SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1908, by Munn & Co.]

Vol. XCIX.—No. 21. ESTABLISHED 1845.] NEW YORK, NOVEMBER 21, 1908. [10 CENTS A COPY $3.00 A YEAR.

Henry Farman making the first cross-country flight that has ever been accomplished with an aeroplane. The 17 miles between the military camp at Chalons and the city of Rheims, France, were covered in about 20 minutes.

A NEW ERA IN AERIAL NAVIGATION.—[See pages 350 and 357.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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

NEW YORK, SATURDAY, NOVEMBER 21, 1908.

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.

A MONUMENTAL BLUNDER.

And so it seems that our worst fears regarding the $24,000,000 Blackwell's Island Bridge are verified; for we are now assured that this, the greatest engineering work of its kind in the world, would collapse, if it were subjected to the loads which it was designed to carry. A little over a year ago, that other great cantilever structure, the Quebec Bridge across the St. Lawrence, crumpled up under its own weight and fell into the river below. Naturally, public attention was at once directed to the Blackwell's Island Bridge; and since it was designed on the same general principles which had been found to be faulty, in some particulars, as developed in the Quebec Bridge, the public demanded that an investigation to determine the actual strength of the structure be made by independent engineers. To this the Bridge Department consented; and Prof. Burr, of Columbia University, and Messrs. Boller & Hodge, bridge engineers, of this city, were asked to make such an investigation. Their reports, which have recently been made public, show that if the bridge were opened and subjected to the loads which it was designed to carry, *the strains, in some of the members, would enormously exceed those for which the bridge was designed, the excess in the case of one member rising to 47 per cent above the safety point!*

Very wisely, when the construction of the bridge was determined upon, the Bridge Department decided to make it strong enough to carry the greatest possible congested loading that could be put upon it; and it was found that, when so loaded, it would be carrying 16,000 pounds of moving weight upon every lineal foot of its length. Subsequently to the completion of the plans, it was decided that to meet the demands of the future it would be desirable to increase the strength of the bridge to accommodate four elevated tracks upon its upper deck, two extra tracks being added to the two already provided for. This, of course, involved a very large increase in the live loads, to say nothing of an increase in the strength and weight of the bridge itself, to carry this extra load.

Prudence would have suggested that at this point a complete recalculation of the bridge be made, and a new strain sheet drawn up showing the exact stresses which would occur, under the heavier loading, throughout the whole bridge. As far as we can learn no such sheet was prepared, the first strain sheet being accepted as correct, and a *pro rata* increase being made in the section of the various members.

When Messrs. Boller & Hodge began their investigations, they wisely determined that the first thing to do was to ascertain what were the actual conditions of stress in the structure as built. Accordingly, they secured the shipping bills showing the weight of every piece of steel that had been built into the bridge, checking these weights by careful measurement of the various members, and from the weights as so received by them and checked, and upon the specification loading of 16,000 pounds to the lineal foot, they drew up a strain sheet, which the Editor recently had an opportunity to inspect, showing the actual conditions in the structure as it stands to-day.

The results are simply appalling. They mark this bridge as the most monumental case of faulty design in the whole history of the art of designing long-span bridges. Furthermore, our readers should understand that, when the maximum stress to which the metal in the bridge could be safely subjected was determined upon, no allowances were made for secondary stresses in the various members (due to tendency to distortion in the members themselves), or for snow load. The omission of snow load is simply amazing; for it means that in the event of a blizzard like that of 1888, in which the vast floors of the bridge and all the huge members might be loaded deep with a heavy burden of snow, the stresses resulting in the structure from this load would not be represented by any corresponding increase of material in the members to carry the additional burden thus imposed. Nor is it an answer to this criticism to say that the bridge might not be congested with traffic at such a time; for it is certain that a heavy blizzard might in itself be the cause of a stalling of trains and cars, and a blockade of vehicular traffic.

That our estimate of the magnitude of the blunder committed in this bridge is not overdrawn is shown by the following facts selected from the two reports: Prof. Burr says: "The result of these computations shows . . . that some of the bottom chord panels of the island span would carry about 25 per cent more than is permitted by the contract specification. . . . There would be also some similar overstresses in riveted tension members in the same parts of the bridge, rising above 33 per cent in a single instance." Prof. Burr exhibits here as elsewhere in his report a tender commiseration for the blunders committed; for he fails to mention that in this "single instance" the overstress rises, as shown by the strain sheet of Boller & Hodge, to no less than 47 per cent above what is allowed by considerations of safety.

When Messrs. Boller & Hodge had proved that the bridge, if subjected to the loading for which it had been calculated, or rather miscalculated, by the Bridge Department, must inevitably collapse into the East River, they set about the calculation of a strain sheet showing what loads the bridge actually could carry, without exceeding the safe limits of stress in the individual members as called for by the specification and by all good engineering practice. And what did they find? *That instead of being able to carry a congested load of 16,000 pounds per lineal foot, the bridge as it stands to-day can carry a load only of 6,000 pounds per lineal foot; and that even this live load can be safely allowed on the bridge, only if the traffic is carefully regulated by the police;* that is to say, if a certain distance be maintained between the trolley cars. This last restriction, being interpreted, means that, if, through carelessness or connivance, the spacing between cars be not maintained, and, as in the case of a sudden accident or panic, the cars become bunched together, the safety of the bridge, even under a live load nearly two-thirds less than that for which it was designed, will be imperiled!

But how is the loading to be reduced to this extent? Boller & Hodge in their report show that it can be done only by removing from the bridge the whole of the four elevated tracks which it was designed, or supposed to be designed, to carry. In other words, this $24,000,000 structure, whose greatest usefulness ultimately would have consisted in its serving as a link between the heavy electric train service, whether subway or surface, of Greater New York, is found to be totally unfit for such a purpose, and must be limited to the service of trolleys, trucks, and pedestrians. No elevated trains on a bridge, for whose approaches nearly half a mile of elevated structure has already been built!

It is beside the mark for apologists, in the endeavor to lighten the gravity of the situation, to suggest that 16,000 pounds per foot is a loading which may never occur. That loading was adopted as a measure of safety and as a means of covering the inevitable growth of traffic in the future. As a measure of precaution, it does not lose its importance in our eyes, because someone has committed a costly blunder in the Bridge Department.

A NEW ERA IN AEROPLANE TRANSPORT.

After his failure to make satisfactory flights in this country last summer, and after losing to Wilbur Wright the prize of the French Aero Club for the longest flight up to October 1, Henry Farman has at last shown himself to be, after all, one of the world's most daring aviators, while at the same time he has opened a new era in aeroplane flight, an era in which the flying machine will be put to practical use in the transport of individuals from place to place.

After a 25-mile flight above the camp at Chalons, France, on October 28, and a mile flight with a passenger the same day, Farman made some changes in his machine to improve its stability. Then, on the 30th, he again soared aloft above the camp; but this time, after describing one or two circles, he flew straightaway across country at a height of 100 feet, and did not alight until some 20 minutes later, when he reached the outskirts of Rheims, after traversing a distance of 17 miles. Our frontispiece shows him passing over one of the intervening villages, before the astonished gaze of several spectators. It was his intention to return in the same manner; but owing to the late hour and the making of some small repairs, he took the aeroplane apart and returned it to Chalons by road.

Not to be outdone by his compatriot, M. Louis Bleriot the next day made a 9-mile flight with his aeroplane across country from Toury to Artenay; and, after making a slight repair, returned to the starting point, making one stop *en route*. A photograph of the monoplane made during this flight appears on page 357.

These two remarkable performances have put France in the lead as far as practical cross-country flight is concerned. They have shown the possibility of winning the $50,000 prize of the London Daily Mail for a flight in stages from London to Manchester, and also the prizes totaling $10,000 for a flight across the English Channel. Furthermore, they have assured the holding of a cross-country aeroplane race next summer in France. A prize of $20,000 has been put up by the Aero Club of France, and it is proposed to run the race from Paris to Bordeaux in five stages.

Had it not been for his unfortunate accident, it is probable that Orville Wright would have made the first cross-country aeroplane flight at least a month before Farman, as the government requirements called for a ten-mile flight of this kind in making the speed test. As no such performance was required by the syndicate which has bought the Wright patents in France, Wilbur Wright has contented himself with making lengthy flights above a level field, in windy as well as in calm weather, and also with teaching several men the operation of his machine. He does not favor such spectacular performances as that of Farman, which, he claims, could not have been made save under ideal weather conditions and with the running of an extreme risk of accident.

WILBUR WRIGHT'S RECORD FOR HEIGHT.

After lengthening the rail from which his aeroplane starts some 35 feet, in order to enable him to attain the necessary speed by means of his propellers alone, Mr. Wilbur Wright competed successfully on the 13th instant for the prize for height offered by the Aero Club of France. The rules forbid the use of a dropping weight for starting the aeroplane, so Mr. Wright was obliged to dispense with his usual starting apparatus. His machine, however, started readily under its own power. At the end of a 5-minute flight, he cleared the line of small balloons placed at a height of 30 meters (98.4 feet) by 49 feet, making a total height of 147.4 feet. In a second flight of 11 minutes' duration, Mr. Wright is said to have risen to a height of 196 feet above ground. These are the first official records for height that the American aviator has made.

THE HANDY MAN'S WORKSHOP.

Among the features which have contributed to the success of the SCIENTIFIC AMERICAN have been articles written for the benefit of the amateur mechanic—articles which told in a simple way how motors, dynamos, batteries, barometers, and a hundred other machines and instruments can be constructed at home without elaborate tools. These articles have been the means of giving to thousands of young men of technical inclinations an electrical and mechanical training, which because of its eminently practical nature, admirably fitted them for the more serious work of the machine shop and the electrical laboratory.

In order to broaden this department of the journal, and to render it even more useful than it has been in the past, we have decided to publish about twice a month shorter accounts, which will tersely yet clearly describe simple devices which can be made by anyone who is reasonably skillful in the use of simple tools, and which will be devoted to the description not only of experimental apparatus, but of utensils and implements for everyday use. The department bears the general title, "The Handy Man's Workshop," and we intend to include under the heading all that it implies. The articles will explain the construction of simple physical apparatus, as in the past, but above all they will be devoted to the making of contrivances that a "handy man" can use about the house. In next week's issue we intend to publish brief articles on the making of simple Christmas devices at home, which will be far more intimate and personal in their appeal than factory-made products. That issue of the SCIENTIFIC AMERICAN will be a very practical Christmas number.

The reception thus far accorded to the innovation justifies us in assuming that "The Handy Man's Workshop" will prove one of the most popular departments in the SCIENTIFIC AMERICAN. Because it is still new, we shall be glad to receive suggestions from our readers for its improvement—if improvement it needs.

Judiciously used, the automobile may offer a remedy for nervous and mental affections. Dr. A. Mounteyrat, a French physician, ventures the opinion that motoring is a cure for anæmia and sleeplessness. He conducted some experiments during several tours of eight days each and states that he found a decided increase in the number of red corpuscles. The average increase figures out at 26 per cent. The effect of a week's touring is much the same as that of residence on high altitudes.

ENGINEERING.

Negotiations have recently been completed for the construction at Southampton of a large drydock capable of accommodating the new steamers "Olympic" and "Titanic" of the White Star Line. The new dock is to have a depth of 40 feet of water at low tide, so that it can accommodate these vessels at any hour at which they may arrive.

It is reported that the engineers who will design the new Quebec Bridge are considering the question of placing the new structure 10 feet higher above the St. Lawrence River than the bridge that fell. The clearance of the fallen structure was 150 feet above high water. The change is designed to accommodate ships that make Montreal a port of call.

The Navy Department will shortly issue invitations for bids for the construction of a long-distance wireless station in Washington, which is to be of exceptional power and is designed to enable the Department to hold communication with vessels over 2,000 miles distant. Proposals will also be asked for a wireless equipment for ships, to have a radius of not less than 1,000 miles.

The announcement that the Japanese are about to open the railroad which they have built in Formosa is the latest evidence of the good work which they are doing in the island, which was acquired in 1895, at the close of the war with China. At the time of the transfer 62 miles of the road were completed. It now covers a total of 334 miles, and Japan has built the additional 272 miles at nearly $2,000,000 less than the estimates.

The War Department is engaged in experiments to determine what can be done in the way of compressing coffee and sugar into tablet forms under conditions which will preserve them for a lengthy period, with a view to including the product in the new haversack ration which has been adopted for the army. This ration includes hard bread, bacon put up in tins, and salt and pepper carried in stout separate envelopes.

The recent award by the Pennsylvania Railroad Company of a $5,000,000 contract to the Westinghouse Company for the electrification of the New York terminals and tunnel connections, is one of the most encouraging signs of the present revival of business activity. During the past two years this railroad has been conducting an exhaustive series of tests, both of electric locomotives and of the different methods of generation and transmission, which have terminated in the placing of this important order.

It seems likely that the first monorail passenger line to be installed on any scale in the United States will be built within the limits of New York city on the route of the old horse-car line from the New Haven Railroad tracks to City Island. The cars will be carried on two two-wheeled trucks, each pair of wheels running in tandem on a single rail, spiked to ties laid on the ground. Stability will be obtained by two overhead trucks, carried on flexible arms, each truck running on L-shaped overhead rails carried on standards. The guide rails will act as conductors, the current being taken through the flexible arms to the motors.

The report of the commissioners appointed by President Roosevelt to consider the question of mine explosions, attaches great importance to the employment for the handling of explosives only of men noted for their great prudence. To prevent the ignition of coal dust, they advise thorough wetting of the mine for a distance of 60 feet from the shot that is to be fired. They recommend that close attention should be given to the question of leaving such an amount of support to the roof of a mine that it cannot fall in in the event of an explosion, and thereby imprison the workmen. Equally important is the suggestion that employees be removed from the mine when a shot is to be fired. It is also urged that there should be strong co-operation between the government and the operators of mines in the maintenance of strict discipline, and that there should be careful periodic inspection by a corps of competent men.

It was inevitable that the proposals submitted to the Public Service Commission for the construction of a freight subway beneath the streets of New York city would result in a storm of protest from the trucking interests; and hence the opposition of the truckmen at the public hearing before the commission excites no surprise. From time immemorial the attempted introduction of improved means of transit has been fought bitterly by the older systems, whose inconvenience and expense they were designed to avoid. The guiding principle, however, in all such conflicts of private and public interests should be that of the greatest good of the greatest number. The obstruction of the city's streets and sidewalks by the present method of freight distribution has become intolerable; and it is certain that if the proposed subway can be shown to be commercially feasible it will prove to be one of the greatest improvements ever made in this city.

ELECTRICITY.

The Navy Department is considering the building of a long-distance wireless telegraph station near Washington which will have a sending radius of 3,000 miles. This station will supersede the present stations along the Atlantic coast. The Department also expects to call for bids on a pair of high-power ship equipments with sending radius of 1,000 miles each.

A movement is on foot in England to reduce cable charges to America and cut the rate between England and the Continent to two cents a word. The idea is to have the various governments obtain control of the cables, and thus permit their use at the lowest possible figures. No doubt this movement will result in considerable complication, owing to the international agreements that would be required.

According to a recent consular report, there is a total water power in Switzerland of 1,000,000 horsepower, three-quarters of which may be exploited, though at present only one-quarter of this is utilized. Steps have been taken to protect the use of the streams, with a view to prevent the transmission of current to foreign countries. A resolution was recently passed by the Swiss Congress, placing the utilization of water power entirely under control of the federal government.

Advocates of municipal ownership have received a serious blow in Chicago. The city has been lighting its street lamps, 7,647 of them, at $81.64 each per year. At the same time, they have been renting lamps at a cost of $75 per year. According to the report of Bion J. Arnold and the auditor, Arthur Young, the city has been wasting between $200,000 and $300,000 per year by endeavoring to manufacture its own electricity instead of buying it from private plants. The municipal plant has cost $3,639,031, whereas its actual value to-day is but $2,353,869.

The United States Geological Survey is recommending the use of electric power in mines. The electrical equipment, however, must be installed with great care, so as to guard against danger of fire or shock. The underground voltage should not exceed 650 for direct current, or 500 for alternating current, and lower voltages are preferable. Where a higher voltage is used, it should be transmitted by a completely insulated cable. No live electric wire should be permitted in any part of the mine in which gas is found to the amount of two per cent.

The new pay-as-you-enter cars of the Chicago Railways Company will soon be put into service. These cars are provided with very long vestibules, permitting two passengers to enter and leave abreast. The overhang from the center of the trucks is 14 feet, and a very strong construction is necessary to prevent sagging of the platforms. The interior of the car is provided with cross seats, except for a pair of side seats at each end. Each cross seat is provided with a push button, which operates a buzzer over the motorman's head. Special precautions have been taken to thoroughly insulate the wiring. The trolley circuit is incased in a metal conduit on the roof of the car.

The increased use of electricity on the Pennsylvania Railroad has led to a study of the dangers of handling live wires, and the methods that must be employed in resuscitating those who have been stunned by an electric shock. A special pair of pliers has been designed, which enables a man to cut a live wire carrying 23,000 volts without danger to himself. To remove the wire from a body when no other means are at hand, a coat is placed under the wire, and lifted by the sleeves, to raise the wire off the body. This was found perfectly safe, even when the garment was damp. Experiments with fire streams showed that there was no danger of the current flowing down the stream of water even from a high-voltage line when the operator held the nozzle at a distance of between three and four feet from the wire. Experiments with chemical extinguishers showed that they were very dangerous where a solid stream was played on the wire.

A new rectifier has recently been brought out which is entirely mechanical in its operation. It consists of a cylinder of insulating material provided with a pair of metallic contact points. Mounted on a ring which surrounds the cylinder are two pairs of contact points and there are in addition four rectifying disks of carbon which with the cylinder are rotated by a motor. By means of a pair of condensers, sparks are made to leap between the points on the rotating cylinder and first one and then the other pair of contact points. The current flows across the gaps between the points and the rectifying disks when the resistance is broken down by the spark, and is conducted to the storage battery intermittently, but always in the same direction. When starting the rectifier, the motor is brought to synchronism by cranking. The rings on which the four points are carried may be revolved about its axis, so that the condenser will discharge at any point of the wave, and thus the voltage of the rectified current may be regulated.

SCIENCE.

The excavations at Pompeii have led to the discovery of two supulchral monuments, the first belonging to the Edile Vestorius Priscus, which is decorated with frescoes, and the second to a woman named Septima. The latter has a marble inscribed tablet intact and a semi-circular seat raised around a column surmounted by a sun dial, which is identified as an exact reproduction of the mosaic picture (so-called) of philosophers lately discovered at the same spot.

Artificial silk is very deficient in strength, especially when wet, but strong threads and fabrics which have the gloss of silk and are not affected by water can be made by subjecting cotton to various treatments. The oldest process, mercerizing or stretching the fibers in a bath of caustic alkali, produces an inferior gloss. In the newer methods, the cotton fibers are practically covered with a coating of artificial silk, either by dipping them into solutions of cellulose similar to those from which artificial silk is made, or by treating them with solvents of cellulose and thus forming the silky coating out of the fibers themselves. The imitations of silk produced by these methods are very glossy and very strong and durable, for exposure to moisture weakens only the coating and not the body of the fiber.

The distinguished seismologist Emilio Oddone has expressed the view that a great earthquake may, by agitating the whole mass of the earth, cause another great earthquake in a distant and unstable part of the earth's crust. For example, about half an hour before the great earthquake at Valparaiso, Chile, on August 16, the seismographs scattered over the globe registered an earthquake of which the center was located in the northern part of the Pacific Ocean. The hourly observations proved that from 31 to 32 minutes elapsed between the two quakes. This is, very approximately, the time occupied by the first derived wave to traverse the diameter of the earth, the length of which is nearly equal to the distance (7,050 miles), in a straight line, between the epicenters of these two earthquakes. Hence the earthquake in the South Pacific may have been the determining cause of the earthquake at Valparaiso.

