570
Grinding machine, C. H. Norton et al..... 940,548
Grinding machine driving gear, J. M. Thompson..... 940,089
Grinding mill, J. C. Clark..... 940,513
Gun hose, automatic, G. L. Wetzel..... 940,101
Hames fastener, adjustable, J. Oppenheim.. 940,269
Hammers, die holder for drop, W. F. Gorton 940,005
Hammers, water attachment for pneumatic, Carnahan & Murphy..... 940,510
Harness, H. H. Crawford..... 939,985
Harrow, R. C. Bowman..... 940,501
Harrow, disk, C. S. Sharp..... 940,203
Harrow, guarded end steel level, W. E. Johnson..... 940,160
Harvester, beet, G. A. Pingree..... 940,189
Hat, J. R. Rash..... 940,062
Headlight cover, C. W. Houghton..... 940,156
Headlight, locomotive, S. W. Emery..... 940,446
Heat transmitter, H. Friedenthal..... 940,244
Heating apparatus, N. B. Wales..... 940,567
Hinging gage, W. H. Gelbaugh..... 940,901
Hod, H. McLane..... 940,350
Hoisting apparatus, G. Hammond..... 940,148
Holdback, M. D. Schaller..... 940,620
Holder, G. Stocker..... 940,086
Horseshoe, G. Loeffler..... 940,337
Horseshoe calk former, E. N. Childs..... 940,235
Hose supporter, E. C. Scruggs..... 940,285
Ice creeper for horseshoes, G. H. Echols.... 940,381
Ice harvesting and cutting apparatus, plate, D. J. Havenstrite..... 940,013
Ingot mold, E. Gathmann..... 940,386
Insect catcher, E. Attaway..... 940,116
Insole or support for deformed feet, I. Tauber..... 940,564
Insulating fabrics, making, C. F. Peterson.. 940,188
Kinetoscope, Pink & Fletcher..... 940,275
Knife and fork scourer, W. D. Holmes..... 940,018
Knockdown box, T. A. Brenner..... 940,122
Labeling machine, F. O. Woodland..... 940,105
Lacing tool and square, belt, H. T. Mumford 940,400
Lacing tool, belt, H. T. Mumford..... 940,401
Lamp, E. Schmidt..... 940,073
Lamp attachment, mercury, C. P. Steinmetz. 940,209
Lamp chimney, G. H. Lee..... 940,468
Lamp globe, A. H. Humphrey..... 940,530
Lamp shade, electric, N. C. Bebin..... 940,649
Lathe tool, combination, O. Carlborg..... 940,301
Lathe tool holder, J. & W. Carr..... 939,976
Leather and the like creasing machine, E. B. Stimpson..... 940,084
Leather cutting, beveling, splitting, and grooving machine, C. Hildebrandt..... 940,390
Ledger, self-indexing loose leaf, P. W. Schwander..... 940,560
Lemon squeezer, J. Wiendl..... 940,628
Lens grinding machine, F. Buchhop..... 939,975
Lifting jack, E. Cook..... 940,433
Light. See Electric light.
Lightning arrester, C. T. Mason..... 940,176
Lightning arrester, E. W. Vogel..... 940,220
Lip turning machine, W. H. Hooper..... 940,020
Lip turning machine, channel, W. H. Hooper 940,019
Liquid fuel burner, R. M. Hammond..... 940,149
Liquid fuel combustion engine, H. R. Setz.. 940,369
Liquids, filling apparatus for, S. Schlangen.. 940,366
Lock, B. Borland..... 940,300
Lock escutcheon, P. K. Magruder..... 940,261
Locomotive tender frame, C. H. Howard..... 940,157
Log loading apparatus, A. W. Kurz..... 940,331
Logging car standard attachment, M. Majette..... 940,262
Loom for weaving tufted pile fabrics, J. P. Humphries..... 940,531
Loom let-off mechanism, narrow ware, G. W. Kuenneth..... 940,330
Loom warp, means for applying wax to, W. F. Mintel..... 940,607
Loom weft-replenishing mechanism, automatic, M. L. Stone..... 940,286
Looms, differential filling supply gaging device for, S. S. Jackson..... 940,600
Lubricator, J. A. Martin..... 940,339
Lubricator, R. C. Agner..... 940,572
Magnetic separator, W. B. Moore..... 940,266
Mail bag catcher, W. Wever..... 940,102
Mail bag deliverer, H. J. Sanderson..... 940,618
Mail catching and delivering device for railways, W. M. Moloney..... 940,180
Mail crane, H. J. Hedrick..... 940,152
Mail delivery car, rural, W. B. Yarberry... 940,107
Mail marking machine, W. Barry..... 940,496
Mailing tube, V. Guertin..... 940,146
Malt kiln, O. H. Luebkert..... 940,172
Mantle, incandescent, O. Kaufmann..... 940,639
Match safe, W. G. Monk..... 940,344
Match safe, J. E. Gearhart..... 940,387
Matrices, producing, P. T. Dodge..... 939,988
Measuring device, chest expansion, C. W. Kennedy et al..... 940,256
Measuring instrument, O. W. Dolph..... 940,439
Measuring instrument, electric, A. H. Hoyt, 940,318, 940,319
Measuring tank, liquid, Smith & Meyer..... 940,206
Metal working machine, Sanford & Marshall. 940,619
Metal working machines, work support for, W. F. Zimmermann..... 940,418
Metallic tie, M. F. Bonzano..... 940,500
Meters, gearing for, A. F. Hintze..... 940,638
Milk heater, A. H. Schlueter..... 940,367
Mine, submarine, A. P. Broomell..... 940,506
Mirror, H. Varder..... 940,411
Mirror, portable, C. W. Angell..... 940,115
Mixtures, obtaining intimate, E. Dor-Delattre..... 939,989

meters (one degree F. per 182 feet). Because of the constant upheavals to which the air is subject in its lower levels, this average rate of temperature reduction as we ascend is not always observed. Sometimes it even happens that for a short distance the thermometer rises instead of falls, but ultimately the temperature drops at a uniform rate until it reaches a point lower than that recorded by any North Pole explorer.

The three layers of air which have been discovered by kites and balloons intermingle but slightly; one floats upon the other as oil floats upon water. Of the great ocean of air at the bottom of which we move and live, three-fourths lies below the permanent inversion layer. All our storms, our clouds or dust are phenomena of the lower two layers.

Treatment of the Eye by X-Rays.

(*Continued from page 394.*)

cyclitous stages, a very moderate application of X-rays does not have an injurious effect upon the ocular tissues and is able, with the aid of local medication, to overcome the disease. In this connection I may cite a personal experience, in which one of my patients was afflicted with a serious ocular traumatism, perforation of the cornea, traumatic cataract, and plastic iridocyclite of fifteen days' standing. The case was brought to me for consultation on the 2d of February, 1907.

The eye was hypotonous, vision was extinct, hardly a sensation of light being preserved. The case seemed to be hopeless, and in despair I made, in the course of one week, four applications of X-rays, extending from the 2nd to the 14th of February, and simply prescribed atropine.

On the 3d of April improvement was apparent, the eye resumed the normal tension, although there still remained perikeratic inflammation and only a very weak luminous perception.

A new radio-therapeutic treatment was effected the same day, and on the 5th of June all traces of the inflammation having completely disappeared a month previously, I was able to extract the cataract with complete success.

It is certain that one single case is not as safe to base conclusions on as is a series of observations on analogous cases. I have always thought, however, as a result of my experience in this case, that I would never have been able to obtain such a rapid improvement and radical cure without X-rays.

Since 1907 I have treated in this manner six cases of iridocyclite and a case of optic neurosis by the continuous rays. In the four initial treatments I have never applied irradiation too strongly, since the very first case (cataract and leucoma) revealed to me the danger of repeated treatments. The treatment has been considerably diminished in duration, and the cure is effected more rapidly than by ordinary medication. Irradiation of neurosis six times in the course of two months did not result in any improvement, but was terminated by optical atrophy.

This personal experience corroborates the conclusions of Cook and of Coover regarding the discontinuous effects of X-rays. The observations reported by the latter apply to *intermittent* X-rays, which seem, in those cases where they have been utilized, to have a particular efficacy upon processes of cellular regeneration.

The cases treated by Coover related to four ulcerous corneas, two iridocyclites, and three optical atrophies. The ulcers and the iridocyclites were cured in a few treatments; and as for the atrophies of the optic nerve, an improvement was achieved in one case after four treatments, in another after three treatments, and in the last case after seven treatments.

These really striking results, especially in cases as grave as optic atrophy, lead

(*Concluded on page 403.*)