A consular report which, as might be supposed, comes from Germany, states that the proper color for beer bottles is a matter of some Teutonic concern. It seems that the actinic or chemical rays of light affect beer harmfully. A German authority on brewing has now shown by an exhaustive series of experiments that no form of colored glass when used for beer bottles affords absolute protection against the effects of exposure to sunlight, and that a wide diversity in degree of protection is observed when glass of different tints is employed. The highest measure of protection is yielded by dark, reddish-brown glass. Repeated experiments have shown that while the chromatic changes in the test liquid take place much more rapidly than the alterations in taste and odor of beer under corresponding circumstances, still the retardation in both cases is proportional. Thus a glass bottle which reduced by 50 per cent the action of the actinic rays on the sensitive solution, as compared with a colorless bottle, would likewise involve double the time of exposure for bringing about a given amount of deterioration in the properties of the beer, if filled with that liquid.

Twenty years ago, the loss caused annually by smoke and fog in London was computed to be more than $22,000,000, divided as follows: Waste of fuel (25 per cent), $5,000,000; additional cost of laundering and wear and tear of garments, $10,750,000; damage to outer garments, carpets, and other fabrics, $5,000,000; loss occasioned by death and illness caused by smoke, $1,600,000. To this must be added at least $5,000,000 for the deterioration of mortar, marble, granite, and other stone in buildings, cleaning and painting walls, signs, and shop fronts, corrosion and perishing of metal work, cleaning windows, deterioration and restoration of paintings, engravings, and books, loss of time by artists, photographers, and others whose occupations require abundant daylight, and damage to trees and plants. Further additions should be made for the cost of artificial light and heat made necessary by the darkness, cold, and humidity caused by the obscuration of the sun, the cost of cleaning chimneys, etc. Finally, the smoke causes the metropolis to be shunned by the wealthy classes, and appreciably diminishes the value of real estate. Hence the total annual loss caused by smoke must be about $30,000,000, or $5 per capita. Mr. John Graham, who makes this compilation and estimate, appeals to every intelligent citizen of London to lessen his individual contribution to the smoke evil by every means in his power. Graham expresses the opinion that the majority of dwellings might be heated with coke or gas instead of coal, and that the smoke discharged by factories could be greatly diminished by the adoption of smoke-consuming devices that are already on the market.

A NEW FORM OF TELAUTOGRAPH.

BY DR. ROBERT GRIMSHAW.

For more than half a century attempts have been made to produce handwriting at a distance; for instance, Bakewell's apparatus of 1842, Caselli's "Pantelegraph" of 1856, Gray's of 1888, Amstutz's of 1893, and Ritchie's and Cerebotani's of later date; while much more recently both Prof. Korn and Herr Karl Grzanna (whom the Germans persist in calling "Gruhn," the name of his former assistant) have been active in this field. As far back as 1904 Grzanna published an account of an apparatus for producing written characters at a distance; and Korn brought out his first selenium cell apparatus in 1906.

Grzanna's apparatus (based on the German patent of the Dresdener Klein) as at present constructed consists essentially of the parts here illustrated. The principle of its action is the resolution of every desired stroke of handwriting into a horizontal and a vertical component on the surface on which it is made, and its exact reproduction in the form of the resultant of such components, on the receiving surface. The Cowper apparatus shown at the Paris Exposition of 1878 did the same thing, using a capillary ink tube to form the letters. But in Grzanna's apparatus mirrors are used at the receiving end which throw a beam of light on a sensitive tape. As one mirror swings up and down in the vertical plane, the other in the horizontal from right to left, in the same way as the analyzed movement of the writing, or drawing, point, the resultant of these two mirror movements corresponds to the path of the pencil, at the sender.

Referring to Fig. 1, which represents the principle of the sender, *t* is the writing point jointed to a lever arm *a*, which is easily movable in all directions in the plane of the writing. The other end of this lever is attached to an arbor *p*, which is also movable horizontally in the line *AB*, so that the pencil can write freely. A stationary electric resistance is indicated at *r*, and a movable resistance, *s*, is connected with the lever arm *a* by the link shown in the illustration. These two resistances are electrically connected with a battery of eight dry cells. A small current collector, *b*, is attached to the movable rod, but is electrically insulated therefrom. At *c* is a stationary current-collector. These two collectors are electrically connected with the line wires *d* and *e* respectively. One portion of the battery current flows through the collector into each line conductor; the amount varying with the position of the pencil *t*. At each point of the writing surface there are two different but definite current strengths, so that one can say that the movements of the writing operation are converted into changes of current strength. The current returns either through the earth or through a third conductor. At the receiving station it enters the apparatus seen in Fig. 2.

In this there is a small electric lamp *L*, that casts its light through a bent tube, with a prism, *p*, and a lens, *I*, on a small concave mirror, *h*, swinging on a horizontal axis; and from this to a second concave mirror, *s*, which swings about a vertical axis. From this latter mirror the rays are reflected to a roll of photographically sensitive paper, *F*. The horizontal axis of the first mirror, *h*, is surrounded by a coil of copper wire in electric connection with the wire *d* from the sending station; the vertical axis of the mirror *s* being in like manner surrounded by a coil, *g*, in electric connection with the other wire, *e*. Current in these coils causes vibration of the mirrors, by acting on magnets attached to their axes.

The invisible photographic writing or drawing on the sensitive paper is automatically developed and fixed. After the message is received, the sensitive paper *D* is drawn off the roll *Ph*, between the pressure rolls and under a yellow glass pane *G*, which shuts off the developing chamber of the apparatus. After developing the paper containing the now legible writing or picture passes out between two more pressure rolls. The lower front rolls are rotated by means of worm-wheels in connection with a worm shaft driven by a small motor, *M*, the latter, as well as the lamp, *L*, being served with current from a small battery, *B*. The mechanism is so arranged that after the message is written, the under rolls are rotated until sufficient of the sensitive paper is drawn along toward *D*, under the developer-reservoir *En*. From this latter, two rubber tubes lead toward two glass strips, lying at an angle to each other on the paper above and thus forming a trough with a small slit below. Through the latter the developing liquid is evenly distributed over the paper *D*. The flow of liquid from *En* is automatically regulated, and when no paper is ready to be developed, the rubber tubes are closed by the pressure of an iron plate. At the proper moment an electromagnet relieves the pressure on the tubes and thus allows the developing liquid to flow. The development takes about ten seconds.

Grzanna's telautograph in use.

The apparatus itself can be driven by a dry battery or by an accumulator; about 12 volts being sufficient. Each apparatus is arranged as both receiver and sender. The German post office department has tested the system on the following lines: Berlin-Potsdam, 30 kilometers; Dresden-Meissen, 27 kilometers; Dresden-suburban line, 4 kilometers; and Dresden-Berlin, 200 kilometers.

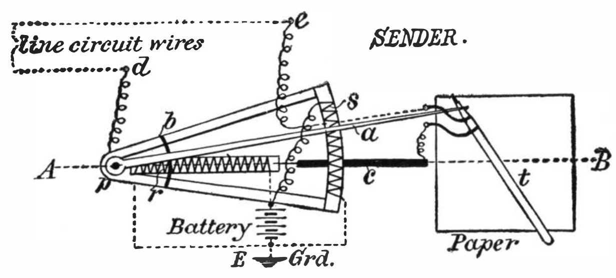


Fig. 1.—Details of the sending apparatus.

The remains of a Tyrannosaurus Rex, forty feet long and twenty-two feet in height, have been found in the Bad Lands, south of Glasgow, Mont., by Barnum Brown, of New York, connected with the American Museum of Natural History. The relic has been shipped to New York. It took sixteen teams to haul the fossil to the railroad. The skull alone weighs 4,000 pounds. The SCIENTIFIC AMERICAN hopes to publish an illustrated description of this "King of Lizards."

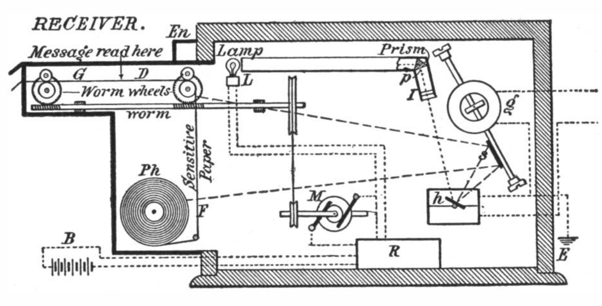
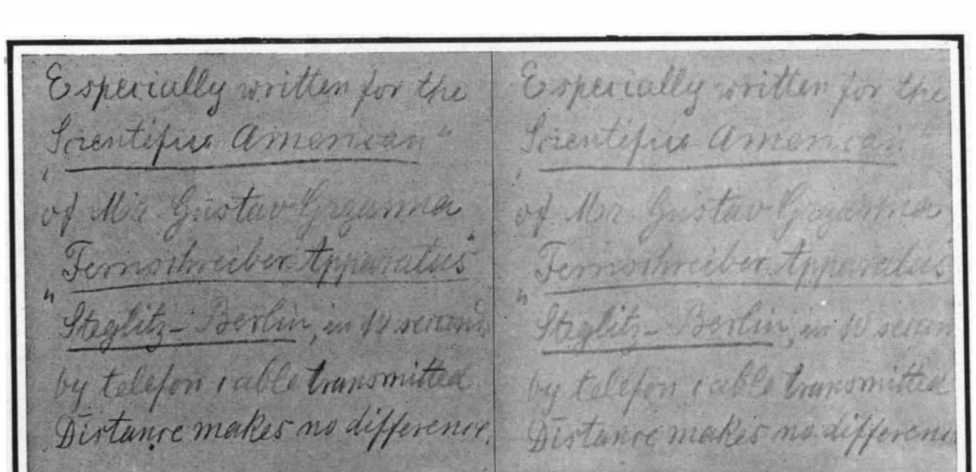


Fig. 2.—Arrangement of the mechanism at the receiving end.



Written by hand. Reproduced by the receiver.

A sample of the work done by Grzanna's telautograph.

A NEW FORM OF TELAUTOGRAPH.

The Cullinan Diamond Cut.

The famous Cullinan diamond, the cutting of which was recently described in the columns of the SCIENTIFIC AMERICAN, has been successfully divided into eleven stones. When first discovered, and even before it was cut, the stone was valued at about $1,000,000, and about that amount was paid for it by the Transvaal government. Fred Wells, the superintendent of the Premier Diamond Company, found the Cullinan diamond in January of 1905. The diamond was a white elephant in its way. Too big and too precious to find a purchaser, the problem of disposing of it perplexed the company not a little. Finally it was decided to present the stone to King Edward, who has intrusted an Amsterdam firm with the splitting and polishing of the gem.

The London Times states that in the original state the Cullinan diamond weighed 3,253¾ English karats, or over 1 1-3 pounds avoirdupois. It is now divided as follows: (1) a pendeloque or drop brilliant, weighing 516½ karats, dimensions, 2.322 inches long and 1.791 inches broad; (2) a square brilliant, weighing 309 3-18 karats, 1.771 inches long by 1.594 broad; (3) a pendeloque, weighing 92 karats; (4) a square brilliant, 62 karats; (5) a heart-shaped brilliant, 18⅜ karats; (6) a marquise brilliant, 11¼ karats; (7) a marquise brilliant, 8 9-16 karats; (8) a square brilliant, 6⅝ karats; (9) a pendeloque, 4 9-32 karats; (10) ninety-six brilliants, weighing 7⅝ karats, and (11) a quantity of unpolished "ends," weighing 9 karats.

The first and second of these stones are by far the largest in existence. Even the second is much bigger than the largest previously known brilliant, viz., the Jubilee, weighing 239 karats, while beside either of them so famous a jewel as the Kohinoor sinks into comparative insignificance, since its weight, 102¾ karats, is little more than one-third of that of the smaller, or one-fifth that of the larger. Moreover, the stones are not more distinguished for size than for quality. All of them, from the biggest to the smallest, are absolutely without flaw and of the finest extra blue-white color existing.

As regards the two largest, an innovation was made in the manner of cutting. Normally a brilliant has fifty-eight facets. In view, however, of the immense size of the two largest Cullinan brilliants, it was determined to have an increased number, and to give the first seventy-four facets and the second sixty-six. This decision has been abundantly vindicated by the results, for the stones exhibit the most marvelous brilliancy that diamonds can show. This fact is all the more remarkable and satisfactory because very large brilliants are apt to be somewhat dull and deficient in fire.

Mechanical Stoking.

Many attempts at mechanical stoking have been made in locomotive design, but for different reasons they must still be considered experimental. These attempts have been answers to a crying need for better results than have been obtained from hand firing. Any devices which tend to improve the results of the present system of locomotive firing should, therefore, be well tried out. One of the greatest evils in connection with hand firing is the necessity for the opening of the firebox door, thus admitting large volumes of cold air. In fireboxes which are arranged with baffle plates to protect the tube sheet, cold air from the fire door is not so destructive, but in those which do not furnish this protection, the damage is very great, both to the steaming capacity of the boiler and to the life of the sheets and tube ends. When the firebox door of a hard-working locomotive is opened by hand for the admission of each fire, the aggregate amount of time in which the outside air has free play through the opening is probably as much as twenty-five per cent of that consumed by the trip. There is in use on some roads a device which should be applied to all locomotives of the heavier types, at least. This device is simply an air door opener and closer. It consists of an air cylinder, the piston rod of which is connected to a lever on the fire door. Air is admitted to the cylinder by a valve operated by the fireman's foot; this drives the piston outward and opens the door. The return is effected by a spring as soon as the air is exhausted. The exhaust takes place automatically when the foot of the fireman releases the valves. The advantage in the use of this device lies in the fact that the time the door must be kept open is reduced. The fireman has the scoop full of coal ready to be discharged immediately the door is opened, and the closing is effected just as quickly.—Railway and Engineering Review.

CYCLONES ON THE SUN.

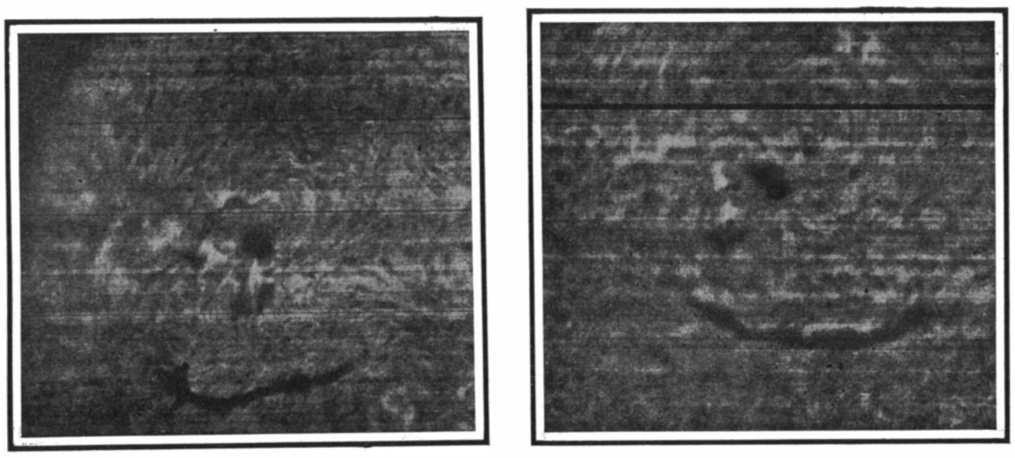
BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

Important discoveries have been made during the past few months at the Carnegie Solar Observatory in California, where Prof. George E. Hale, its director, has gained valuable knowledge about the sun in showing the process whereby fuel is fed into the solar furnace. By improved methods of research, by careful diligence in closely observing the sun, aided by a little stroke of luck, photographs have been taken which show a mass of cool hydrogen gas being sucked into the vortex of a sun spot, the result of a terrific solar cyclone. These critical photographs, which are of excellent quality, speak volumes for the observers on Mount Wilson in regard to their ability in perfecting new lines of research, their hard-working methods in observing, and their genius in properly interpreting the results of these fine pictures. When related, these discoveries appear extremely simple and matter-of-fact, but the work that has led up to them required a series of brilliant discoveries which are probably equaled nowhere in any other science.

Mount Wilson near Pasadena in California was chosen for the observatory of the Carnegie Institution because its position offered the possibility of continuously observing the heavens for weeks at a time unhampered by clouds. The talented director of the Yerkes Observatory of the University of Chicago, chosen as its head, decided to limit observational work to the sun, for the reason that the sun is a typical star, and in closely studying it we are not only gaining information about the body which is of most importance to us on earth, but we are also shedding considerable light on the great and important problem of astronomy, the study of stellar evolution. While still a young man in 1893, Prof. Hale invented the spectroheliograph, and since that time much has been expected from him in astronomic research. His present discoveries are a fitting climax to a long series of brilliant discoveries rendered possible by great genius and remarkable enthusiasm.

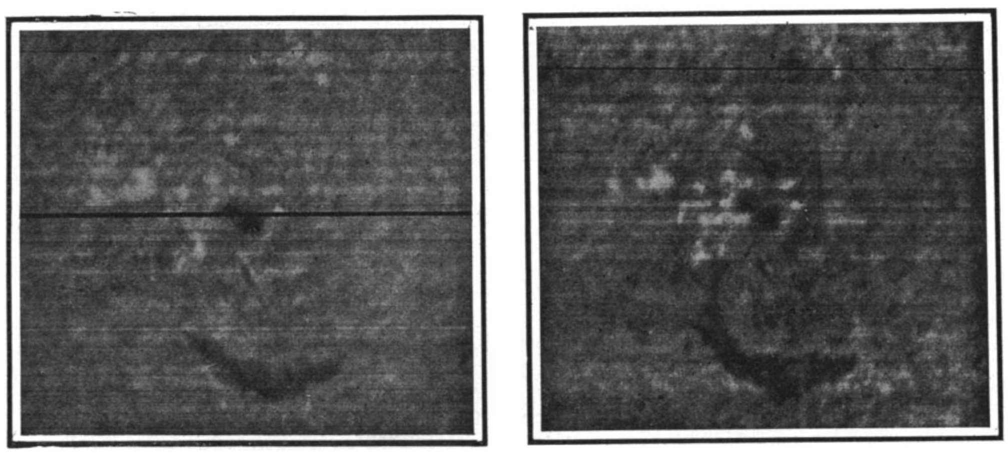
If astronomers of the present day had only the photographic camera to assist with their eye observations at the end of a telescope, very little could be known of the sun or its surface. The photographic plate has been of enormous value in giving a permanent record of fleeting phenomena on the sun's surface, and without it the great advances of to-day would have been impossible. Since 1868 the spectroscope has given its aid to solar investigations. In that year Janssen of France and Lockyer of England almost simultaneously pointed out that the red flames or prominences, which formerly could be seen only during the few minutes of a total solar eclipse, were now an everyday phenomenon. By a peculiar use of the spectroscope it is now possible to see these red flames in broad daylight when they are on the sun's edge, in spite of the fact that the light from the sun is a thousandfold more powerful than the light from the prominences. Another field of fruitful research was thus opened, and in the capable hands of the late Prof. Young of Princeton, a long list of discoveries were added to the science of astrophysics. Flames could be seen shooting to enormous distances from the sun's edge at a speed greater than one hundred miles per second! The end of all research seemed nearly reached when it became possible to photograph and obtain a permanent record of these gigantic eruptions, as was possible by Prof. Hale's invention of the spectroheliograph. As the name signifies, the sun is photographed by means of its spectrum. A powerful grating or prism train at the eye end of the telescope spreads the sun's light out into its spectrum. By allowing the light from one line of the spectrum, as *H* or *K*, to pass through a secondary slit, a photograph of the sun and its surroundings can be taken in *H* or *K* light alone. Overcoming the mechanical difficulties involved in this, gave Prof. Hale the spectroheliograph. At first on his 12-inch telescope, later on the 40-inch of the Yerkes Observatory, were photographed wonderful pictures of the prominences at the sun's limb, the sun on the original plates with the 40-inch being seven inches in diameter. With the new spectroheliograph it became possible to photograph not only the prominences but also the face of the sun, and if the secondary slit were set at the center of the *K* line at the violet end of the spectrum, a plate of the sun was obtained in the light of glowing calcium vapor. This photograph was decidedly different in appearance from that of a straight picture taken in the ordinary way.

In experimenting with the spectroheliograph, it was found that the solar image looked different according as the second slit was set directly on the center of the *K* line or a little to the red or the violet side.



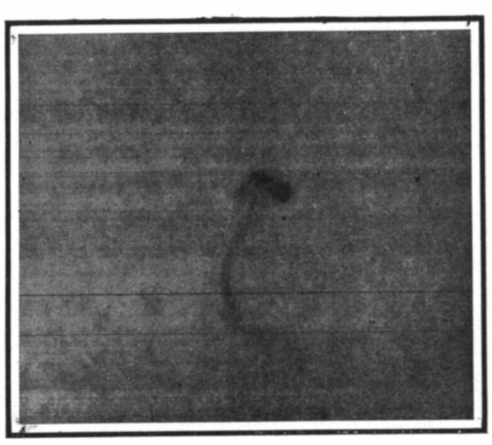
Photographs showing the sunspot on May 29 and June 2, 1908.

Note the long, dark mass of hydrogen and the marked whirling structure.



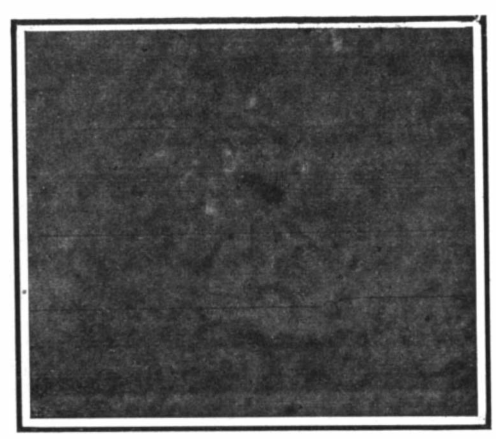
The sunspot on June 8 at 4:58 p. m. and 15 minutes 88 seconds later.

The hydrogen mass is rapidly moving toward the spot.



8 mins. and 6 secs. after last photograph.

Hydrogen mass is being sucked into the vortex.



View on the following morning.

Note radial lines. Whirling structure has disappeared.

Photographs by Prof. Hale.

CYCLONES ON THE SUN.

This had led to the discovery of flocculi by Prof. Hale, masses of luminous gas floating at different elevations above the sun's surface. Still later investigations led Prof. Hale to the conclusion that it was now possible to take photographs representing the condition of the sun's atmosphere at different elevations. When we think that remarkably little is known of our own atmosphere at a height of five miles above the earth's surface, we get a slight idea of the power of the astronomer in photographing the sun ninety-three millions of miles away, and gaining a knowledge of the condition of the sun's atmosphere at different levels! This work was of far-reaching importance, and it became more and more necessary to photograph the sun daily. But at Yerkes and at all observatories in the eastern part of our country, daily work on the sun is often interrupted by clouds, and the advantage of a location in California was recognized by the Carnegie Institution. Work there progressed along the same lines which had brought so much success at the Yerkes Observatory; and Prof. Hale planned to carry out researches on a grander scale than was possible even with the 40-inch telescope.

In carrying out the work on the flocculi, the greatest success had been obtained in the use of the calcium *H* and *K* lines of the solar spectrum. The hydrogen lines $H\beta$, $H\gamma$, and $H\delta$, were also used to photograph these interesting phenomena, and it was found that there were great differences in the appearance of the sun as the calcium lines were employed or as the hydrogen lines were made use of. In fact, there were marked variations as the sun was photographed in the light of each of these three hydrogen lines. Consequently, Prof. Hale desired greatly to learn what would be the results when the $H\alpha$ line of hydrogen was employed. The $H\alpha$ or the *C* line of the solar spectrum is the one exclusively used in visual observations of prominences. But unfortunately this *C* line is far in the red, and the ordinary photographic plate is not sensitive to red light, a fact of which we are all aware, since photographs are ordinarily developed in red light. If a plate sensitive to red light could be obtained which would not require too long an exposure, it might then be possible to photograph the sun in the light of glowing hydrogen gas, the *C* line. Experiments to make red-sensitive plates rapid enough for use had not met with much success until within the last year. Mr. Robert James Wallace of the Yerkes Observatory showed a method of doing this by bathing ordinary plates in a certain solution. With this new weapon of research photographic work on the sun was undertaken at Mount Wilson with renewed energy. Seed's "Gilt Edge" plates bathed according to Wallace's directions proved to be splendidly adapted to the purpose. The first experiments with the new plates were tried about the middle of March, 1908, though the first satisfactory photograph was that of April 30. The new plates showed a great improvement in detail over the old. Not only were prominences seen better, but the spots on the sun's surface took on an added interest, for it was at once seen that they are centers of attraction which draw toward them the hydrogen of the solar atmosphere. It became necessary now more closely than ever to observe sun spots, for discoveries would follow each other in rapid order.

On May 26, 1908, a spot reached the east limb of the sun at 8:16 A. M. and the looked-for opportunity was at hand. On May 25, before the spot turned the edge of the sun, evidences of activity could be seen in the shape of prominences which were undoubtedly connected with the spot group. On May 28 at 6:58 A. M., with the spot very close to the eastern limb, traces of a cyclone could be seen near the spot, matter there being in rapid whirling motion, and likewise was seen what proved later to be especially interesting, a flocculus of dark cool hydrogen. (The spot remained on the face of the sun until June 8.) The splendid series of photographs taken show the cyclones continuing on a gigantic scale around the spot. The dark mass of hydrogen—the flocculi—showed changes here and there, giving evidence of great agitation on the sun. Suddenly on June 3 a catastrophe happened; the cool hydrogen gas, which had been continuously in the same location since the spot came around the edge of the sun on May 26, was quickly set whirling and was rapidly sucked into the great maelstrom on the sun. Prof. Hale was lucky enough to have this great solar cyclone—the first of its kind ever seen—recorded on a series of nine photographs all taken within ten minutes. We congratulate Prof. Hale on his energy and his great fortune. The speed at which this cool hydrogen rushed into the center of the spot was about sixty miles per second—rather faster than any motions we know of on the earth—a velocity comparable with that at which prominences are thrown off from the sun.

The photographs showing the solar cyclone were taken about 5 P. M. June 3. At 6 the next morning quite a change was evident around the spots. Bright masses of *heated* hydrogen gas began to appear, and this heated gas kept on increasing in amount for the next couple of days. Thus we become aware of the manner in which relatively cool matter is subjected to the heat of the solar furnace, tracing a mass of hydrogen gas before and after being treated by the solar fire. These are the beginnings of a new set of discoveries which will give us much knowledge regarding our great sun. Spots are thus the centers of disturbances on the sun. But how much disturbance is centered there? And what connection have sun spots with other phenomena? The scientific world has known for more than fifty years that sun spots closely affect the amount of terrestrial magnetism; spots on the sun are connected with "electric storms," and with displays of northern lights, but how related? The sun is evidently the seat of a great electro-magnetic field, whose lines of force stretch outward even as far as the earth. In fact, the appearance of the hydrogen flocculi on the new photographs of Prof. Hale recall to the mind the appearance of iron filings in a magnetic field; and one wishes to know what kind of an electro-magnet the sun is, how it displays its force, and whether sun spots are the centers of lines of force running out. We shall expect Prof. Hale to tell us whether the lines of the spectrum of a sun spot show the Zeeman effect, and how it is that the lines of force from the spot alter the appearance of the spectrum lines.

These discoveries emphasize strongly the great importance of a close and careful study of sun spots, for they are somehow connected with a variety of phenomena such as electric storms, aurora borealis, prominences, flocculi, faculæ, corona, and possibly with conditions of temperature or weather here on earth.

More Curious Facts About Numbers.

BY J. F. SPRINGER.

Those who read attentively the writer's article on numbers in the SCIENTIFIC AMERICAN for March 28, 1908, may have wondered how such groups of numbers as (3, 4, 5), (5, 12, 13), (8, 15, 17), and (7, 24, 25) may be obtained. These groups have the property that if their members be squared the sum of the first two squares is equal to the third. Thus $3^2 + 4^2 = 5^2$. These few cases were, perhaps without exception, found by observation. But the writer has devised a method whereby an unlimited number of such groups may be obtained with quickness and certainty. Consider the equation

[1] $(x^2 + y^2)^2 = (2xy)^2 + (x^2 - y^2)^2$.

Now this equation is true irrespective of the particular values that x and y may have. This may be seen by actually carrying out the operations indicated. Thus, squaring as directed, we have,

$$x^4 + 2x^2y^2 + y^4 = 4x^2y^2 + x^4 - 2x^2y^2 + y^4.$$

Returning now to equation [1], and remembering that it is true whatever the values of x and y, we may obtain groups of numbers having the desired property by simply selecting any values we choose for x and y. Thus, by making $x = 2$ and $y = 1$, we obtain (using dot for multiplication)

$$(2^2 + 1^2)^2 = (2 \,.\, 2 \,.\, 1)^2 + (2^2 - 1^2)^2.$$

That is, $5^2 = 4^2 + 3^2$. This is one of our old groups. Making $x = 5$ and $y = 2$, we obtain

$$(5^2 + 2^2)^2 = (2 \,.\, 5 \,.\, 2)^2 + (5^2 - 2^2)^2.$$

yielding

$$29^2 = 20^2 + 21^2.$$

Again, making $x = 8$ and $y = 3$, we get

$$73^2 = 48^2 + 55^2.$$

Or, if $x = 7$ and $y = 4$,

$$65^2 = 56^2 + 33^2.$$

Finally, if $x = 13$ and $y = 8$,

$$233^2 = 208^2 + 105^2.$$

By performing the operations of squaring, one may convince himself that these results are correct. Thus, in the last case $233^2 = 54{,}289$. The squares of 208 and 105 are 43,264 and 11,025, which upon being added yield 54,289. The reader should use formula [1] and devise groups for himself. By carrying out the squaring operations he may satisfy himself of the correctness of his work.

An interesting property of numbers is the fact that if we add the squares of two consecutive numbers together, we shall obtain a new number such that if we multiply it by 2 and subtract 1, we shall obtain a square number. Thus, suppose we add the squares of the consecutive numbers 2 and 3. Multiplying the new number (13) by 2 and subtracting 1, we get 25—which is a square number. Again, adding the squares of the consecutive numbers 12 and 13, we get 313. Multiplying this by 2 and subtracting 1, we obtain 625—a square number. Indeed, the square number obtained finally is the square of the sum of the two consecutive numbers. Thus, in the first case, 25 is the square of 5, which is the sum of 2 and 3. So, also, 625 is the square of 25, which is, in turn, the sum of 12 and 13. If we desire to see the reason for this, we may represent the two consecutive numbers by x and $x + 1$. Squaring and adding, we obtain $x^2 + (x + 1)^2$, which equals $2x^2 + 2x + 1$. Multiplying this by 2 and deducting 1, we get

$$4x^2 + 4x + 1.$$

But this is a square number, being in fact,

$$(2x + 1)^2.$$

This may be written

$$[x + (x + 1)]^2,$$

from which it may be seen that it is the sum of x and $x + 1$ which is squared. That is to say, by adding the square of the two consecutive numbers, multiplying the result by 2 and subtracting 1, we get the square of the sum of the consecutive numbers.

In the preceding article, a method was given whereby any cube could be expressed as the difference between two squares. That method utilized the formula

[2] $$x^3 = \left(\frac{x^2 + x}{2}\right)^2 - \left(\frac{x^2 - x}{2}\right)^2$$

Another method will now be shown, by which we may differently express a cube as the difference between two squares:

Assuming

$$x^3 = y^2 - z^2,$$

we have to determine y and z. Instead of factoring x^3 into x and x^2 (as in the former article), we factor into 1 and x^3. Putting these equal to the factors of $y^2 - z^2$, we have,

$$y - z = 1$$
and $$y + z = x^3,$$

and we obtain for y and z: $y = \frac{x^3 + 1}{2}$, $z = \frac{x^3 - 1}{2}$.

We may now write,

[3] $$x^3 = \left(\frac{x^3 + 1}{2}\right)^2 - \left(\frac{x^3 - 1}{2}\right)^2.$$

This equation is true, whatever the value of x, as may be readily shown by performing the operations indicated. As formula [3] stands, it is applicable only to odd values of x. For, if x is even, then x^3 is also even. This would make $x^3 + 1$ and $x^3 - 1$ odd numbers. Consequently $\frac{x^3+1}{2}$ and $\frac{x^3-1}{2}$ would remain fractions.

If x be taken equal to 13, we shall have

$$13^3 = \left(\frac{13^3 + 1}{2}\right)^2 - \left(\frac{13^3 - 1}{2}\right)^2$$

That is $13^3 = 1{,}099^2 - 1{,}098^2$. Again,

$$7^3 = \left(\frac{7^3 + 1}{2}\right)^2 - \left(\frac{7^3 - 1}{2}\right)^2$$

or, $$7^3 = 172^2 - 171^2$$

As formula [2] is good for all numbers, whether even or odd, it will be interesting to express by its means the cubes last used (13^3 and 7^3) as the difference between two squares.

Thus, $$13^3 = \left(\frac{13^2 + 13}{2}\right)^2 - \left(\frac{13^2 - 13}{2}\right)^2$$

And $$7^3 = \left(\frac{7^2 + 7}{2}\right)^2 - \left(\frac{7^2 - 7}{2}\right)^2$$

These give, $13^3 = 91^2 - 78^2$

And, $7^3 = 28^2 - 21^2$.

An interesting property of the natural numbers is that if we add any number of these together beginning with unity, double the sum and subtract the last of the numbers, we shall have the square of this final number. Thus, suppose we consider the numbers from 1 to 9. Adding, $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$, we get 45. Doubling this and subtracting the final number (9), we get 81, which is the square of the final number. To understand the reason for this is not difficult. Thus, we write

$$S = 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$$

And, $S = 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1.$

Adding we get $2S = 9\ (9 + 1)$.

Expressed more generally, n being both number of terms and last term, we have

$$2S = n\ (n + 1) = n^2 + n.$$

We have therefore

$$2S - n = n^2 + n - n = n^2.$$

We will now pass to some theorems which, so far as the writer is aware, appear now for the first time. The first theorem is to the effect that if we have the fifth power of any number (not itself a multiple of 11), we may, by the addition or subtraction of unity, make this number divisible by 11. For instance, the fifth power of 921 is 662,671,283,348,601. By adding 1, it is divisible by 11. Search as you may, you will find no number (unless it itself is a multiple of 11) which upon being raised to the fifth power will not become divisible by 11 upon the addition or subtraction of 1.

In order to establish this result generally, let us represent any number (not containing 11 as a factor) by x. Now this number x upon being divided by 11, will yield a remainder less than 11 and more than 0 (as it is supposedly not divisible by 11). We may write, therefore,

$$x = 11y + z,$$

where z may have any integral value from 1 to 10 (inclusive). We now write,

$$x^5 = (11y + z)^5.$$

This gives, by ordinary algebra,

$$x^5 = 11^5y^5 + 5 \,.\, 11^4y^4z + 10 \,.\, 11^3y^3z^2 + 10 \,.\, 11^2\,y^2z^3 + 5 \,.\, 11yz^4 + z^5.$$

If we attentively observe the right-hand side of this equation, we shall see that 11 occurs in all the terms except the last. We may write, then,

[4] $x^5 = 11 \,.\, R + z^5.$

Now, as before observed, z is limited in its range of values. Let us examine these

For $z = 1$,	$z^5 = 1$	$= 11 \times 0 + 1$
$z = 2$,	$z^5 = 32$	$= 11 \times 3 - 1$
$z = 3$,	$z^5 = 243$	$= 11 \times 22 + 1$
$z = 4$,	$z^5 = 1{,}024$	$= 11 \times 93 + 1$
$z = 5$,	$z^5 = 3{,}125$	$= 11 \times 284 + 1$
$z = 6$,	$z^5 = 7{,}776$	$= 11 \times 707 - 1$
$z = 7$,	$z^5 = 16{,}807$	$= 11 \times 1{,}528 - 1$
$z = 8$,	$z^5 = 32{,}768$	$= 11 \times 2{,}979 - 1$
$z = 9$,	$z^5 = 59{,}049$	$= 11 \times 5{,}368 + 1$
$z = 10$,	$z^5 = 100{,}000$	$= 11 \times 9{,}091 - 1$

It will be seen, from an examination of the last column, that z^5 may always be expressed as a multiple of 11 plus or minus 1. That is, we may write

$$z^5 = 11 \,.\, M \pm 1.$$

Consequently, equation [4] may now be written

$$x^5 = 11 \,.\, R + 11 \,.\, M \pm 1.$$

From which is easily obtained,

$$x^5 \mp 1 = 11 \,.\, (R + M).$$

That is to say, either the addition or subtraction of unity will cause any fifth power to become divisible by 11, unless the number raised to the fifth power is itself a multiple of 11, when the addition or subtraction of no number is needed to make it divisible by 11.

This seems to be a very curious result. Another apparently new proposition affirms that if we subtract a number from its seventh power the result is divisible by seven. Thus 128 is the seventh power of 2. Subtracting 2, we get 126, which is divisible by 7. Again, 279,936 is the seventh power of 6. Subtracting 6, we obtain 279,930, which upon trial we find to be divisible by 7. As a final illustration, consider the number 62,748,517. This is the seventh power of 13. Subtracting 13 from it, we get 62,748,504, which is divisible by 7.

In order to establish this proposition generally, let x represent any number not divisible by 7. It is superfluous to consider multiples of 7, as the proposition is obviously true in their case. So then, we have to prove that

$$x^7 - x$$

is divisible by 7, when x is a non-multiple of 7. As x is not divisible by 7, we may write

$x = 7y + z$, when z varies from 1 to 6 (inclusive).

We have, then,

$$x^7 - x = (7y + z)^7 - (7y + z).$$

Now, upon expanding the right-hand side of this equation the number 7 appears in every term except z^7 and $-z$. So that we may write

[5] $x^7 - x = 7 \,.\, Q + z^7 - z.$

Let us consider the possibilities of $z^7 - z$ for the six possible values of z (1 to 6).

For $z = 1$,	$z^7 - z =$	0
$z = 2$,	$z^7 - z =$	126
$z = 3$,	$z^7 - z =$	2,184
$z = 4$,	$z^7 - z =$	16,380
$z = 5$,	$z^7 - z =$	78,120
$z = 6$,	$z^7 - z =$	279,930

Examining the column on the right hand, we find every number to be divisible by 7. Consequently, whatever value it is possible for $z^7 - z$ to possess, each and every one is divisible by 7. So that the right-hand side of equation [5] is divisible by 7, throughout—which establishes the proposition.

A similar proposition, and one apparently new, is to the effect that if we subtract a number from its thirteenth power the resulting number is divisible both by 7 and 13, and consequently by 91 (since $7 \times 13 = 91$). As an example, consider the thirteenth power of 2. This is 8,192. Subtracting 2, we obtain 8,190, a number divisible both by 7 and 13. Again, the number 2,541,865,828,329 is the thirteenth power of 9. Subtracting 9, we have, 2,541,865,828,320. This number, upon trial, we find to be divisible both by 7 and by 13. These seem to be pretty striking results. But perhaps some one may question whether they are not mere matters of coincidence.

To prove the fact generally, let us denote the number, whose thirteenth power is to be taken, by x. We have, then, to show that $x^{13} - x$ is divisible both by 7 and by 13. As the proposition is self-evident, as far as 13 is concerned, if x is a multiple of 13, we shall consider that x, upon division by 13, yields a remainder less than 13. That is,

$$x = 13y + z.$$

Where z varies from 1 to 12 (inclusive). We write now,

$$x^{13} - x = (13y + z)^{13} - (13y + z).$$

The entire right-hand side of this equation contains 13 as a factor except

$$z^{13} - z.$$

Let us consider the possible values of this expression.