Moistener and affixer, automatic stamp, W. Z. Bean 940,497
Moistening device, L. W. Homire 940,598
Mold, J. R. Kay 940,463
Molding articles, L. H. Baekeland 939,966
Mortar or concrete mixer, A. M. Peterson 940,552
Motor control system, E. F. W. Alexanderson 940,112
Motor control system, electric, A. C. Eastwood 940,241
Motor starting apparatus, electric, S. B. Paine 940,550
Motors, arrangement for regulation of speed of compensated single-phase, Arnold & La Cour 940,492
Music turner, E. E. Van Dine 940,219
Nail puller, L. Scarbrough 940,197
Nozzle, spraying, A. E. Preston 940,477
Nut and wrench, combined, A. A. Friz 940,000
Nut lock, M. H. McCoy 940,267
Nut lock, L. S. Brach 940,503
Nut lock, T. Loughlin 940,605
Obstetrical device, H. J. Barnes 940,576
Oil burner, automatic, A. H. Light 940,539
Oil cloth cutting knife, A. H. Fesemyer 940,308
Oil cup for planes, D. James 940,324
Oiling device for gas meter diaphragms, automatic, J. R. Daly 940,304
Oven, baker's W. Schoenhaar 940,559
Package, metal, J. H. La Fave 940,168
Packing and display case, F. S. Ferry 940,451
Packing reciprocating pistons and the like, means for, S. Robinson 940,068
Pail, dinner, E. M. & G. L. Adams 940,571
Pail, milk, C. E. Shreve 940,372
Pallet setting implement, G. W. Riebe 940,278
Paper bag machine, E. E. Claussen 940,515
Paper bag machines, diamond fold forming mechanism for, C. D. King 940,534
Paper bag manufacturing machine, E. F. Muller 940,183
Paper box, C. B. Davis 940,634
Paper box covering machine, C. W. MacDonald 940,541
Paper decoration, A. Simonson 940,484
Paper roll holder, H. C. Rosebery 940,364
Paper receptacle, G. H. Griffiths 940,592
Pastry cutting machine, E. B. Coburn 939,981
Pen nib, fountain, D. Cameron 940,509
Pencil, polypoint, J. C. Haring 940,247
Pencil sharpening device, R. W. Pittman 940,613
Petroleum burner, W. H. Eaton 940,305
Phonograph records, apparatus for making duplicate, J. W. Aylsworth 940,631

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The Nat'l Co-op. Real Estate Co., Suite 378, Marden Bldg., Washington, D. C.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

ANYONE, anywhere, can start a mail order business at home. No canvassing. Be your own boss. Send for free booklet. Tells how. Heacock, 1279, Lockport, N. Y.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

WANTED, $5,000.—This sum will build and patent new type airship; also three other valuable devices, inventor take half. Engine builder to experiment with new rotary. For particulars address F. W. McLean, 511 Milam St., Shreveport, La.

PATENTS FOR SALE.

FOR SALE.—U. S. Patent No. 931,826, on work boxes. Compartment work box, useful to every woman at home or traveling. Full particulars on request. Tind Werstad, 610 Hudson St., Eau Claire, Wis.

Inquiry No. 8996.—Wanted addresses of manufacturers of machinery for working orange wood manicure sticks.

FOR SALE.—Direct to manufacturers, Patent No. 928,764, granted July 20, 1909, on a ratchet monkey wrench. For further particulars address A. C. Jenrich, Columbia, Nev.

Inquiry No. 8990.—For information regarding shoes not made of leather but similar to the same and are as durable.

THE SANBORN BAG LIFTER. A device to assist in handling bags of grain, cement, etc. Saves the fingers and avoids damage to bag. Sample sent free on request. H. & E. Sanborn, Portland, Maine.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

FOR SALE.

FOR SALE.—Engine lathe, swings 9¼ in., takes 25 in. between centers. Complete with full set change gears to cut all size threads, 3 to 40 in. Price only $43.50. Address L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9016.—Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

HELP WANTED.

WANTED ENGINEER.—General knowledge mechanical, electrical and practical engineer, capable of handling construction work and establishing economical basis for power plants. Engineer, Box 773, N. Y.

Inquiry No. 9023.—Wanted, to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

EDUCATIONAL.

CIVIL SERVICE EMPLOYEES are paid well for easy work; examinations of all kinds soon; expert advice, sample questions and Booklet 40 describing positions and telling easiest and quickest way to secure them free. Washington Civil Service School, Washington, D. C.

Inquiry No. 9025.—Wanted, address of rubber manufacturers in Germany.

MISCELLANEOUS.

"LIGHT, HEAT, MAGNETISM AND ELECTRICITY are all one and the same thing." If you want to know what they are, send fifty cents for a copy of this pamphlet to A. M. Howland, El Paso, Texas.

Inquiry No. 9028.—Wanted, to buy a washing machine that is run by a coil spring motor.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9034.—For manufacturers of machinery that could reduce stumps to kindling wood.

Inquiry No. 9036.—Wanted, the address of the manufacturers of "Cycle Ball Bearing Suspenders."

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

Inquiry No. 9043.—Wanted the address of the manufacturers of mirrors that are transparent when the light in the rear is stronger.

Inquiry No. 9044.—Wanted to buy outfits necessary for agate polishing.

Inquiry No. 9045.—Wanted the address of the International Lumber and Development Co., manufacturers of hardwood.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., Inc., 361 Broadway, New York City, or by any bookseller or newsdealer

Phonographic needle, A. J. Smith	940,486
Phonographic recording and reproducing machine, T. A. Edison	939,992
Photographer's range finder, G. B. Brayton	940,504
Piano action, F. Meyer	940,264
Piano attachment, automatic, J. Sampere	940,072
Piano case, upright, C. Mayer	940,340
Picker. See Cotton picker.	
Pictures, apparatus for viewing stereoscopic or other, J. Richard	940,479
Pictures, electric process for making, B. D. Avis, Jr.	940,495
Pipe, H. W. Nicholes	940,184
Pipe couplings, making metal rings for, G. H. White	940,414
Pipe or hose cleaning device, C. C. Gerhardt	940,457
Pipe riveting machine, F. W. McKnight	940,608
Pipes, apparatus for jointing, W. S. Sigler	940,562
Planter attachment, corn, F. A. Cook	939,983
Planters, gage wheel for corn, W. T. Ellis	940,382
Planting machine, potato, W. A. Hall, Sr.	940,147
Plastic or adhesive material, machine for applying, O. Ashton	940,419
Plate holder, R. Kroedel	940,030
Plating machine, H. F. Dunbar	940,990
Plow handle adjustment, J. E. Newberry	940,609
Pneumatic separator, H. N. Middleton	940,469
Pocket book and savings bank, combined, E. S. Hoch	940,315
Poke, animal, P. W. Amlie	940,573
Potato digging and gathering machine, J. K. Bleashack	940,121
Pressing machine, garment, H. P. Shupe	940,078
Printer's quoin, T. J. Amundson	940,113
Printing press gripper, Alger & Jacobson	940,491
Printing press roll renewing attachment, J. T. Peto	940,272
Printing presses, means for supplying rolls of paper to, L. F. Pfister	940,273
Pritch, C. Hoff	940,597
Propelling and steering device, vessel, W. B. Marble	940,039
Porportional meter, J. C. Anderson	940,114
Pulp agitator, W. C. Paterson	940,612
Pulverizing mill, J. C. Clark	940,129
Pump, breast, E. P. Fowler	940,454
Pump, centrifugal, C. V. Kerr	940,257
Pump counterbalancing device, J. O. Bane	939,967
Pump, double acting, J. J. Rexroth	940,192
Pump, hydraulic, A. J. Pocock	940,056
Pump, milk, C. O. Lucas	940,651
Pump, well, W. A. McGregor	940,545
Pumping system, automatic, J. Hanson	940,312
Punching machine, E. Bambauer	940,575
Quilting frame, S. S. Russell	940,070
Rabble arm and rake, Thomson & Kelly	940,488
Radiator, W. J. Elder	940,445
Radius rod shifting means, joint for, O. W. Young	940,224
Rafter marking instrument, J. L. Richter	940,067
Rail bending tool, J. R. James	940,325
Rail brace and fastener, A. F. W. Prelle	940,554
Rail joint, A. Bynum	940,633
Rail sanding device, C. F. Johndrow	940,025
Rail splice, J. Thomas	940,218
Rail supporting means of metallic ties, brace for, M. F. Bonzano	940,579
Railway coach, R. A. Felton	940,383
Railway frog, J. A. Foster	940,523
Railway rail, J. Huntington	940,320
Railway signaling apparatus, F. F. Brush	939,974
Railway signaling apparatus, electric, W. J. Cook	939,984
Railway switch, G. L. McFarland	940,646
Railway system, electric, W. M. Stephens	940,211
Railway system, third rail electric, C. Kozesnik	940,028
Railway tie, J. W. Leahy	940,640, 940,641
Range finders, scale for, Barr & Stroud	940,425
Razor blade holder, safety, D. Conekin	940,516
Razor blade stropper, Trowbridge & Wheelock	940,412
Receptacle inclosure, Wilbur & Marshall	940,653
Refrigerating apparatus, C. M. Gay	940,590
Refrigerator, W. H. Young	940,416
Refrigerator car, A. G. Brown	940,124
Resistance unit, H. E. Heath	940,151