For $z = 1$,	$z^{13} - z =$	0
$z = 2$,	$z^{13} - z =$	8,190
$z = 3$,	$z^{13} - z =$	1,594,320
$z = 4$,	$z^{13} - z =$	67,108,860
$z = 5$,	$z^{13} - z =$	1,220,703,120
$z = 6$,	$z^{13} - z =$	13,060,694,010
$z = 7$,	$z^{13} - z =$	96,889,010,400
$z = 8$,	$z^{13} - z =$	549,755,813,880
$z = 9$,	$z^{13} - z =$	2,541,865,828,320
$z = 10$,	$z^{13} - z =$	9,999,999,999,990
$z = 11$,	$z^{13} - z =$	34,522,712,143,920
$z = 12$,	$z^{13} - z =$	106,993,205,379,060

Examining the column of figures at the right hand, it will be seen that each and every number is divisible by 13. Consequently, the expression $x^{13} - x$ is divisible by 13. We have yet to show that it is also divisible by 7. We represent x now by $7m + n$, where n may be any number from 1 to 6. The expression $x^{13} - x$ now becomes

$$x^{13} - x = (7m + n)^{13} - (7m + n)$$

Just as before, every term on the right-hand side, when expanded, contains the factor 7 except the expression

$$n^{13} - n$$

To examine this for values from 1 to 6, is simply to look over the column of figures last obtained beginning with the first and extending through the sixth, to see whether 7 is a factor. Upon examination, we find that it is. So that as a result of our investigation we find that all numbers of the form $x^{13} - x$ are divisible both by 7 and by 13—consequently by 7×13, or 91.

But we have not reached the end as yet. In raising numbers to the several powers, we find that powers of numbers ending in 1 also end in 1. Thus, any power of 31 will terminate in the figure 1. If a number ends in 2, the final figure of its various powers runs through the cycle 2, 4, 8, 6. Constructing a table, we find the following results:

Final Figures.	Powers.					
	1	2	3	4	5	6
1	1	1	1	1	1	1
2	2	4	8	6	2	4
3	3	9	7	1	3	9
4	4	6	4	6	4	6
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	9	3	1	7	9
8	8	4	2	6	8	4
9	9	1	9	1	9	1
0	0	0	0	0	0	0

Thus for numbers ending in 7, the final figures of the powers run through the cycle 7, 9, 3, 1. Upon examining the table closely, it will be seen that these cycles consist of one, two, or four numbers. In consequence of this periodicity, the thirteenth power of any number will terminate in the same figure as the first power, all the cycles starting afresh at this power (as also at the fifth and ninth). Consequently, if we subtract the first power from the thirteenth we shall obtain a number whose final figure is 0—the final figures of minuend and subtrahend being the same. Consequently, all numbers of the form $x^{13} - x$ terminate in 0, and are for this reason divisible by both 2 and 5. We learn, then, that all numbers of the form $x^{13} - x$ are divisible at once by 2, 5, 7, and 13—that is, by 910.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1716, deals with the subject of the short-distance transportation of the products of the mine, field, and forest from the outlying districts to the railroad. The use of dry air in the blast furnace as patented by Gayley is described fully. Various conjectures have been made as to the cause of the destruction of Count Zeppelin's airship. One very plausible explanation ascribes the catastrophe to the effect of atmospheric electricity. The electrical principles involved are described in the SUPPLEMENT. Whether as a toy, as a scientific instrument, or as an object of practical utility, the gyroscope is of great interest. As an illustration of its possible development, a gyroscope invented by Prof. Ach of Berlin is described, which has for its object a means of securing the invariability of the axis of rotation of the gyroscope, no matter what arbitrary movements may take place in the carrier of the gyroscope. The invention comprises means to do away with the influence of gravity on the spinning body. Sir William Ramsay discusses the subject, "Do the Radioactive Gases Belong to the Argon Series?" The making of artificial diamonds is described. Mr. Alexander A. Chenoweth writes on reinforced concrete as a substitute for wooden piles, cross-ties, or sleepers. Photographic bird's eye views have hitherto been obtained by means of balloons, or kites. Dr. Neubronner has discovered that they may also be taken with the aid of carrier pigeons. The necessary apparatus is described and illustrated.

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the SCIENTIFIC AMERICAN, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best non-mathematical explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the following conditions:

1. No essay must be longer than 2,500 words.

2. The essays must be written as simply, lucidly, and non-technically as possible.

3. Each essay must be typewritten and identified with a pseudonym. The essay must be inclosed in a plain sealed envelope, bearing only the pseudonym. With the essay should be sent a second plain sealed envelope, also labeled with the pseudonym, and containing the name and address of the competitor. Both these envelopes should be sent to "Fourth Dimension Editor, SCIENTIFIC AMERICAN, 361 Broadway, New York, N. Y."

4. All essays must be in the office of the SCIENTIFIC AMERICAN by April 1, 1909.

5. The Editor of the SCIENTIFIC AMERICAN will retain the small sealed envelope containing the address of the competitor and forward the essays to a Board of Judges, who will select the prize-winning essay.

6. As soon as the Board of Judges have agreed upon the winning essay, they will notify the Editor, who will open the envelope bearing the proper pseudonym and containing the competitor's true name. The competitor will be notified by the Editor that he has won the prize, and his essay will be published in the SCIENTIFIC AMERICAN.

7. The Editor reserves the right to publish in the columns of the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT three or four of the more meritorious essays, which in the opinion of the judges are worthy of honorable mention.

The Editor of the SCIENTIFIC AMERICAN is now engaged in selecting the judges who will award the prize. They will be three in number, and all will be eminent American mathematicians. The names of the judges will be announced in a later issue of this journal.

Substitute for Chromate of Silver.

Running short of Lord Kelvin's glass tubes for deep-sea soundings, and finding the prices charged in America—40 cents each—rather high, Mr. John Martin of the S. S. "Akershus" informs us that he tried to find some substitute for chromate of silver, and succeeded. He bought a ¼-inch (inside diameter) water-gage glass of the same length as Lord Kelvin's tubes, closed one end with a flat piece of cork, a small rag over it and some sealing wax. Next he cut a sheet of drawing paper into narrow strips at a bookbinder's. Along the middle of the paper strip he drew a line with a copying pencil. The paper slip was then shoved up the glass tube, forming a blank scale. The lower end of the strip was turned around the edge of the tube and tied with a piece of cotton thread to prevent the paper from being displaced by the water as it rose in the tube. The tube was used in the same way as Lord Kelvin's. The depth was read off from the boxwood scale. The ink pencil line distinctly indicated how far the water reached. The guard tube containing the gage glass was made from an old condenser tube.

The Death of William Edward Ayrton.

William Edward Ayrton, the distinguished English electrical engineer and inventor, died in London on November 8 in his sixty-first year. He was educated at University College, London, and after graduation entered the Indian Government Telegraph Service. In 1873 he was appointed to the chair of natural philosophy and telegraphy at the Imperial College of Engineering, Japan. Here he remained for five years. In 1884 he was made professor of electrical engineering at the Central Technical College, South Kensington. He was president of the Physical Society, 1891-2, and president of the Institution of Electrical Engineers in 1892.

The Death of John Henry Mills.

John Henry Mills, a pioneer heating engineer and inventor of heating boilers, of Boston, Mass., died at his home in Faneuil, a suburb of that city, on Tuesday, October 6, in his seventy-fifth year. He was an authority on heating, and his work, "Heat—Its Application to the Warming and Ventilation of Buildings," is one of the standard books on the subject.

Correspondence.

USEFUL ARTIFICIAL WATERWAYS.

To the Editor of the SCIENTIFIC AMERICAN:

The proposition to retain water at the heads of large rivers and their tributaries is surely well worth careful consideration, as it will aid in retaining moisture, not only on the surface, but to great depths, replenishing old-time underground rivers and furnishing water for wells in the surrounding country. Such reservoirs can be used to keep machinery running during the dry season too, thus adding millions of dollars valuation to power plants, by steadying business, in regulating production so as to secure equal results throughout the whole year.

Yet still all the water that can be retained will prove to be an infinitesimal quantity in checking the overflow of the lower streams of any great system of rivers, such as the Mississippi and the Amazon.

The best possible command of the Mississippi River can be secured by dredging a deep and broad channel for several hundred miles inland at a proper distance from the river channel on both sides of the river.

The channel on the west side should extend from Atchafalaya Bay, keeping west of the extremely troublesome Bayou Lafourche and passing east of Opelousas and Alexandria, La., east of Pine Bluff, Ark., on to the head of White River, across the line of Missouri, to a point opposite Charleston near the Mississippi River, and Van Buren on the Iron Mountain Railway. This will drain large tracts of wet, unproductive flat lands, which will be of excellent quality and most of them fertile and productive when properly drained. There are hundreds of thousands of acres of flat, wet land along the proposed course of this west side canal.

The east side channel should begin at Bay St. Louis, extending north, crossing the Pearl River, to a point above Lake Pontchartrain. There bending west should cross the Illinois Central Railway, near the town of Amite, reaching the Mississippi Valley a few miles below Natchez, on into the Yazoo Valley, then on up that valley, passing near and east of Memphis and on to the Ohio River Valley. There bending east, follow the course of that river as far as the land formation makes it desirable. At certain points it may be necessary to leave off one side of a river and take up construction on the other side. This being a question of easy decision for any competent engineer.

These channels will have a threefold purpose of usefulness: First, as channels of drainage, they will add several hundreds of millions of dollars value to the country traversed, by providing several outlets for drainage of swamps and farm land in general. For such an outlet there is a burning necessity which should have been provided for long years ago.

Second, for relieving the strain upon the levees of the Mississippi and the other rivers and bayous included in the districts traversed by the canals, also to prevent overflow by letting surplus water into these channels, through intersecting canals a any point of greatest strain. This can be done at any point where cross-sectional channels have been constructed.

Third, if set free to the traffic of all who own suitable crafts, the value for purposes of navigation alone will eventually pay the cost of construction and fat dividends besides.

These main channels can be constructed a liberal width in the beginning and shallow, to be deepened by dredging until, if found desirable, seagoing vessels of the highest tonnage can pass each other with ease, and take their loads inland to the head of these canals.

On the east side of the Mississippi River, beginning about 30 miles above Cairo and extending up to St. Louis, is an extensive bottom-land country, which would be tripled in value by a canal of sufficient capacity to carry off the local surplus water, and aid in relieving the Mississippi whenever a threatened overflow at that part of its course created a call for an extra outlet.

Between Omaha, Neb., and St. Joseph, Mo., a good deep and broad canal would aid greatly in preventing the destructive overflowing and changing of channel of the Missouri River.

At Kansas City, too, relief from inundations of the lower portions of that city can be secured by one or two canals of capacity requisite for drawing off the surplus water whenever a surplus approaches with all its threatened consequences.

On the middle and upper Ohio, along the rivers of Kansas, wherever there is a necessity in localities mentioned or others not named; wherever are found large rivers or threatening streams subject to extraordinary floods, in any part of the world, this proposed plan will bring security from ordinary ensuing disastrous consequences. Think for a little how much this means.

From the northwest corner of Lake Pontchartrain a cypress swamp extends north for many miles. This swamp has water nearly all over its surface, for the greatest part of the year. If drained, it would soon become farm land of great value on account of its fertility. This can all be drained by one canal and a levee along the shore of the lake, then pump the water over the levee into the lake.

Many other similar localities can be reclaimed in like manner. The above proposed system is of vast and far-reaching importance, and should be carefully investigated at the earliest possible opportunity afforded to those upon whom the responsibility devolves, and whose duty it is to have this work of altogether unprecedented importance performed.

Whose duty should it be, if not the unbounded duty of the people, all the people, of the great republic, the United States of America? Every citizen of this whole country should be interested. This work will benefit all of them, both individually and collectively.

J. A. STOCKFORD.

Spokane, Wash., November 2, 1908.

From the returns compiled by Lloyd's Register, it appears that, excluding warships, there were 319 vessels of 733,378 tons gross under construction in the United Kingdom at the close of September, 1908.

AN AEROPLANE FACTORY.

BY JACQUES BOYER.

The construction of aeroplanes is the latest new industry to be started in France; and the exploits of Santos Dumont, Bleriot, Farman, Delagrange, and the Wright brothers, by focusing public attention upon aviation, have aided in its development. As a result, there are to-day several factories especially fitted up for this purpose near Paris. The most important of these, that of Voisin brothers at Billancourt, has a capacity of four machines a month.

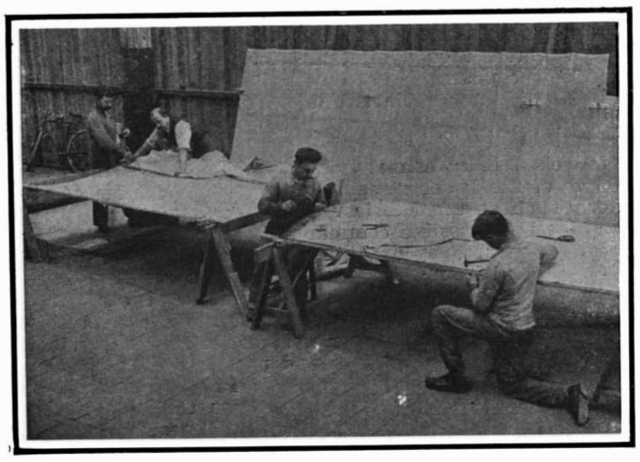
In the principal room of this original factory are found scattered about the various parts of aeroplanes in course of construction. In one corner is to be seen the body framework or skeleton of a future aerial vehicle, some 36 feet in length by about 2½ feet in width, while a little farther on are placed the cells, or enormous wings, having a spread of some 32 feet, and intended to be mounted on monoplane, double- or triple-surface machines.

The tools used in the aeroplane factory are of the simplest sort. They consist of mallets, saws, chisels, and such other tools as are used by carpenters. The wood used in making the body framework is generally oak, while the uprights that connect the main planes are of the same material or of poplar. The main longitudinal pieces are cut from very dry wood. They are about 32 feet long, and are selected so that the grain runs from one end to the other, in order to give a maximum resistance for a given section. They are planed down and grooved in certain places, and then fitted together by means of uprights that are mounted in aluminium sockets attached to them. The framework thus formed is suitably braced by means of steel piano wire, drawn taut and fastened to eyelets in the aluminium sockets. In the aeroplanes of the Farman type constructed by Voisin, the finished body framework has a total length of 9½ meters (31.16 feet), weighs 55 kilogrammes (121¼ pounds), and is so rigid that it will support a weight of over 1,000 pounds at its front end.

The body framework tapers at the front and terminates in a steel and aluminium plate, in the center of which is fastened the bearing for the propeller shaft. The motor is mounted on a metal frame, and the seat of the aviator consists of a board with a back attached.

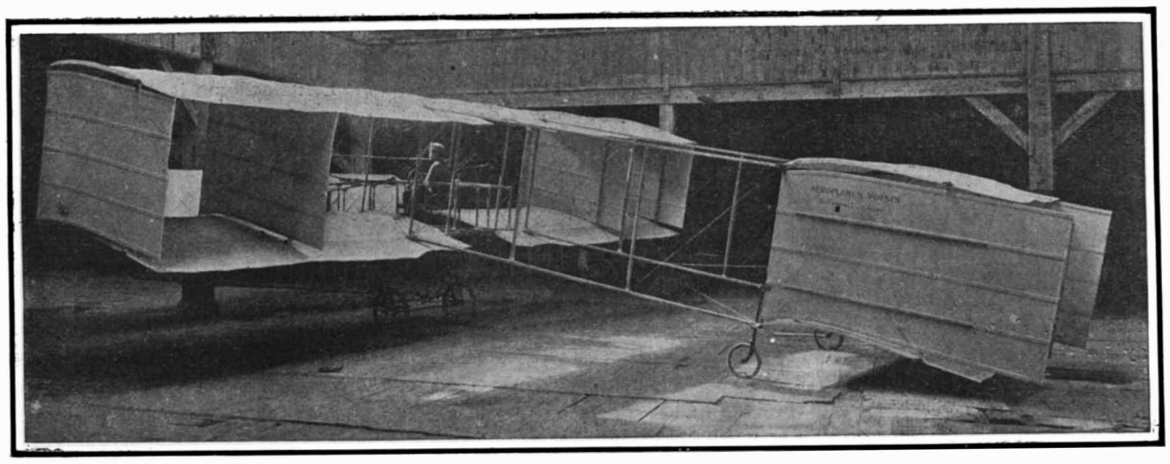
The cells or wings, which are attached to each side of the body framework, consist, in the case of a double or a triple-surface machine, of two or three superposed surfaces, connected together by poplar uprights mounted in the aluminium sockets, and braced by steel wires in order to make them sufficiently rigid. These surfaces are made up of a frame consisting of two strips of wood (one in front and one at the back) connected by curved ribs of poplar, and covered with rubber-impregnated cloth, which is nailed to the strips

(*Concluded on page 358.*)



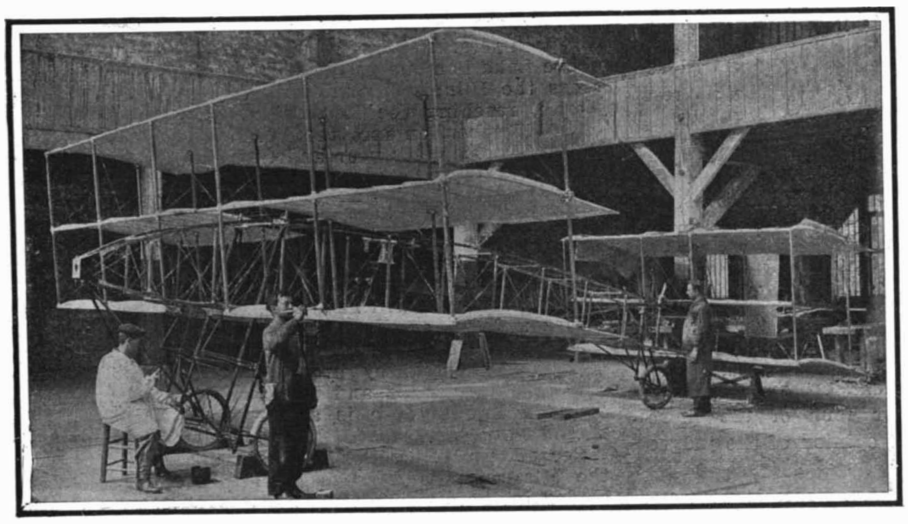
Covering the frame of a plane with cloth.

A waterproof cloth having pockets for the ribs is used to form the planes.



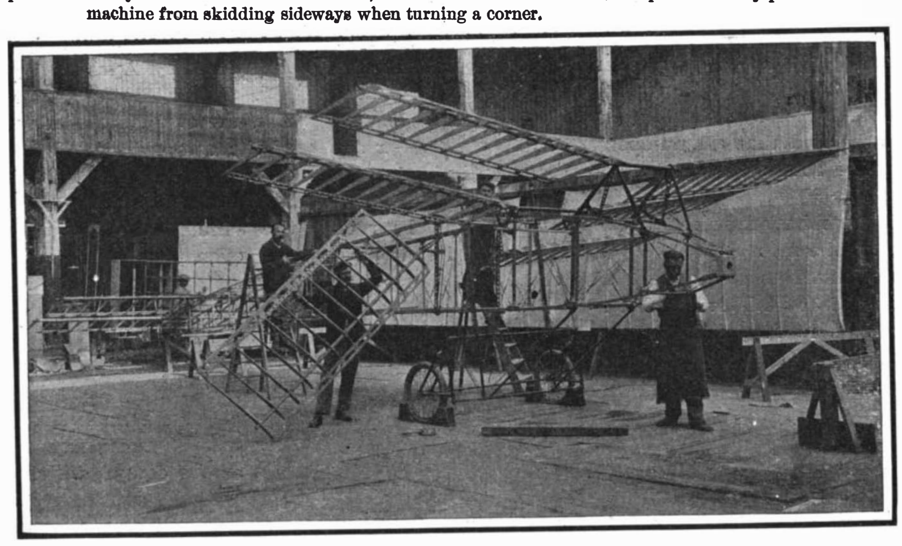
Farman's aeroplane, showing some of the recent changes in its construction.

Vertical partitions have been placed half way between the center and ends, and also at the ends of the main planes. They prevent the machine from skidding sideways when turning a corner.