Retort furnace, E. Schmatolla	940,199
Reversing device, C. H. Norton et al	940,549
Riddle or sieve, Martin & Haskins	940,338
Rims, means for attaching demountable, H. H. Ford	940,243
Rivet, A. L. Eaton	940,442
Rivet holder, H. E. Lau	940,467
Riveting machine, R. Jay	940,533
Road making machine, E. L. Lathrop	940,169
Rocking chair, reclining, M. Bruflat	940,233
Rod. See Stadia rod.	
Rotary engine, J. C. Hagerty	940,246
Rotary motor, E. E. Hauer	940,150
Ruler for drawing curves, flexible, C. & O. Bartels	940,118
Safe or vault, W. G. Norris	940,268
Saw and like machines, feed device for, H. J. Hick	940,016
Saw carriage, P. J. Murphy	940,470
Saw filing clamp, G. McKenzie	940,045
Saw swage, R. S. Jackson	940,024
Saw tooth, Dunn & Randall	940,518
Saws, straight edge for circular, B. Lafleur	940,032
Scaffold bracket, A. W. Guthat	940,459
Scale extension, D. N. Collins	940,130
Scales, automatic cut-off for weigh, R. W. Romig	940,616
Scarf pin, E. Wagner	940,094
Seal, box, Ferrall & Mackay	940,242
Seal, box, E. J. Brooks	940,505
Seal lock, E. L. Pitts	940,475
Sealing machine for containers, vacuum, J. Brenzinger	940,123
Secondary battery, W. Morrison	940,043
Seed germinating tester, W. E. Lacy	940,167
Seeding machine, H. Arnold	939,964
Seeding machine, raisin, W. H. Knapp	940,327
Separator, J. M. Seaver	940,076
Separator, J. M. Stone	940,212
Sewing machine, T. G. Plant	940,053
Sewing machine, sole, T. G. Plant	940,054, 940,055
Sewing machine, sole, L. Goddu	940,637
Shade adjusting device, window, Barnett & Pickel	940,226
Shade hanger, adjustable, W. B. Caswell	940,380
Shade roller bracket or support, curtain, J. M. & H. H. Bryant	940,507
Shade roller fixture, N. Fleischaker	939,994
Sharpening device, razor, Benson & Harris	940,298
Shaving mug, T. Toffler	940,409
Shelving, G. Holden	940,017
Shipping bill register, T. F. Schirmer	940,481
Shoe stretcher, J. Umdenstock	940,092
Show case, A. Johnson	940,251
Show case, J. F. Bierend	940,299
Shut off, automatic, J. F. Parker	940,050
Shuttle, L. Pavia	940,271
Sign, R. C. Lafferty	940,536
Signal apparatus, visual, R. Einbigler	940,444
Silo, B. F. Lockwood	940,170
Sizing composition, W. Hoskins	940,317
Skate, ice, R. Yates	940,108
Skirt gage, D. A. Reynolds	940,615
Sled, depressible runnel dirigible, M. Walker	940,221
Slicer, vegetable, G. L. Reenstierna	940,063, 940,064
Slicer, vegetable, V. Johnson	940,252
Sliding gate, F. H. Doering	940,134
Snap, J. A. Stubblefield	940,213
Soap powder, production of, W. Luring	940,398
Soldering, flux for use in, W. Ackerman	940,111
Sole leveling machine, H. A. Webster	940,627
Solutions, apparatus for concentrating, E. Monti	940,644
Sound regulator, W. W. Young	940,109
Sound reproducer, A. N. Pierman	940,051
Spangle cutting and attaching machine, G. W. Bingham	940,229
Spanner, adjustable, P. P. Stromberg	940,625
Spark plug, A. Helwig	940,594
Spindle driving bands, mechanism for guiding and applying tension to, J. Boyd	940,502
Stacker, pneumatic straw, S. D. Felsing, reissue	13,039
Stadia rod, J. H. Granbery	940,007
Stalk cutter, T. J. Love	940,171
Stamp, hand, J. C. Otteson	940,186
Stenographic machine, W. J. Kehoe	940,255
Stock and poultry fountain, A. A. Kramer	940,259
Stocking, G. T. Drennan	940,585
Stone crusher head, W. G. Nichols	940,352
Stone gatherer, J. M. Rorabaw	940,558
Stopping mechanism, T. G. Plant	940,052
Storage battery, A. O. Tate	940,288
Storm shield, C. F. Wensinger	940,413
Stove attachment, cook, O. Deschamps	940,238
Stove regulator, gas, A. M. Johnson	940,391

us to hope that in a not far distant time we shall be able to cure this redoubtable affection, or may at least be able to prevent its evolution from the moment that the diagnosis has been made.

Time alone will assure that the cures related by Coover are permanent. The results so far achieved, however, deserve, in my estimation, our serious consideration.—Cosmos.

Test of an American Helicopter.

In the recent Berliner-Williams helicopter trials at Washington, D. C., on the farm of Mr. Emile Berliner, the two revolving-cylinder motors of Mr. Berliner rested upon the platform of the machine, each being connected by its own countershaft to the main gear-wheels of the oppositely revolving propeller shafts, which are tubular and concentric. Mr. Williams also stood upon the platform, on the opposite side of the shaft from the motors. The total weight lifted in this trial, including Mr. Williams, was 610 pounds. The weight of the complete helicopter without him was 460 pounds; and the two motors, with countershafts, pinions, connections, etc., weighed 248 pounds.

In previous trials each of the motors, installed singly, had lifted the machine, with a little added weight upon an outrigger, for balance; the thrust, or lift, being about 350 pounds, which compares favorably with previous experiments made by Mr. Berliner last fall, when, with a single propeller of somewhat greater diameter and area, he got about the same results.

The two motors, which are duplicates, are of the star-shaped, 5-cylinder, revolving type of 36 rated horse-power. They were built specially for Mr. Berliner, and they had been overhauled, tested, and worked into good running shape at Mr. Berliner's laboratory.

The helicopter, built by Mr. J. Newton Williams, of Darby, Conn., about two years ago, was first tried with a motor that proved to be too small for the work. It was then connected by flexible shafting to the factory power, to test the thrust of the propellers, which in a series of trials with from 13 to 19 measured B. H. P. lifted from 250 to 430 pounds, and in a final trial, in which the horse-power was not measured, a thrust was obtained of 560 pounds. The machine was later taken to Hammondsport, N. Y., where an 8-cylinder 40 horse-power Curtiss motor was installed, and a number of trials made, the motor lifting the machine with added weight, totaling from 410 to 485 pounds, but not being equal to lifting the weight of an average-sized man.

In this last trial at Washington the blades of the propellers had been enlarged, increasing their diameter from 16 feet 8 inches to 18 feet 8 inches, and increasing their area from 64 to 80 square feet. This increase of superficial area of the propellers increased the general efficiency of the machine, as the greater lifting surface gave a greater resultant lift per unit of horse-power, and the reduced revolution speed of the propellers, due to increased resistance, gave a reduced revolution speed to the motors, which, with the transmission used, seemed to give them greater efficiency.

The propeller speed was 120 R. P. M., while the speed of the motor was 900 R. P. M.

Mr. Williams expects to have a 7-cylinder motor built of the same revolving type, and of 50 per cent more power, and will also build a helicopter on about the same lines, but of larger size and lighter construction.

The completed machine will have a parachute to retard the fall in an emergency, and its dirigibility is assured by very simple controlling devices, which are now being patented.

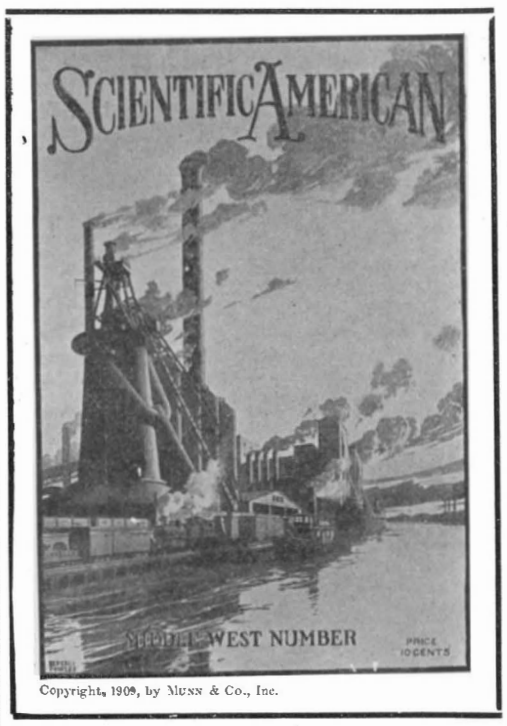
It is regrettable that the Lighthouse Board has changed the name of the buoy marking the historic spot where the ironclad "Merrimac" went down after her defeat by the "Monitor." "Merrimac wreck buoy 28" will now be called "Channel buoy 28."

SENSITIVE LABORATORY BALANCE

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184**. Price 10 cents. For sale by MUNN & Co., Inc., 361 Broadway, New York City, or any bookseller or newsdealer

ELECTRO MOTOR. SIMPLE, HOW TO

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



Copyright, 1909, by MUNN & Co., Inc.

The Middle West Number of the SCIENTIFIC AMERICAN

On December 11th, 1909, the Scientific American will issue a number devoted entirely to the wonderful Middle West region of the United States, a number which will set forth broadly and lucidly not only the agricultural interests of that region, but also those larger engineering undertakings which are destined to transform the Middle West, in part at least, into a manufacturing territory.

With that object in view the Middle West Number will publish articles on the following subjects:

I. The Chicago and Gulf Waterway.—An illustrated description of Chicago's drainage canal, an engineering work which stands without a parallel in the world.

II. Chicago as a Railroad Center.—Chicago is the greatest railroad center in the world.

III. The Wonderful Grain Trade of Chicago.—Chicago is an enormous wheat bin, into which much of the grain raised in the middle West is poured.