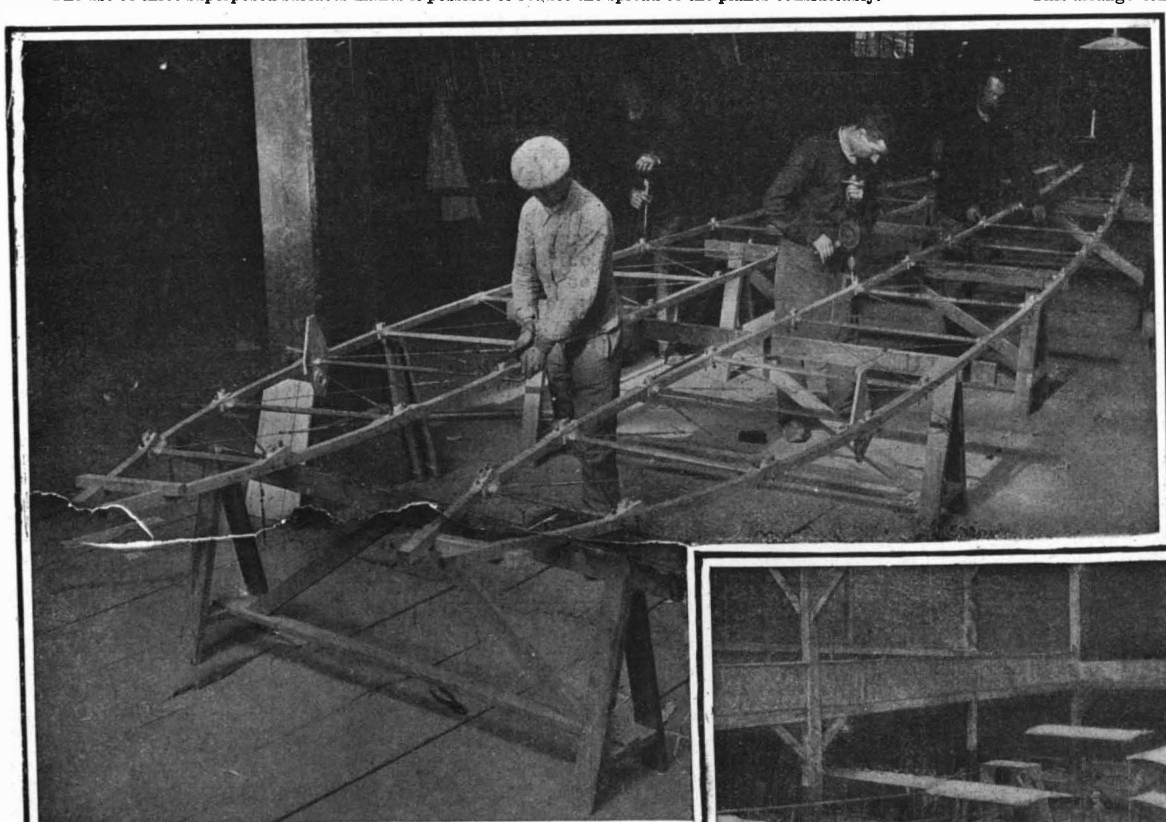
The Goupy three-decker. This machine was tried without encouraging results.

The use of three superposed surfaces makes it possible to reduce the spread of the planes considerably.

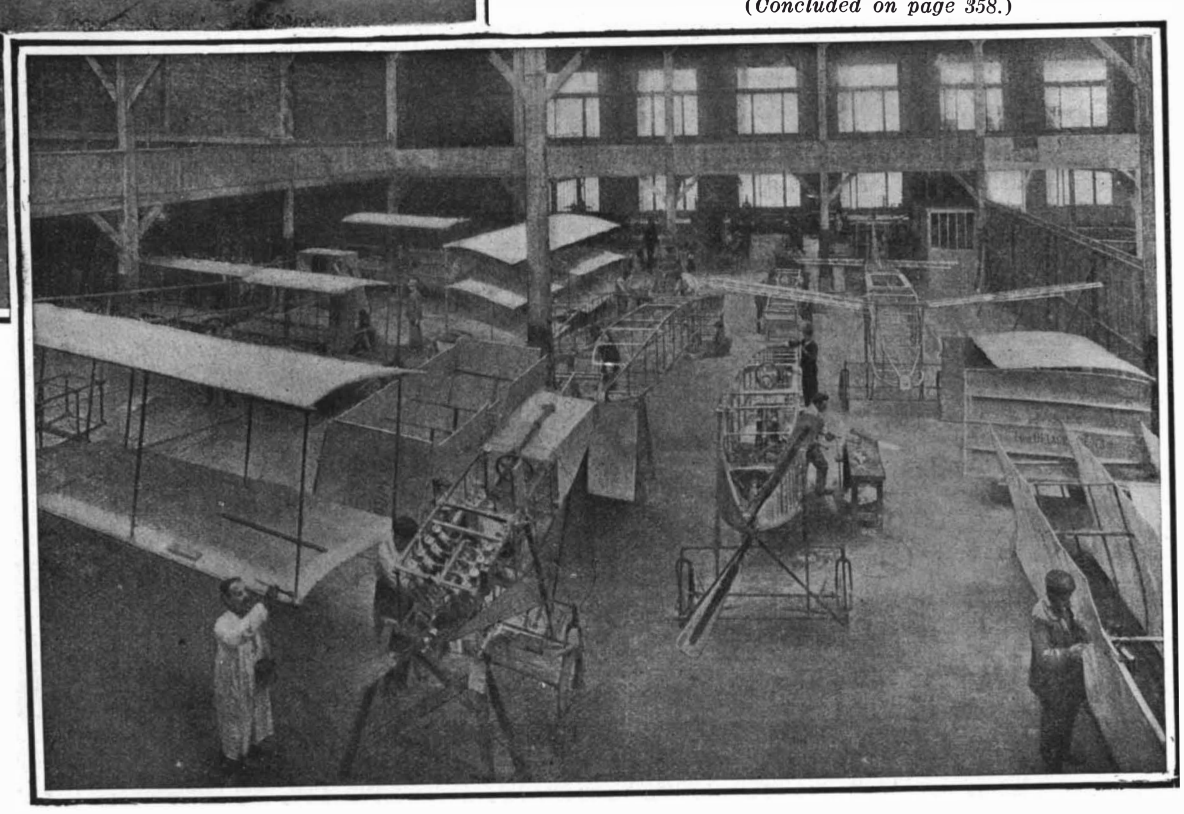


Assembling the "Flying Fish," Farman's untried following-plane machine.

This arrangement of following planes also makes possible the reduction of the wing spread.



Side members of the main body frame of an aeroplane.

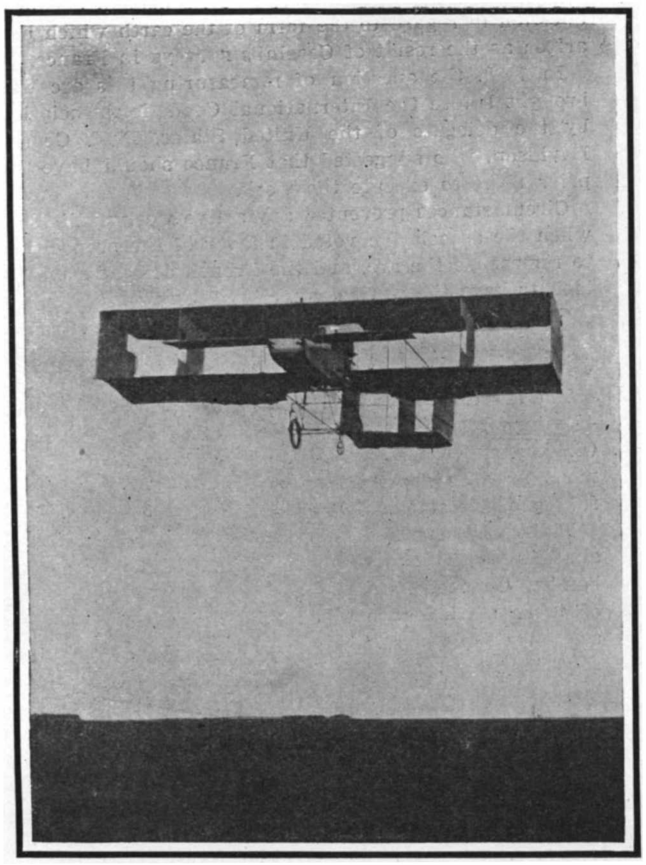


Interior of the Voisin factory, showing finished aeroplanes and others in course of construction.

THE CONSTRUCTION OF AEROPLANES.

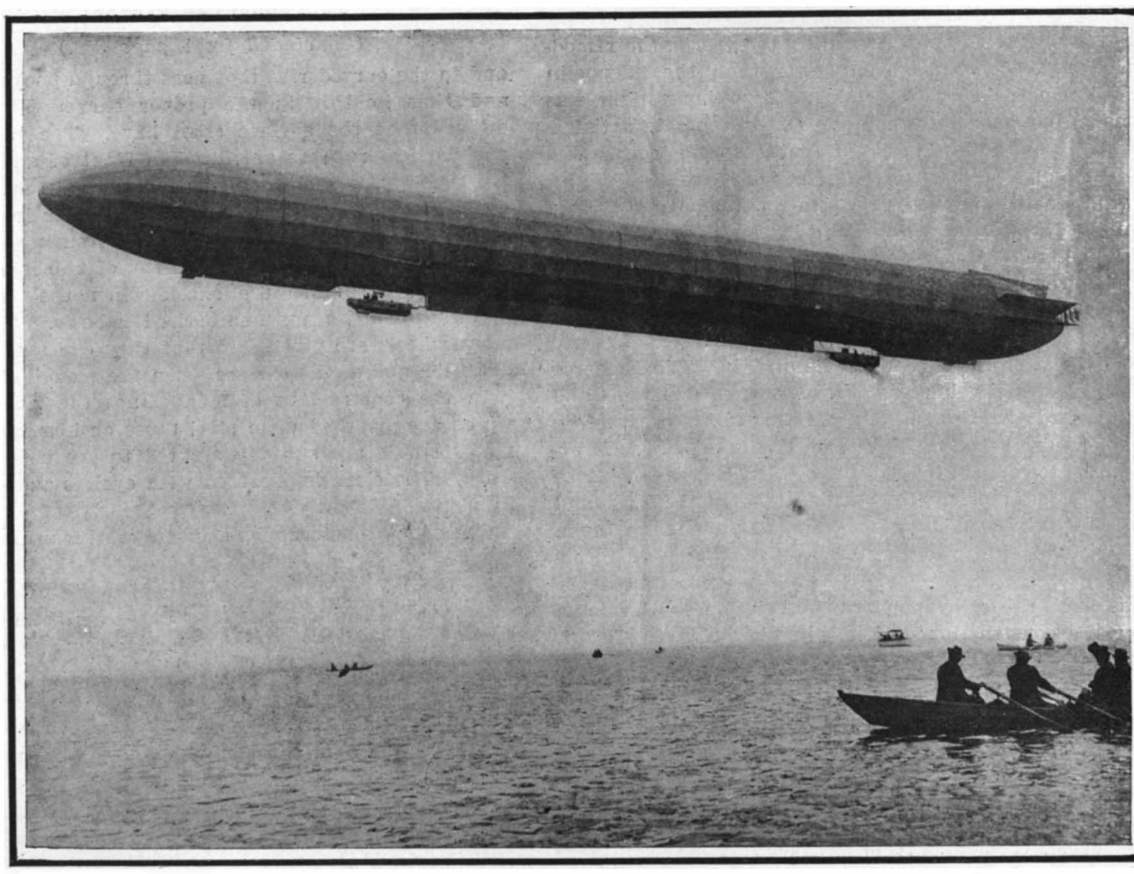
THE LATEST EUROPEAN AIRSHIPS AND AEROPLANES AND THEIR PERFORMANCES.

As noted in our issue of October 31, Count Zeppelin, on the 23d ultimo, brought out his fifth airship for its first trial. One of our illustrations shows this huge air craft undergoing its first trial. The new airship is the remodeled "Zeppelin III." of 1906, which, before the building and operation of the fourth airship last year, had shown remarkable results. It has been lengthened out 8 meters (26¼ feet), and, because of its smaller diameter than the No. 4, Count Zeppelin has used two 85-horse-power motors in place of the 110-horse-power engines that were on the later airship. The remodeled No. 3 has the same inclined stabilizing planes attached to its sides at the rear that were first tried out upon it and afterward used in a modified form upon the No. 4, but in place of the very large vertical rudder the latter had at its rear end, small triple vertical rudders only appear to be used between the stabilizing planes on each side. A three-surface horizontal rudder is used on each side



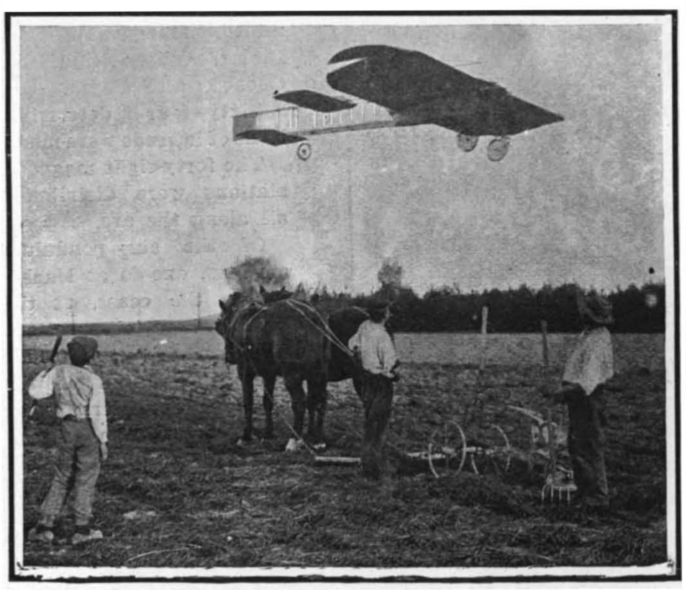
Farman's aeroplane flying across country.

Note the vertical partitions connecting the planes. These have been added recently.



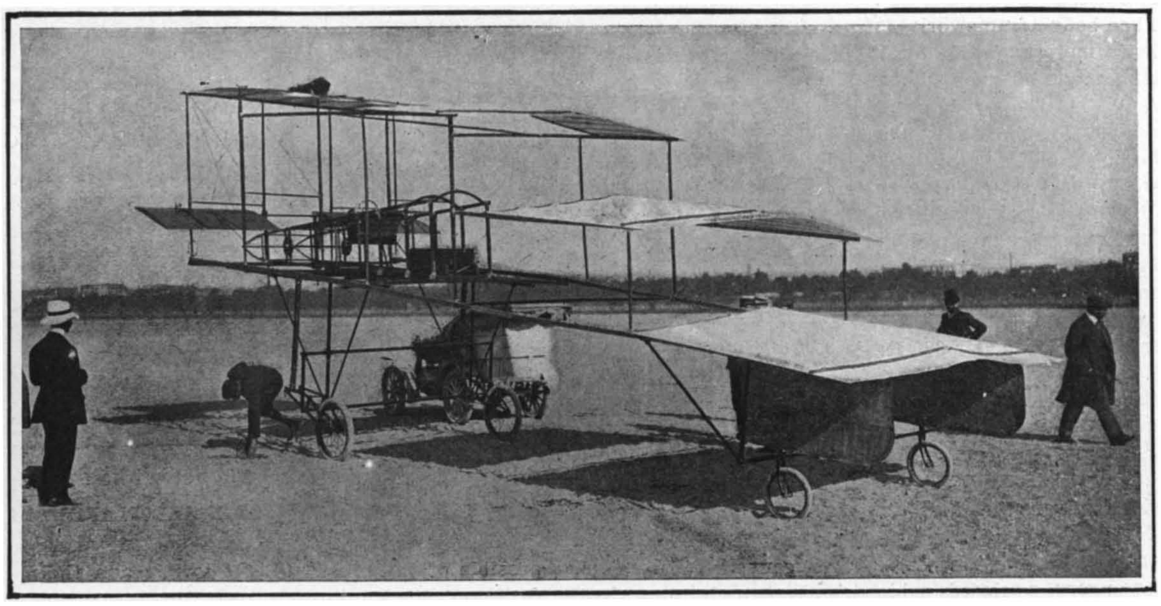
The latest Zeppelin airship—the remodeled No. 3—in flight above Lake Constance.

The large vertical rudder at the rear has been dispensed with and replaced by small triple rudders on each side.



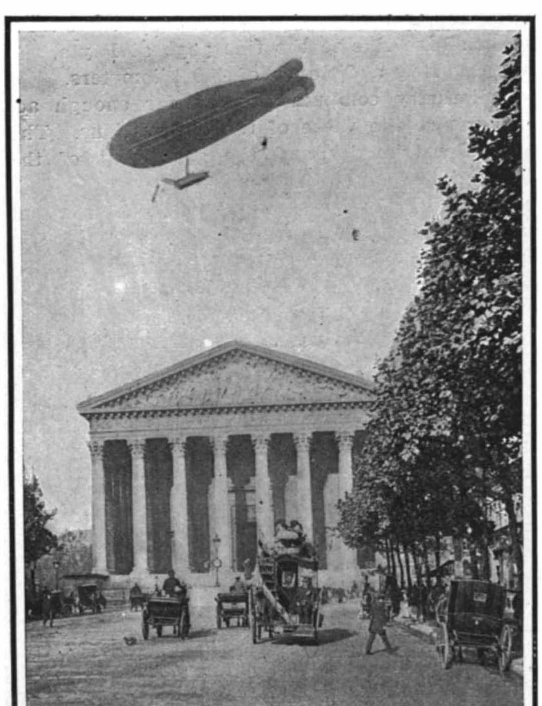
Bleriot's monoplane on its nine-mile cross-country flight.

Despite numerous accidents, this machine has proved its worth by its flights across country and in a strong wind.



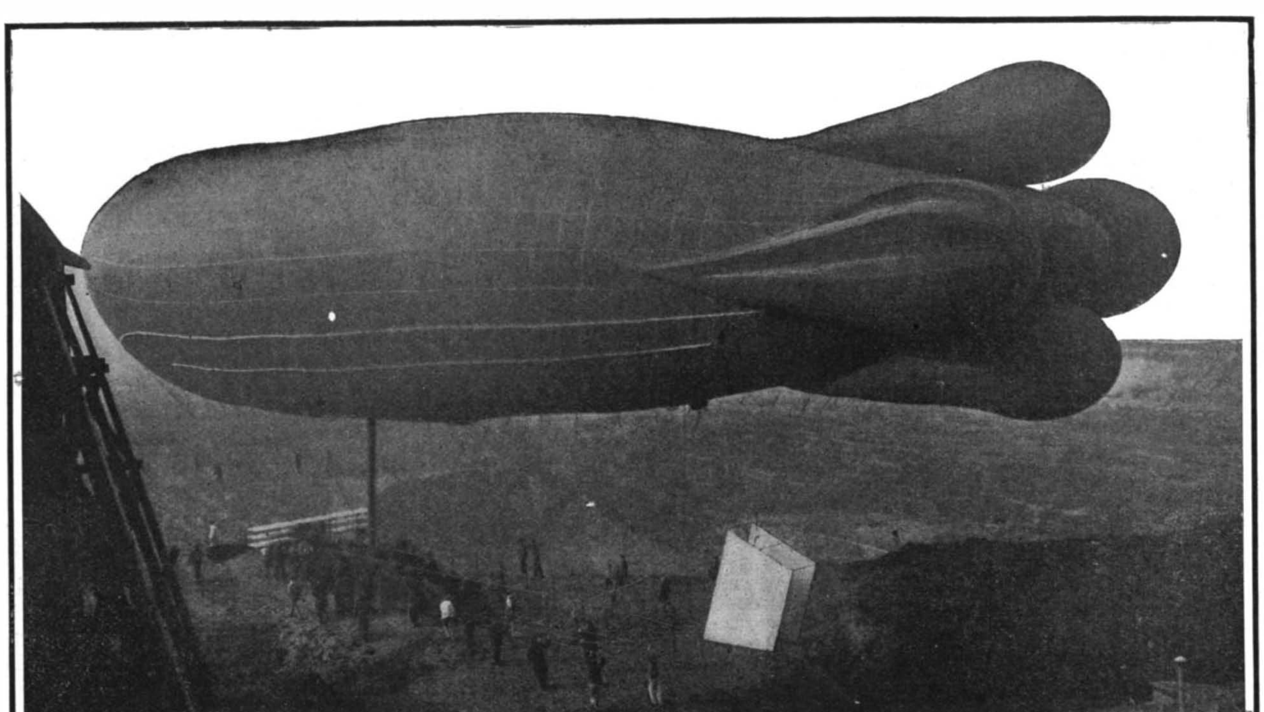
Three-quarter rear view of the Witzig-Lioré-Dutilleul aeroplane.