IV. Shipping on the Great Lakes.—Most of the iron ore that is now smelted in Pennsylvania is mined in the middle West. To transport it to the blast furnaces of the East at a cost which will enable American steel makers to compete with foreign steel makers, it has been necessary to devise a new kind of lake transportation. Ships of 10,000 and 12,000 tons burden have been constructed which convey ore at small cost through the Great Lakes, and which are without a counterpart anywhere in the world.

V. The Handling and Shipment of Iron Ore.—The above-mentioned fact that iron ore is mined in the middle West and smelted in the East has necessitated not only the construction of special freight-carrying steamers, but also the designing of special machinery for loading and unloading the ore from the steamers.

VI. Freighting on the Mississippi.—Freighting on the Mississippi is a more important industry than most of us may realize.

VII. The Steel Industry.—One of the greatest steel plants in the world is that which has been built at Gary.

VIII. The Freight Subway System of Chicago.—Chicago can boast of a rational system of handling freight by means of subways.

IX. The Water Supply of Chicago.—Chicago's source of water is Lake Michigan. The city is supplied with water by means of a tunnel which extends two miles out into the lake.

X. Reclaiming Arid Lands.—The United States Government has under way many irrigation projects for the purpose of reclaiming lands which are arid, but which will blossom if properly watered.

XI. Harvesting the Grain of the Middle West.—Farms that cover not acres but square miles, crops that aggregate not simply bushels but car-loads, have rendered it necessary to plant and harvest on an unprecedented scale in the middle West. The ingenious agricultural machinery which has been designed to cope with these peculiar conditions is described and illustrated.

The Middle West Number will be more than twice the size of the regular SCIENTIFIC AMERICAN. It will be lavishly illustrated. It will be contained in a colored cover which strikingly depicts Chicago's grain elevators at work. Order from your newsdealer or from

MUNN & COMPANY, Inc., 361 Broadway, New York City

Stovepipe, F. Schmidt	940,406
Stovepipe attachment, C. E. Mathews	940,542
Straining apparatus, continuous centrifugal, A. J. Ericsson	939,993
Stud or rivet, E. B. Stimpson	940,083
Surfacing machine, pneumatic, G. L. Badger	940,297
Surgical applicator, E. H. Eastman	940,519
Swingletree safety clip, E. Graham	940,388
Switch, A. L. Vissat	940,566
Switch, L. H. Moulthrop	940,645
Switch and blow out, combination, W. C. Hafemeister	940,311
Switch and fuse plug, combined, F. Mackintosh	940,174
Table, L. Welker, Jr	940,490
Talking machine sound box, M. Keen	940,161
Tamping tool, dirt, H. A. Sherman	940,370
Tannin containing extract and producing same, A. Kumpfmiller	940,394
Tapping furnace, G. O. Seward	940,561
Tea or coffee pot, Smith & Curtis	940,081
Teeth, making artificial, J. Humphrey	940,599
Telemeter, coincidence, O. Eppenstein	940,137
Telemeter, separating prism, A. Konig	940,166
Telephone, F. G. Sargent	940,284
Telephone and telegraph cables and other electrical conductors, suspension device for, E. C. Read	940,555
Telephone attachment, J. W. Nilsson	940,047
Telephone call recording device, G. R. Fawkes	940,140
Telephone detector device, T. W. Ralph	940,359
Tellurian, D. F. Nickols	940,546
Tester, H. L. Scott	940,482
Textile fabrics, apparatus for treating coated, Sydeman & Meade	940,563
Thread cutting clip, H. R. Benda	940,228
Threshing machine feeder, A. F. & H. C. Johnson	940,026
Ticket, transfer, R. C. Osman	940,048
Tin from waste, recovering, A. Nodon	940,471
Tinned sheet iron boxes, etc., for detinning, preparing E. Goldsmith, reissue	13,042
Tire, W. D. Harris	940,528
Tire armor, B. F. Ginn	940,591
Tire case, spare, J. J. Murray	940,543
Tire, cushion, G. G. Hayes	940,460
Tire protective rivet, E. B. Stimpson	940,085
Tire shield, O. A. F. Mittelstadt	940,343
Tire, vehicle, C. O. Henderson	940,014
Toast rack, C. P. Conger	940,303
Tobacco, etc., treating, G. Montag	940,181
Tool holder, H. C. Norrick	940,185
Torpedo, M. Larsen	940,033
Toy, F. B. Whitcher	940,223
Track sanding apparatus, J. W. Stickley	940,375
Track sanding device, W. H. Prendergast	940,476
Traction system, electromagnetic, Stanbro & Wagner	940,487
Train despatcher's chart, P. J. Simmen	940,079
Tree felling apparatus, E. L. Freese, reissue	13,040
Trimming knife, Ayers & Dorr	940,420
Trolley harp, J. T. Archer	940,574
Trolley head, B. F. Foss	940,309
Truck, S. R. Temple	940,465
Truck, car, E. A. Curtis	940,133
Truck for locomotives, forward, W. L. Austin	940,494
Trunk leg, folding, R. C. Bain	940,421
Truss, T. H. Stanley	940,622
Tube. See Mailing tube.	
Tunnels and the like, bulkhead for, G. W. Jackson	940,323
Type bars, manufacture of, F. H. Richards	940,404
Type casting and composing machine, W. Ackerman	940,377
Type receiving and supporting device, E. Terrell	940,087
Typewriter, S. Aronson	939,965
Typewriter attachment, E. Z. Lewis	940,336
Typewriter tabulating device, C. S. Labofish	940,395
Typewriting machine, O. L. Ingram	940,322
Typewriting machine, C. S. Labofish	940,332
Typewriting machine, C. C. Robbins	940,363
Types and type bars, machine for making, F. H. Richards	940,277
Typographic machine or machine of like character, O. Mergenthaler	940,071
Umbrella, foldable, A. M. Morton	940,346
Urinal, M. L. Sherman	940,077
Vacuum cleaning apparatus, separating tank for, D. Fogarty	940,142
Valve, C. A. Dawley	939,871
Valve, C. H. Smith	940,629
Valve, engine, W. R. McKeen, Jr	940,349
Valve, fluid pressure, J. Folco	940,385
Valve for locomotive boilers, etc., check, T. R. Fondren	940,453
Valve for steam engines, etc., reducing or pressure regulating, H. Roux	940,195
Valve for water tanks, float, E. N. Campbell	940,127
Valve, hydraulic, E. W. Marshall	940,643
Valve inserting machine, F. A. Phelps	940,356
Valve of the globe type, H. J. Kiel	940,163
Valve, radiator, Morgan & Webster	940,182
Valve stem lubricator and packing, W. E. Foltz	940,143
Valve, stop or like, G. J. O. D. Dikkers	940,239
Valve, straightway, T. Barrett	940,577
Valve, thermostatic, A. D. Horne	940,155
Valves, automatically opening and closing, G. Dalen	939,986
Vaporizer for disinfectants, C. C. Leathers	940,604
Vehicle bodies, detachable floor for, W. B. C. Hershey	940,154
Vehicle, motor, B. D. Gray	940,145
Vehicle, motor, F. E. Case	940,511
Vehicle spring fork, wheeled, J. W. Gates	940,245
Vehicles, front wheel drive for traction, L. K. Brown	939,972
Vending machines, coin selecting mechanism for, E. D. Schmitt	940,074
Ventilator, G. A. Lewis	940,036
Vessel, apparatus for recording deviations in the course of a, Fraser & Jumeaux	939,999
Violin chin rests, shoulder pad attachment for, C. Schaumburg	940,405
Wagon, G. W. Gayle	940,456
Wagon brake, J. E. Hewitt	940,249
Wagon dump, Ewel & Clement	940,447
Wagon storm front, H. Foster	939,998
Wagon, log, W. M. Norris	940,547
Warping machine, G. Sipp	940,080
Washboard, H. A. Bierley	940,499
Washing machine gearing device, W. H. Johnson	940,253
Watch, A. Aune	940,117
Water closet stool, D. Craig	940,435
Water closet tank valve, J. F. Willis	940,295
Water heater, instantaneous, C. E. Durvea	940,240
Water purifying apparatus, feeding device for, D. W. Patterson	940,402
Well drilling and operating apparatus, Fithian & Murray	940,589
Wells, plunger mechanism for oil, McCarthy & Vroman	940,347
Wheel, W. P. Davies	940,584
Wheel blocking device, truck, L. Samuel	940,365
Wheel rim, vehicle, O. Kirsch	940,602
Whiffletree, H. O. Schultz	940,368
Willow stripping machine, C. C. Larsen	940,260
Winding machine, S. W. Wardwell	940,489
Windmill, F. A. Preuss	940,057
Window frame, A. W. Krieger	940,029
Window frame, C. Singer	940,485
Window screen, J. L. Wilgis	940,569
Windows, device for cleaning the outside of, J. Edman	940,135
Wire cabinet and measuring table, screen, N. W. Clouse	940,236
Wire stretcher, J. C. Barclay	940,423, 940,424
Wire stretching appliance, G. A. Endicott	940,521
Wire supporting device, J. M. Leadon, Jr	940,034
Wire twisting machine, L. Blessing	940,231
Wrench, S. C. Foster	940,524
Writing and adding machine, M. H. Lockwood	940,037
Yoke attachment, neck, P. Bissen	940,230

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

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