Note the step-like arrangement of the surfaces, with the horizontal rudder in front and the twin vertical rudders at the rear.



The Clement dirigible sailing over the Madeleine in Paris on its initial trip.

Note the aluminium cabin in the body framework.



The new Clement airship, showing the peculiar tail, the propeller, and the horizontal and vertical rudders.

During its maiden voyage on October 29, this new airship, piloted by M. Kapferer, carried seven people from Sartrouville to Paris and back at a speed of between 25 and 30 miles an hour.

SOME NEW AND IMPROVED FOREIGN AEROPLANES AND AIRSHIPS.

of the bow also. Among the new features is a telegraph line connecting the two cars.

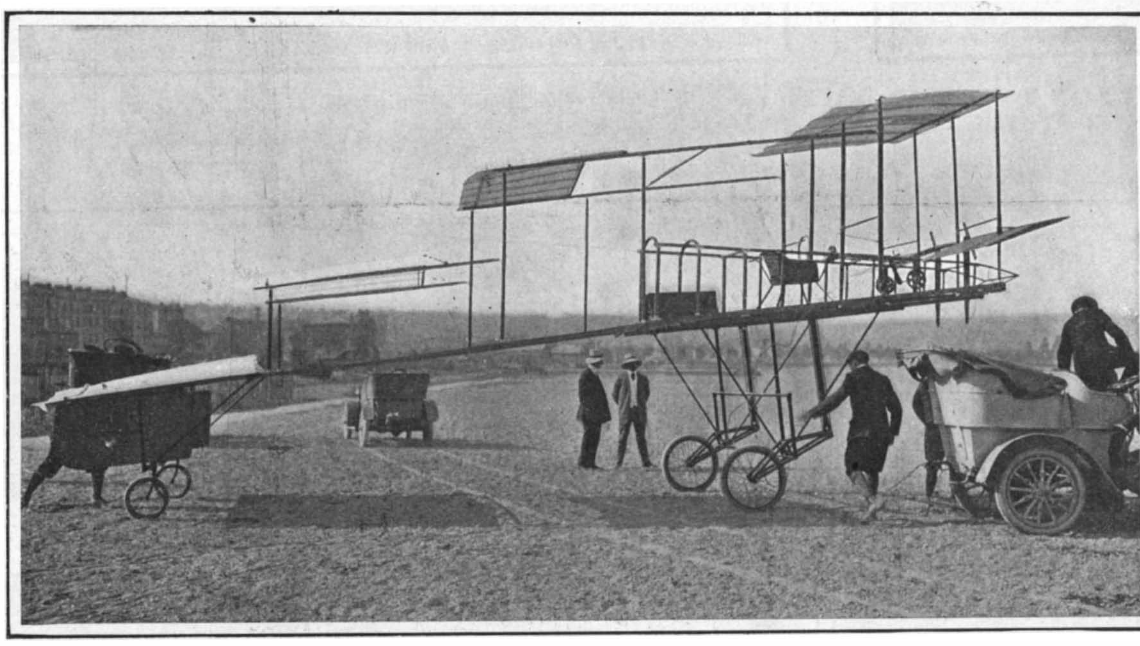
A few of the recent flights of the remodeled airship are enumerated below. The first was made on October 23, when the airship flew over Lake Constance and the city of the same name about four hours. On the next day a flight of two hours was made, and on Sunday, the 25th of October, another two-hour flight much more remarkable than the one of the previous day was carried out. According to experts, the remodeled vessel operates even better than the "Zeppelin IV." On the 26th of October a three-hour flight was made, but one of the motors did not operate satisfactorily. The following day, Count Zeppelin took Prince Henry of Prussia with him for an extended flight, which lasted six hours. A trip was made to the Falls of the Rhine, and the airship developed a speed of 50 kilometers (31 miles) an hour. Several days after, on November 7, Crown Prince Frederick William accompanied the Count, and made a trip to Donaueschingen, Baden, where the Emperor arrived by rail shortly after the arrival of the airship. The Emperor conversed with his son through a megaphone, and afterward the Crown Prince returned in the airship to Friedrichshafen. Emperor William himself expected to make a trip in the airship on the 10th instant, but instead he watched it from the lake, and at the termination of the flight he conferred upon Count Zeppelin the order of the Black Eagle, in recognition of his achievement. At the present time there has been raised by popular subscription in Germany, for the construction of Zeppelin dirigibles, $1,378,334. This gives a good idea of the decided success Count Zeppelin has finally met with among his countrymen.

The other dirigible which we illustrate is the "Clement-Bayard" of M. Clement, the well-known automobile manufacturer of Paris. This airship has been constructed for the personal use of M. Clement. It is 56 meters long (183.6 feet) by 10.58 meters (34.7 feet) in diameter, and it has a capacity of 3,500 cubic meters (123,602 cubic feet). The body framework is 28½ meters (93½ feet) long, made of steel tubing. A triple-surface horizontal rudder is placed at the forward end of the body framework, and a 5-meter (16½-foot) propeller is at the extreme front end. The 120-horse-power Bayard-Clement motor is mounted on springs, and drives the propeller 380 R. P. M. by reduction gearing. Every conceivable kind of indicating apparatus has been fitted. For example, there is a tachometer which gives the number of revolutions of the motor at every instant. For the convenience of the passengers a closed cabin of sheet aluminium has been provided. A specially noticeable feature of this dirigible is the peculiar tail, which consists of four club-shaped gasbags placed beside the reduced rear end of the main envelope. This form of tail has been found to work quite satisfactorily, and to give the balloon a considerable degree of stability. M. Clement expects to use this airship in making excursions to his country place.

Two of the photographs reproduced herewith show Farman's remodeled aeroplane and the latest Bleriot monoplane in full flight. The Farman machine has been changed by the placing of vertical partitions at the ends of the main planes and by the moving of the partitions that were formerly on each side of the center part to points about half way between the center and the ends of the main planes. M. Farman has also fitted horizontal auxiliary planes or shutters to the rear edges of both the upper and lower planes. The angle of these shutters can be varied to tilt up the machine when turning a corner. After making the sensational cross-country flight mentioned elsewhere, Farman, on October 31, won the "Prix de la Hauteur" of the Aero Club of France by flying over a line of captive balloons placed at a height of 82 feet.

The Bleriot monoplane has not been changed very much of late. The movable wing tips are still used on the ends of the plane, and there is but a single horizontal rudder below the rear end of the body framework. A small additional plane is fitted above the body framework toward the rear. These rudders and movable wing tips apparently work very well, since M. Bleriot was able, on October 22, to drive his machine against a strong wind of between 25 and 30 miles an hour. The speed of the machine itself is about 37 miles an hour.

The other aeroplane we illustrate is a new type, in which the surfaces are arranged in a series of steps. This aeroplane is known as the Witzig-Dutilleul. It has a total surface of 50½ square feet, and is to have a 50-horse-power Antoinette motor. No experiments of any account have as yet been made with it.



Side view of Witzig-Lioré-Dutilleul aeroplane, showing step-like arrangement of the following planes.

SOME NEW AND IMPROVED FOREIGN AEROPLANES AND AIRSHIPS.

AN AEROPLANE FACTORY.

(*Concluded from page 356.*)

and to the curved ribs that pass through pockets in it, and thus hold it in the proper curve which it is desired that the surface shall have. The horizontal and vertical rudders are fitted in front of and behind these planes. the former being mounted at the forward end of the body framework, and the latter in the box tail at the rear. The main frame is supported upon a chassis of steel tubing by means of two long coiled springs that absorb the shock when the aeroplane alights upon its pneumatic-tired wheels. The two front wheels are pivoted so that they can assume any direction and act as casters when the machine alights.

In the construction of monoplanes the ribs of the wings are mounted upon steel tubes or I-beams of aluminium that are suitably secured to the body framework. The cloth is provided with eyelets and is laced in place.

One of our photographs shows a workman mounting the six planes of Farman's "Flying Fish" aeroplane upon the body framework. The planes can be set at varying angles, and the proper angle for them will be determined by experiment. The factory has a laboratory, in which experiments are made to determine the best form of aeroplane, the curves of the surfaces, and the resistance of the planes and of the framework. In constructing an aeroplane, use is made as much as possible of the different light metals and their alloys. Ordinary steel tubing is used for the planes, while for the propeller shafts and the blades nickel steel, offering the greatest resistance for the least weight, is employed. All pieces working under compression are made of aluminium, in order to diminish the weight. The propellers, in particular, are very carefully constructed. The hub is made of cast steel, and to it are clamped the steel arms, which are forgings of very high resistance. To these arms are secured aluminium blades. When one notes that this mass of 2.3 meters (7½ feet) diameter revolves at from 1,000 to 1,400 revolutions a minute, one can see that it must be exceptionally strong. At 1,335 revolutions per minute the end of one of the blades travels through space at the rate of 525 feet a second (350 miles an hour) and the blade itself is constantly under a centrifugal force of nearly 9,000 pounds, tending to project it outward.

The motor is one of the most important parts of the aeroplane. Heretofore Voisin brothers have used only the Antoinette motors of the 8-cylinder V type; but lately they have adopted the "Vivinus," or the motor of the Belgian Société Metallurgique. This latter motor, which is the one used on the Goupy, Florio, Moore-Brabazon, Farman ("Flying Fish" for two passengers), and De Caters aeroplanes, is a 50-horse-power, lightweight, automobile motor weighing about 300 pounds. Whatever motor is adopted, the installation of it requires only a few days. In fact, a complete aeroplane can be constructed in about a week's time. The cost of one of these machines in France is $4,000, half of which is represented by the motor. Very probably, however, the cost will be reduced as the machines come into more general use, for in reality, the materials used and the work necessitated in their construction are less than in the case of an automobile.

The Arc of Peru.

The committee of the French Academy of Sciences having scientific control of the French geodetic operations on the equator has reported the completion of the remeasurement of the historic arc of Peru.

This arc was measured by the French (1736-1743) and used in connection with a similar arc in the Arctic regions, also measured by the French, to decide a question in regard to the form of the earth which had arisen as the result of Cassini's surveys in France.

In 1889, the question of remeasuring this arc was brought before the International Geodetic Association by the delegate of the United States, Prof. George Davidson, who suggested that France should have the prior right to execute the work.

Circumstances prevented any active work until 1898, when the association voted in favor of the proposition to remeasure the arc, and the French delegates undertook to have the work done.

Officers of the Geographic Service of the French army left Paris for Ecuador in May, 1899, and the work was continued until completed.

The arc extends from Tulcan, Ecuador, Lat. +0 deg. 48 min. 25.6 sec., to Payta, Peru, Lat. —5 deg. 05 min. 08.6 sec. and the work accomplished in the remeasurement may be summarized as follows, viz.: Seventy-four geodetic stations. Three base lines measured.

Eight differences of longitude determined between stations at Tulcan, Piular, Quito, Latacunga, Riobamba, Cuenca, Machala, and Payta. The first five of these stations are distributed along the northern section of the arc, the sixth at the middle of the southern section, the seventh on the coast at the same latitude as the sixth, and the last at the end of the southern section, on the coast. The comparison of the differences of longitude, geodetic and astronomic, between the stations at Machala and Payta and the station at Cuenca will throw light on the form of the geoid, as the first two stations are on the coast and the third is in the inter-andine region.

Six azimuths were determined, namely, at Tulcan, Piular, Quito, Riobamba, Cuenca, and Payta.

Sixty-four determinations of latitude were made.

The forty-eight magnetic stations were distributed all along the arc.

Of the six pendulum stations, one is at Machala, on the coast, at the point where observations for longitude were made; one at the foot of the western Cordillera, near Chimborazo; one, at an elevation of 4,150 meters in the western Cordillera; two, in the inter-andine region at Riobamba and Quito; and one at an altitude of 1,800 meters in the plain of the Amazon on the eastern slope of the eastern Cordillera.

Of the two lines of levels of precision, one runs from the Riobamba base line to Guayaquil and to the tide gage at Salinas on the Pacific coast and the other from the southern base line to the tide gage at Payta, the two lines covering a distance of 410 kilometers.

The preliminary computations are far enough advanced to assure the value of the observations. The closure of the triangles and the agreement of the computed and the measured lengths of the base lines compare well with the results obtained in the revision of the meridian of France.

The publication of the results of the work will be regarded as an important event by geodesists throughout the world.—Abstract from Science.

A new and peculiar use for electricity has been found. The city of Zittau possesses extensive and beautiful forests, in which such depredations have been made by the larvæ of the "nun" moth that it has been found necessary to cut down all the trees over large tracts. Last summer the electric light was enlisted in the warfare against the insects. On the roof of the city electrical station were mounted an exhaust blower and two powerful searchlights, the beams of which were directed to the forest five miles away. The hoped-for result followed. The moths flew by the thousand toward the searchlights but, before they could reach these, they came within the field of action of the blower and were carried away to destruction. In one night 66 pounds of moths were destroyed in this way, in addition to the great numbers of moths which found death in the electric arcs of the street lamps, from which the globes had been purposely removed.

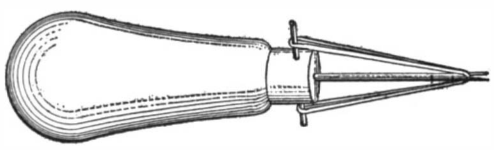
The Editor of Handy Man's Workshop will be glad to receive any hints for this department and pay for them if available.

Christmas Hints for the Handy Man will be published in next week's issue.

HANDY METHOD OF REPAIRING A PUNCTURED TIRE.

BY GEORGE F. LINKE.

The accompanying sketch shows a handy device for mending punctures in bicycle tires. It consists of a common darning needle of a large size and with a



A TOOL FOR REPAIRING PUNCTURES.

large eye, with its point inserted into a wooden handle. There are two pins also in the handle, projecting from opposite sides, and the top of the needle is cut off, leaving the end of the eye open.

To mend a puncture, stretch elastic rubber bands over the pins and through the slot in the end of the needle as tightly as possible until judgment shows that there is enough rubber to fill the puncture. Then insert needle and rubber through puncture in tire, throw the rubber off the pins and withdraw the needle. The rubber being tightly stretched will contract when released, filling the puncture and leaving a small lump inside and outside of tire. This will wear off outside in a very short time. It is advisable to ream the hole smooth before applying the rubber. This can be done by heating the needle with a match and then searing the edges of the hole.

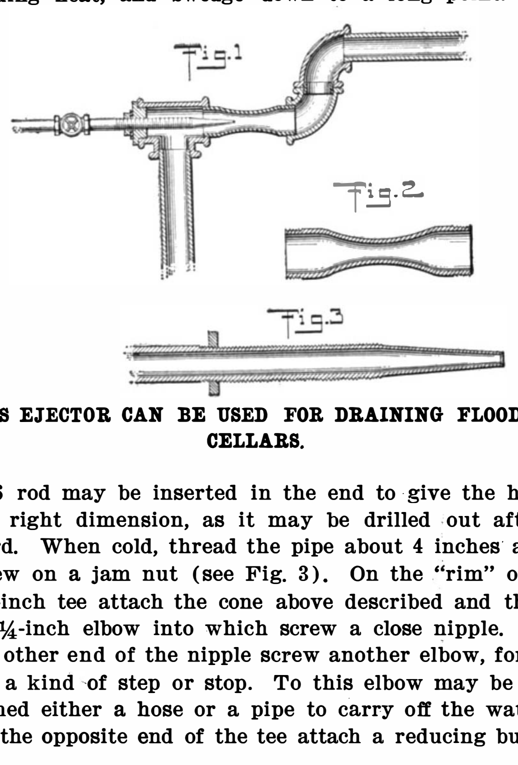
EJECTOR MADE OUT OF PIPE FITTINGS.

BY B. A. JOHNS.

A simple ejector may be made out of ordinary pipe fittings, which will compare very favorably with some of the ejectors on the market. It may be used in draining a flooded cellar, in which case it may be attached to the ordinary water faucet for motive agent. It can also be used for emptying cisterns or in excavations for new work where water is struck. (Of course, in this case, steam will be used as motive agent.)

Some time ago I was engaged in building a reservoir, and at a depth of 15 feet a spring of water was struck. Having no means at hand to get the water out of the excavation, I decided to make an ejector out of some old pipe fittings I had in the tool chest. I succeeded in making four that kept the water level down while the work was being done. One of these ejectors worked night and day for nearly three weeks until completely worn out, owing to the fact that a great amount of sand and gravel was carried through.

These ejectors can be duplicated as follows: First take a 1¼ x 6-inch nipple; screw on each end of same any kind of fitting so as to preserve the threads. Heat same in the middle to a white heat. Then swedge down until outside diameter is about ¾ inch. When cold remove the fittings, and the cone is made (see Fig. 2). Now take a ½-inch pipe, heat one end to a welding heat, and swedge down to a long point. A



THIS EJECTOR CAN BE USED FOR DRAINING FLOODED CELLARS.

3/16 rod may be inserted in the end to give the hole the right dimension, as it may be drilled out afterward. When cold, thread the pipe about 4 inches and screw on a jam nut (see Fig. 3). On the "rim" of a 1¼-inch tee attach the cone above described and then a 1¼-inch elbow into which screw a close nipple. On the other end of the nipple screw another elbow, forming a kind of step or stop. To this elbow may be attached either a hose or a pipe to carry off the water. On the opposite end of the tee attach a reducing bushing, into which insert the nozzle shown in Fig. 3. Care should be taken to get the nozzle in perfect alinement with the cone, and when in proper place, screw up the jam nut with some packing behind it, to make it air tight. In the other opening of the tee attach a pipe or a very heavy hose, preferably "ironclad," as the suction will have a tendency to close it up.

STORAGE BATTERY WITHOUT CHEMICALS.

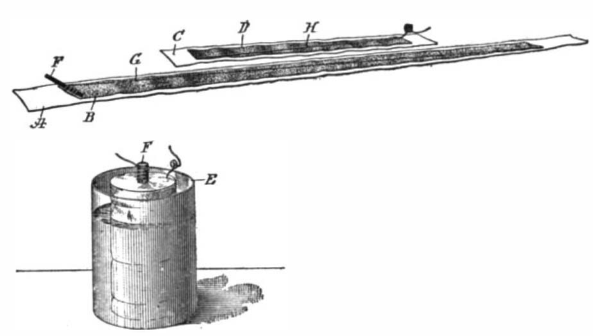
BY WALTON HARRISON.

An experimental storage battery, having qualities of interest, and at least remotely suggestive of commercial possibilities, may be constructed at a cost of a few cents, as follows:

Provide four strips *A*, *B*, *C*, *D*, of thin cloth (calico will answer), the strip *A* being 20 feet long and 4 inches wide, the strip *B* 18 feet long and 3 inches wide, the strip *C* 10 feet long and 4 inches wide, and the one designated as *D* 9 feet long and 3 inches wide. Procure an ordinary battery jar *E* of cylindrical form, a pound of commercial flake graphite, a few gum bands, and two pieces of No. 30 bare copper wire, one (*G*) being 20, and the other (*H*) 10 feet in length. These parts and materials, together with a carbon rod *F* of the kind used for arc lighting, comprise everything needed except water and enterprise.

Spread out the strips *B* and *D*, shower them liberally with water, and dust the graphite upon them. Then stroke them off with the hand. This will remove all excess of graphite, and leave them shining like strips of new tin plate. A single coating of the graphite upon one face of the cloth is sufficient.

Spread out the strip *A*, which remains uncoated, and lay the strip *B* centrally upon it, so as to leave exposed all margins of the strip *A*, its ends extending equally and in opposite directions beyond the ends of the strip *B*. Extend the wire *G* along the strip *B* from one of its corners to the opposite corner, the wire thus being slightly oblique relatively to the strip, and extending a couple of feet beyond one corner. Next place in position the strip *C*, which remains uncoated, centering it lengthwise in relation to the other strips, and bringing its longer edges flush with those of the



STORAGE BATTERY WITHOUT CHEMICALS.

strip *A*. Place the strip *D* on the strip *C*, leaving all margins equally matched. Stretch the wire *H* along the strip *D*, from one corner to the corner opposite, the wire being slightly oblique to the strip, so as to cross the wire *G* and leaving a foot of the wire *H* projecting.

Wind the projecting end (2 feet long) of the wire *G* tightly around the carbon rod *F*, and lay the rod squarely across the adjacent end of the strip *B*, so as to make good contact with the graphite. This will leave a foot of the strip *A* extending from the rod *F*. Bend this extending portion back over the rod so as to cover it, and then, using the rod *F* as a spool, roll it along, pressing it down hard; and thus wind tightly upon it all of the strips and both of the wires, so as to form a hard roll having generally the appearance of a solid white cylinder. Stretch two or three rubber bands around the roll, so as to hold all of its parts rigidly in position. Find the projecting end of the wire *G*, and leave it exposed. Set the roll into the jar, so that the exposed portion of the wire *G* and also a portion of the carbon rod *F* extend upwardly. Now fill the jar with water, preferably submerging the roll to within half an inch of its top.

This completes the battery. In some instances it may be improved by making the strips *A C* of cloth thicker than that above designated.

The battery may be charged from an ordinary dry cell, by connecting the zinc shell of the dry cell with the carbon rod of the storage battery, and the carbon of the dry cell with the protruding wire of the storage battery. After being thus charged for fifteen or twenty minutes, the storage battery may be disconnected, after which it will yield, for a few minutes at least, a current not differing greatly from that with which it was charged, and adequate to operate a telegraphic sounder or an electric bell. If the energy of the battery be conserved by leaving the circuit open, the charge may last for several days. Like other storage batteries, this one, after being partially exhausted, will recuperate to some extent if the circuit be left open, though of course the total energy it gives out can never exceed that with which it is charged.

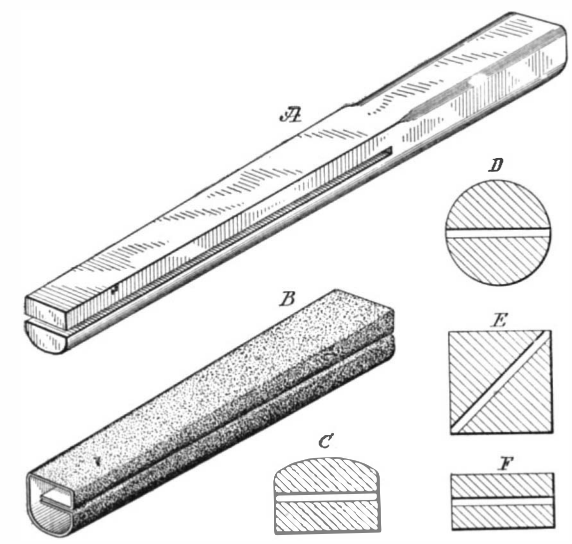
This device is in every sense a true "gas" battery as well as a storage battery. While it is being charged, the current sent through it disintegrates a portion of the water into its two component gases. The hydrogen, being disengaged throughout the entire length and breadth of the graphite coating carried by the strip *B*, is simply absorbed or occluded within the pores of the cloth, and thus effectively held as a free gas in a state of captivity. The oxygen, being in part in its allotropic form of ozone, is similarly collected and held in the strip *C*. The strip *A* holding the hydrogen, being twice as long as the strip *C* holding the oxygen, is adapted to hold twice as much gas, thus compensating for the difference in volume between the hydrogen and oxygen. Both gases, being freshly liberated, are in their nascent state and eager to recombine. After the charging is completed, therefore, and a conducting path is established from one of the coated strips to the other, the gases recombine, forming water, and in so doing they generate an electric current flowing in a direction opposite to that of the current previously used for breaking up the water and forming the gases.

It is a fact not generally known that if a quantity of hydrogen and a quantity of oxygen be subjected as nearly as practicable to the same physical conditions, they will present relatively to each other a difference of potential of about a volt and a half.

CONVENIENT HOLDER FOR SANDPAPER.

BY EDWARD J. TIEDE.

In sandpapering irregular shaped woodwork, the paper is laid over a stick of wood and used practically as a file. For holding the paper I have often used a simple holder for different kinds of work with satisfactory results. The holder consists of a stick, preferably of pine wood, of the required shape and size and tapering slightly toward one end. Into the narrow end saw a slot in the center to about two-thirds its length. Cut off a piece of sandpaper wide enough to go around the stick, allowing a liberal margin to fit into the slot. Fold the paper so it can be slipped



CONVENIENT HOLDER FOR SANDPAPER.

into the slot and around the holder from the end; pull it down until it fits snugly, when it is ready for use. Emery cloth can be used in the same way for polishing parts of machines and the like.

In the drawing the holder is shown at *A*, and the paper folded ready to apply at *B*. The sections *C* to *F* suggest some shapes that may be used.

THE CONSTRUCTION OF A WORKSHOP.

BY I. C. BAYLEY.

The interest taken by the boy in a shop that is his very own, particularly if he is allowed to build it himself, will be very manifest, and the good derived, by keeping him off the street, if nothing else, will well repay the small outlay of the first cost.

Fig. 1 shows the inside view of a workshop good enough for any boy, no matter what his station in life may be. The framework was put up by a first-class mechanic, but the furnishings are all home-made, such as any boy will be able to construct. Such a shop as this is hardly necessary for the average young mechanic, the object of the sketch being more to show how a shop can be fitted up inside. The lathe, and also a jig saw, not shown, will be described, in a later number, as will also the bench, drawing table, and other accessories.

A shop about 9 feet by 12 inside dimensions will be ample enough, and if it is made as an addition to the house, but three extra sides will be necessary, or if built in a corner, as is sometimes convenient, then but two extra sides will be needed.

The ground must be leveled, and prepared for the six piers, which can be of concrete, brickwork, or timber. If of timber, let them be 6 to 9 inches square by 2 feet long, buried in the ground about 18 inches. Holes should be dug of suitable depth and the stumps dropped in, care being taken to get them the proper distance apart, 9 feet by 12, out to out, so that the sides of the building, when erected, will be flush, and not have to be cut around the piers, or offset in an unworkmanlike manner. The first pier can be permanently set by ramming broken bricks and earth into the hole with a piece of heavy timber brought down on end. The remaining piers are leveled up from this one, by means of a builder's level.

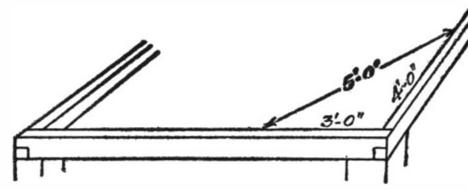
Since it is a very important matter that these piers should be true and level with each other, it will be well to make a suitable straight-edge, or leveling board, for this purpose. This can be 12 or 16 feet in length, cut from a 1-inch board, and shaped as shown in the cut. A hand-hole is formed in the center, at the top, and a small shelf, upon which is placed the spirit level, is nailed to one side, immediately below. The leveling edge must be planed very true, while the small shelf on the side must be made exactly parallel with it. Place the level upon the shelf, and, holding the leveling board on the tops of each pair of piers successively, commencing with the permanent one, level them all by raising or lowering them in their respective holes, when they should be permanently set, as was the first.

The wall plates or bottom framing are made from 4 x 6 timber, half jointed at each corner, and secured to each pier with tenpenny nails driven in from either side. The four corner piers being 9 x 12 feet out to out, one pair of the 4 x 6 timbers will be 12 feet in length, and the other 9 feet. The framework must form a perfect right angle at each pier, which can be tested by means of the carpenter's square or laid out in the following manner:

Along the inside edge of the framework lay off a line 3 feet in length on one timber and 4 feet on the other, when the two timbers must be closed, or opened, until the distance between these two points measures exactly 5 feet, as shown in the sketch.

The posts, or studding as they are sometimes called, are made from 3 x 4-inch timbers. Two are cut 10 feet 6 inches in length, and three are made 7 feet 6 inches long. The ends are cut true and square, to get a good bearing, when the posts are set up. The rear posts can be secured to the side of the house, after being tried with a plumb bob, or level, and can be secured to the bottom plate or framing by toe-nailing; but the two front corner posts, after being erected plumb, and secured to the framing, must be held temporarily, in the manner illustrated. The top plates and rails are next put up. Make a half joint at the front, and nail the other ends to the rear posts with nails driven through either side. The other door-post is erected, then the intermediate rails and the door lintel. Rails and door lintel are 2 x 3 inches.

The rafters are made of 2 x 4-inch timber, notched where they rest upon the plates, which are 2 inches by 3. One rafter can be cut to the proper length and notched, using it for a templet, or as a guide for cutting the others. The two end rafters should be secured to the plates first, by driving in tenpenny nails through the sides, as in the case of the floor joists,



Laying out a square corner.

then the others may be evenly spaced from end to end, about 2 feet apart.

The framework of the building is now complete, as shown in Fig. 2. A detail of construction is shown to the right. Rough boards, with a space between them of about one inch, are laid across the joists for the roof, and secured with eightpenny nails. The sides can either be made of tongue-and-grooved boards, or ordinary boards like the roof, only built close, with narrow strips of wood nailed over the joints.

Space must be left in the sides for the windows and doorway; the latter should measure 2 feet 6 inches by 6 feet 6 inches. The windows had better be double sliding, on three sides of the building, to get a good light. If 10 x 8 glass is used, the framework or sash will be about 2 feet 4¾ inches by 1 foot 11⅝ inches high. The window openings in the sides of the building, therefore, should be 1 foot 11 inches high by 4 feet 8 inches long for a double sash. They should be centrally located in the sides and front, the boards being cut flush with the top of the middle rails, to which they are nailed. The boards at the top of the opening are nailed to an inside strip, 2½ by 1¼ inches, detailed in one of the sketches, which sketch also shows the grooves in which the sash moves. A tongue-and-groove connection should be made where the two sashes meet, or a strip of wood should be nailed on either, to overlap the other, and keep out the wind and rain.

The flooring, which can be made of ordinary boards or a cheaper grade of tongue-and-groove boards, planed on one side only, are cut to fit close up to the sides, and around the studding or posts, and nailed to the joists with eightpenny nails. The joists are 2 x 4, notched 1 inch, as shown.

It will be noticed that the first board of the sides, nearest the house, is notched all the way down, to fit up snugly against the weather boards. This is done by means of a pencil and a small stick, held as illustrated. The stick is traced along the outline of the weather boarding, while the pencil, being held against the upright board of the shop, makes an exact copy of the outline, as a guide for the saw. Narrow boards, sometimes called plates, are nailed all around the top of the sides, under the eaves of the roof, notching them out where the joists of the roof come through.

The door can be made of the same stuff as the sides, strengthened with battens as shown in Fig. 1. A diagonal batten can be put on also, letting it bear top and bottom against the horizontal battens, and taking care to let it slope in the right direction, the lower end being near the hinges. Hinges and a latch, also a draw-bolt, are all the furnishings necessary for the inside, and a padlock for the outside. A plain narrow frame can be put around the outside of the windows, and a sill made from 1-inch stuff, for the door and windows, will improve the appearance. A door-step can be made from the same stuff as the sides, or from 1-inch boards, nailed to the front of the shop, before the tread is put on. The ground should be made level, and a large stone, or bricks, put under the bearing edge.

The roof is covered with tar paper, which can be made of sheets of brown paper, covered with pitch and sanded, or it can be purchased already prepared. Commence at the eaves, allowing enough to tuck under the eaves on both sides and in front. The next layers are allowed to lap over by about 2 inches, and the last one is tucked under the weather boarding, on the side of the house. Large-headed galvanized nails are used to hold the tar paper or felt covering to the roof; or barbed wire nails with tin caps will do. Space them not less than 2 or 3 inches apart, all along the edges of the laps, and under the eaves of the roof.

The shop should be given two coats of paint on the outside to match the house or surrounding buildings. A small stove, either oil, gas, or coal, will nicely heat the shop in cold weather, a chimney connection being made in the roof or one of the sides if a coal stove is used.

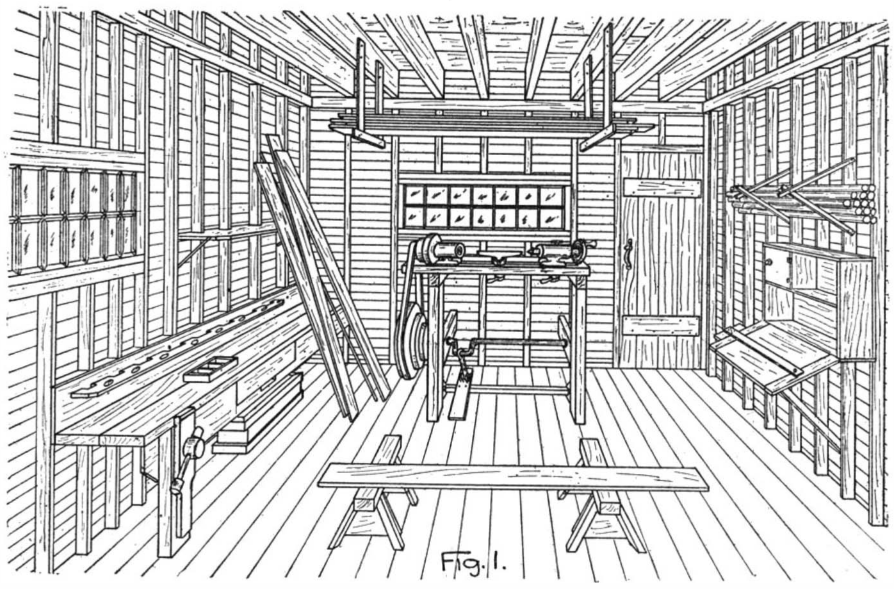


Fig. I.

A model workshop for the amateur.

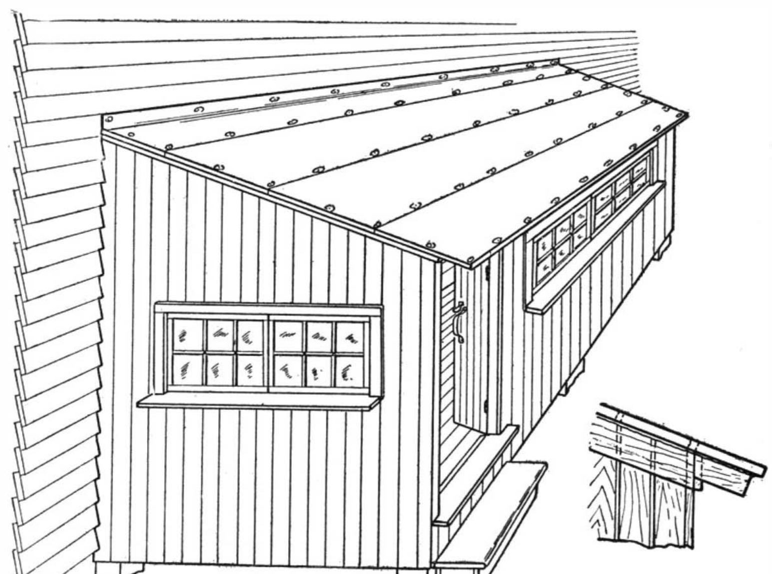


Fig. III

Exterior view of the finished building.

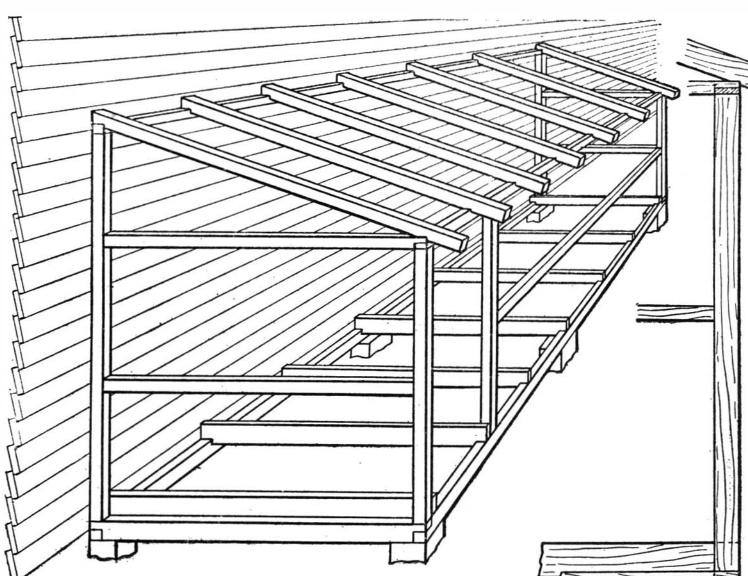
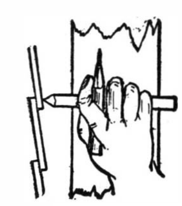


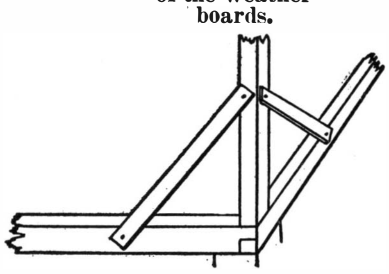
Fig. II.

Setting up the frame of the shop.

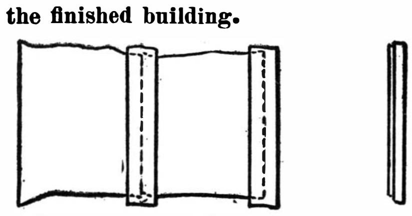
A builder's level.



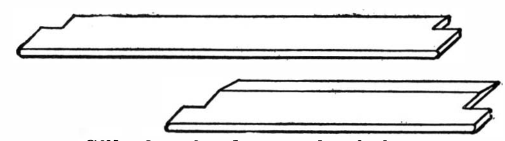
Tracing a profile of the weather boards.



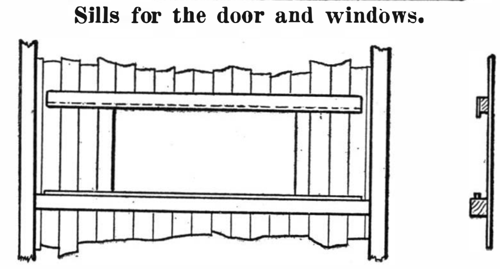
Temporary bracing for corner posts.



Cracks in the siding covered by narrow strips



Sills for the door and windows.



A window opening, showing grooves for sash.

THE CONSTRUCTION OF A WORKSHOP.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

SHOULDER-BRACE.—M. W. Ferris, South Orange, N. J. The braces tend to hold the body of the wearer in proper upright position, with a view to insure an upright, healthy carriage at the same time allowing sufficient yielding for comfort, protecting the arm straps against perspiration, preventing the shoulder straps from accidentally sliding off the shoulders, and allowing convenient adjustment to accurately fit the body.

POCKET FOR SHIRTS.—S. Elbaum, Bayonne, N. J. The invention relates to outer shirts for working men, mechanics and other persons, and its object is to provide a pocket for shirts, which is provided with separate compartments, one for general storage purposes, one for the safe housing of a watch, and one for containing a lead pencil, rule or the like.

Electrical Devices.

AUTOMATIC FIRE-ALARM SYSTEM.—C. J. Fox, 11 Queen Street Place, London, England. The invention consists of a combined electric bell service and automatic fire alarm system; that is to say, a system in which the leads for the electric bell installation serve also as leads for the fire alarm thermostat circuit, so that the leads appertaining to the thermostat in any apartment will be tested each time the electric bell in said apartment is used.

Of Interest to Farmers.

CHURN.—A. Barber, Watsonville, Cal. More particularly the invention relates to churns such as are provided with improved dashers whereby a more effective action is brought about in churning. The device is provided with a dasher having three vertical blades, the intermediate blade serving pivotally to mount the dasher in position and to facilitate its rotation.

COTTON-COMPRESS.—T. B. Lee, Charlotte, N. C. This improvement provides a dense and uniform bale and completes it before releasing any pressure. It provides means for neatly and conveniently covering the bale with bagging and securely hooping the same with tie wires or bands. It also provides a bale which can be sampled at any part of the same, so as to show the character of the cotton in the entire bale, leaving no chance for false packing.

BALE-TIE.—D. Margolius, Norfolk, Va. The improvement is more especially in such ties as are employed on cotton bales, the improved feature residing primarily in the connection between the ends of the tie. The fastening between the overlapping ends of the tie is made so that the tie will not catch in the press. It is applicable not only to joining the ends of new ties, but also in joining one or more pieces of an old tie together.

COTTON CHOPPER AND CULTIVATOR.—R. H. Purnell, Rosedale, Miss. A special feature of this machine lies in the means for preventing stubble, weeds, or trash of any kind from being drawn inward by the hoe in its revolutions, whereby the latter would become clogged and its work rendered imperfect. Another is the rotary bevel disks that when set in one position serve to throw dirt toward the row of cotton plants, whereas when arranged at an opposite inclination they serve to scrape the sides of the cotton row. It is an improvement upon the machine for which Mr. Purnell formerly obtained Letters Patent.

Of General Interest.

METHOD OF TREATING HIDES.—W. J. Ward, West Philadelphia, Pa. This invention refers to the treatment of hides or leather, preliminary to the tanning process, for the purpose of removing hair and grease, and of ultimately improving the quality of the leather to be made. The method makes plumper leather and it does not "pipe with the grain."

SAFETY ROPE-GRIP.—C. F. Sinclair, Jersey City, N. J. The object in this instance is to provide a rope or grip for attachment to the wrist of a person and for connection with one of the guide ropes of the bathing place, to allow the user to safely venture into the water for bathing and swimming purposes, and to aid the user in learning to swim.

PROCESS OF MAKING CANDY.—L. Hirschfeld, New York, N. Y. This process is designed to impart to pulled candy a peculiar consistency, rendering the candy less strenuously tough than ordinarily and permitting the candy after a time to completely dissolve in the mouth, and a further purpose is by means of the process to obtain a product that will retain its consistency for a great length of time.

LOGGING-JACK.—C. D. Moore, South Bend, Wash. In this patent the improvement is in that class or type of jacks in which a rack-bar is raised by means of a pivoted lever provided with a pawl adapted to engage a rotatable ratchet which is in turn connected with the rack-bar through the medium of a pinion.

DISPLAY-RECEPTACLE.—M. Gianini, New York, N. Y. Candy boxes are often arranged with trays or divisions for different kinds of candy, but they are not all in view. A box constructed according to the present invention is especially useful for this purpose, as the box may be opened out to expose the contents of all its divisions. While intended especially to be used as a candy box, it may be used for other purposes.

FASTENING DEVICE.—A. C. Goddard, New York, N. Y. The invention relates to metallic door casings, base boards, chair rails and the like, and its object is to provide a device for fastening the metallic parts in position without the use of screws, nails and the like and without showing the fastening means exteriorly.

EASEL.—Genevieve Booth, New York, N. Y. The invention relates to improvements in devices for use in supporting pictures, pamphlets, books, and the like, and relates more particularly to that type of holder formed of sheet metal and serving not only to support the picture, pamphlet, book, or copy, in a substantially upright position, but also serving to hold it in an open position.

HORSESHOE.—P. W. Carney, Norfolk, Va. In this patent the invention is an improvement in horseshoes having for an object the provision of an attachable and detachable attachment having calks, and which can be readily applied to ordinary horseshoes when necessary and removed therefrom when the necessity for calks no longer exists.

VAGINAL SYRINGE.—O. Katzenberger, San Antonio, Texas. The purpose of this invention is to provide details of construction for a syringe, which adapt it for a very convenient service, and enable the internal application of a suitable medicinal liquid or powder for the disinfection or cure of diseased tissue, the said liquid or powder being preferably employed as a remedial agent.

HOOF-PAD.—D. T. Barber, Gustavus, Ohio. In the present patent the invention is an improvement in that class of hoof-pads which are formed of elastic material and are arranged beneath a metal shoe and are secured to the animal's hoof by the same nails that hold the shoe.

CAN-OPENER.—C. E. Sands, Palatka, Fla. In operation the pointed end of the long arm is inserted in the can top, at approximately the center thereof, and bent downwardly until the cutting wheel is in contact with the tin. The arm is now revolved around the edge of the top, the cutting wheel being held firmly in contact therewith, thus severing the center of the top from the margin.

ANIMAL-TRAP.—L. Horinko, New York, N. Y. The purpose here is to provide a device for catching small animals, such as mice, rats, etc., which embodies in its construction a cage, an auxiliary cage open at both ends and having means adapted to hold the bait, and a trap door in the top of the cage, forming the bottom of the auxiliary cage.

Heating and Lighting.

CLEANING DEVICE FOR FEED-WATER HEATERS.—T. V. Elliott, New York, N. Y. In this case the object of the inventor is to provide a new and improved cleaning device, more especially designed for effectively cleaning feed water heaters whenever desired, without requiring shutting off the feed water from the boiler.

Household Utilities.

WASTE FOR BATH-TUBS, BASINS, AND LIKE FIXTURES.—P. F. Guthrie and T. Hayes, Nutley, N. J. The object of the invention is to provide a waste for bath tubs, basins, and like fixtures, arranged to prevent contaminated water rising into the fixture when filling the same with water. It relates to wastes such as shown and described in the Letters Patent of the U. S., formerly granted to Messrs. Guthrie and Hayes.

Machines and Mechanical Devices.

BOAT-HANDLING DEVICE.—L. Tanning and W. J. Ryan, New York, N. Y. The invention pertains to boat-handling devices, the more particular object being to enable a boat carried on shipboard, to be readily raised from the chocks, normally supporting it, and otherwise made ready for immediate action upon the water.

APPARATUS FOR COALING SHIPS AT SEA.—A. Johan, New York, N. Y. Transferring is done by placing a collier in tow of the vessel and providing one or more traveling cables between them, on which the coal or other material is carried, said cables having means to maintain them under constant and equal tension during rolling and pitching, the tension on the cables being maintained irrespective of the tension on or slackness of, the hawser connecting the two boats together.

STOKER.—T. V. Elliott, New York, N. Y. The object of the present invention is to provide a new and improved stoker for use in automatically feeding coal and like fuel to a furnace, to automatically remove the ashes, to insure at all times a proper uniform combustion of the fuel.

ATTACHMENT FOR KEY-OPERATED MACHINES.—J. V. Y. Diaz, Habana, Cuba. The invention relates to improvements in typewriters or other machines having a plurality of keys adapted to be manually operated, and the object of the invention is to provide means for locating and defining the keyboard by other than the sense of direct sight, whereby the operator instinctively retains the hands in the proper position in respect to the keyboard while reading copy and operating the machine simultaneously.

Railways and Their Accessories.

MOLD.—J. Wilson, Rochester, N. Y. This improvement is for use more especially for chilled car wheels, and has in view primarily a molding flask by which the variation at present experienced in the thickness of flanges and the weight of the wheels, will be eliminated, and a uniform and well balanced wheel produced.

MAIL-HANDLING APPARATUS.—M. M. Miller and G. S. Steinberger, Allentown, Pa. The invention relates more particularly to apparatus which is used with mail or other railroad cars for securing and delivering mail bags, and is adapted to be arranged adjacent to a railroad track, and which has means for receiving mail bags from a train while the latter is in motion.

Pertaining to Recreation.

AQUATIC MERRY-GO-ROUND. — H. E. Riehl, New York, N. Y. The invention refers to amusement apparatus, such as are used in parks, exhibition grounds, pleasure resorts, and the like. The object of the inventor is to provide a new and improved aquatic merry-go-round, arranged to provide an exceedingly novel and highly interesting ride.

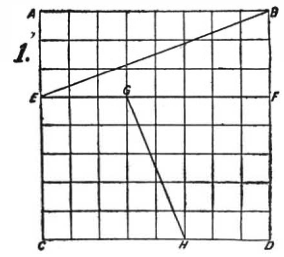
Pertaining to Vehicles.

SWINGLETREE AND DOUBLETREE.—G. P. Simpson, Marysville, Idaho. The invention is applicable to swingletrees, doubletrees, neckyokes and similar constructions. The construction is simple, easily applied, reinforces and strengthens the body and protects the rear side of said body when the latter is used as a swingletree against injury from coming in contact with the wheels or other portions of the running gear of the vehicle.

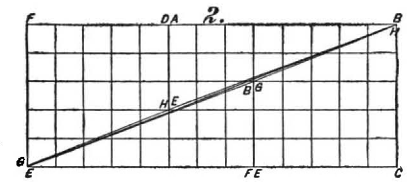
Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Full hints to correspondents were printed at the head of this column in the issue of November 14 or will be sent by mail on request.

(10994) G. L. P. writes: H. J. F. asks if a piece of paper 8 by 8 inches square can be cut so as to make 65 square inches. You say: "No, by no conceivable means." Now you will find enclosed a piece of paper 8 by 8 inches, which you are to cut on the lines and put together as lines shown on the smaller piece, and then measure. I think you will find it to be 5 by 13 inches, which equals 65 square inches. I am unable to explain where the square inch comes from, but it is there. A. No, friend, it is not there. We exceedingly regret that any of our correspondents should think us capable of believing that a square of eight inches on a side can be cut into pieces and put together in another way so that its area shall be increased 1 square inch. We are having a deluge of letters on this point, of which we print one, many criticising us more or less severely for saying that this cannot be done. But of course it cannot be done. We repeat it—No. by no conceivable means. It transcends common sense to ask it. Try it with pennies, or kernels of corn, or any convenient similar pieces. Lay out 64 in a square of eight on a side. Then change them to a figure of 5 rows of 13 on a side. There will be a missing kernel or coin. You cannot complete the second figure. It is the same if you cut a piece of paper of the same dimensions; 8 x 8 cannot be anything but 64, and can never be 65. Why not settle one's self first upon simple foundations? Then one will not say, as our confident correspondent does, "But it is there." That begs the question. It is not there, and cannot be there. There is evidently a fallacy here somewhere. Now, this is no new trick. It has been traveling around for an unknown period of time, and has been shown up as often as it appears. The Scientific American had it a generation ago. Still, apparently, there are a host of intelligent people who have never seen the exposure. Hence we will give it, not following the usual mode of treatment, but giving our own explanation of the falsity of the proposition. This is not a puzzle, for a puzzle should have a rational solution, and this thing has no such solution. It is a trick, to make the false seem true. The proper attitude of mind toward it is to seek for the reason of its falsity, since it cannot be true. Only one of our correspondents even suggests that it cannot be true. When you see a juggler perform an impossible thing, such as cutting a man's head off, pulling a great quantity of dry goods out of a hat, or doing the curious box trick, you do not immediately demand that all these shall be accepted as realities; on the contrary you seek the method of the deception. That is the right attitude of mind toward a physical impossibility, and is applicable here. Perhaps the easiest way to show the falsity of the question under discussion, is to draw a figure 5 x 13, divide it into squares and draw a diagonal line across the figure as in Fig. 2.



Our Fig. 1 shows the square of 8 inches divided for the purpose of the puzzle. Draw the perpendiculars as shown and the points *HE* and *BG* do not fall at the corners of squares. They cannot. Yet the so-called solution which all our correspondents send us, shows the same thing—that the lines *EG*, *BF*, *AE*, *BF*, which should be 3 inches long, are more than 3 inches long. In every figure



this is so. You should be sharper than to draw a figure like that and send it to us if you are to convict us of error. There is an error, but *you* are in error. The diagonal of your long figure, 5 x 13, must be a straight line, if you are correct, but the four pieces of paper when put together do not give a long straight diagonal, as any one can see who will put the pieces together, then use his eyes and look for himself. If your eyes will not show it to you, take a straight ruler and it will disclose the truth for you. The long, sloping line of the pieces of paper is not straight. The four pieces of paper do not cover the area which they seem to cover. There is a long, narrow strip in the center which is not covered. The area of this strip is just one square inch, the square inch you think you gain. You put your rulers on and draw a long straight line sweeping from one corner of the 5 x 13 figure quite across to the other corner, and say "There it is, I have made 64 square inches into 65 square inches." Great act! But you have not. Now turn to the square of 8 inches on a side, our Fig. 1. The line *BE* slopes 3 inches in 8, or ⅜ of an inch in 1 inch. The line *GH* slopes 2 inches in 5 inches, or 2-5 of an inch in 1 inch. And you ask us to believe that a line whose slope is ⅜ should form a straight line with one whose slope is 2-5. We cannot do it. The reason anyone is deceived is that the pieces are rarely cut with a high degree of accuracy. They are often cut out of thin paper, and will not lie flat. When they are put together they seem to cover the space as well as could be expected and so the deception takes effect. If the trick were approached from the other side, that is, cut the pieces from the piece which is 5 x 13, and put upon a square carefully drawn to be 8 x 8, the pieces would then more than cover the square figure and deception would not be so easy.

(10995) G. R. M. asks: Will you kindly answer the following through the columns of Notes and Queries in your valuable paper, and oblige a faithful reader: 1. What causes the changes of the moon? A. The phases of the moon are produced by the moon's revolution around the earth. The sun shines upon the moon all the time. When the moon in its motion around the earth comes between the sun and the earth, the sun is shining upon the side of the moon which is farthest from the earth. The dark half of the moon is toward the earth. That is the time of new moon. About two weeks later the moon has traveled around so that it is farther from the sun than the earth is, and the earth is between the moon and the sun. The lighted side of the moon is toward the earth. That is full moon. As the moon has changed from showing no lighted surface to the earth to showing the entire lighted surface to the earth, there was a time when she showed half her lighted surface to the earth. That was first quarter. Similarly there will be a time between full and new moon, when she will show half her lighted surface to the earth. That is last, or third quarter. If you will look up this matter in astronomies in your city library, you can read about it, and see the illustrations of it in the books, which will give you a much better idea than mere description in words. Ask the librarian about it. 2. Why does the mercury in the barometer stay higher when storms come from an easterly direction than it does when they come from any other direction? I have noticed this time and again and some of our largest and worst storms come from the east, and still the mercury will stay away up. I have wondered if the ocean had anything to do with it. As regards the power of a telescope, what is meant when manufacturers say they magnify 20, 33, or 50 diameters? A. We were not aware that a storm coming with an easterly wind was characterized by a higher barometer than one which comes with the wind from a southerly quarter. Storms always travel from west to east around the world. In crossing our country the paths curve considerably because of the mountain ranges, plains, and rivers. In the storm the wind blows inward toward the center, and the storm as a whole rotates from east to north, west and south, as we say, opposite to the hands of a clock in the northern hemisphere. This causes the northeast winds in the northern front quarter of such a storm. The ocean has little influence on these storms as far west as Ohio. The storm does not come from an easterly direction, but from the west, and the wind in its whirling in the storm blows from an easterly quarter in the front, and from a westerly quarter in the rear of the storm as it goes away. It clears off with a westerly wind, as you have observed.

(10996) A. W. asks: 1. What is meant by "polyphase" as applied to electric machines; and by "cycle" as applied to gas engines? A. A cycle is a series of changes through which a varying quantity passes, including all its values, and it fluctuates through these changes periodically. Thus a cycle of an alternating current of electricity is the successive values of the E. M. F. through one series of changes from zero to its highest value, and down through zero to the lowest and back again to zero. This succession of values the current will have as many times per second as there are cycles, ordinarily 30, 60, or 120. Polyphase currents are those whose E. M. F.'s differ from each other by a fraction of a phase. Thus three currents a third of a cycle apart will furnish a three-phase current in the lines with which it is connected. See Sloane's "Electrician's Handy Book," price $3.50. A cycle is like a complete succession of the heights of one tide in about twelve hours at the seashore. A phase is any single value or height of the water. If two or three tides come together by different channels in the same place or bay we have a two-phase or three-phase current of the tide. 2. What is meant by jibing a sail-boat? A. A sailing vessel is tacked when in changing from one course on the wind to another it presents its bow to the wind; it is jibed when it is turned in the opposite direction so that it presents its stern to the wind. In a high wind the latter is always a difficult and sometimes a dangerous operation. 3. Is a catboat so called because the mast stands straight up at one end of the boat like a cat's tail from its body? A. We are certain that a catboat is not so called because its mast stands straight up like a cat's tail. The mast is at the front end of the boat, and so far as we have observed cats have their tails set at the stern end. We do not know the derivation of the name catboat, but think it far more likely that it was given because of the quickness with which these boats will come about. 4. Does an electric motor differ in structure from a dynamo? Can they be interchanged? A. There is no theoretical difference between a dynamo and a motor. In general, each may be used for either service. There are, however, many structural differences between the two classes of machines, so that it can be easily told to which class any particular machine belongs. 5. How can a steady, effective current proceed from a dynamo giving an alternating current? The current changes polarity each instant, as understood. A. A steady current is not produced by an alternator. An alternating current can, however, be changed to a steady direct current by means of a rotary converter. 6. What light form of motor would you recommend for driving a dirigible balloon? A. Probably some form of gasoline motor is best adapted for use in a dirigible balloon.

(10997) O. E. G. asks: 1. Is the speed of radiant heat (whose medium is the same as light) the same as light and electricity? A. The latest science does not make any such distinction as between radiant heat light, electricity, etc. They are all the same radiation. If the waves are of a length to affect the proper nerves we feel them as heat; if they can affect the eye we see light. 2. Is the difference between light, electricity, and radiant heat due to the difference in wave-length? A. The sole difference between the several effects is due to wave-lengths. See the "New Knowledge," by Prof. Duncan, price $2. 3. If light moves in transversal waves, how can it move forward? A. In all vibratory motions it is the wave form simply which travels. A wind moving over a field of grain is the very best illustration of this one can have remote from the ocean. Water waves on the ocean are good illustrations of a transverse wave with an onward motion of the wave form. It is not light which moves, but a wave form. The matter which vibrates moves to and fro, the wave advances. 4. Please explain wave-length. A. Wave-length is the distance from a particle moving in a certain direction to the next particle in exactly the same condition of motion. In a water wave, the wave-length is from a drop on the crest, for example, to the next drop exactly on the crest, also. 5. What is the wave-length of electricity, and does it vary with the amperage? A. There are all sorts of wave-lengths of electricity down to very short waves, but not so short as those which produce light. Those used in wireless telegraphy with a single wire as an aerial are very closely four times as long as the height of aerial wire from which they are radiated into space. When a capacity is in the circuit this affects the wave-length. The wave-length varies with the rapidity of the oscillations of the discharge. 6. Does a heated conductor of electricity retard the current? A. A hot metal has more resistance than it has at a lower temperature, and so reduces the current which flows through it. Carbon, however, has a much greater electrical resistance when cold than when hot.

(10998) E. G. asks: Kindly give me a clear definition of adiabatic heating, explaining fully the difference between a gas adiabatically heated and one heated by mechanical compression. A. The word "adiabatic" is derived from the Greek and has three parts. *A* means without; *dia* means through; *batio* means going. This word as a whole means "without going through." Applied to heat, the sense is that no heat passes through to affect the temperature of the gas under test, be it steam in a boiler or any other gas in any receptacle or in the air in the atmosphere. A gas which is compressed without any heat leaving it becomes hotter, and a gas which is expanded without any heat coming into it grows colder. Both of these are adiabatic changes. The gas which is heated by mechanical compression is heated adiabatically. Adiabatic changes are of great importance in the atmosphere. 2. In reducing a barometer reading of a given latitude to sea level, the average temperature of the air must be known. Is this average obtained by taking the average of the dry thermometer readings at the A. M. and P. M. observations, or by taking the average of the maximum and minimum temperatures for the day? A. The average temperature of the air in the problem of the reduction to the sea level is the average of the temperature of the air at the various altitudes from the sea level to the altitude of the observation. This can be found only with considerable probable error, since the change of air temperature with altitude varies greatly in different regions, and any error in this causes an error in the weight of the air column to be calculated. The actual temperature at the place at the time of observation is the only temperature to be employed in the reduction of that observation. 3. Is water vapor properly classed as one of the constituents of the atmosphere? A. Water vapor is one of the constituents of the atmosphere. No percentage value can be given for it, since it varies very much, from a mere trace to as much as five per cent of the amount of dry air. The chemical composition of air as ordinarily given is usually that of dry air.

NEW BOOKS, ETC.

CANADIAN TYPES OF THE OLD REGIME. 1608-1698. By Charles W. Colby. New York: Henry Holt & Co., 1908. 8vo.; pp. 366. Price, $2.75.

This handsomely made book is illustrated by well chosen engravings. Some idea of the contents may be gained from the chapter headings, which are as follows: "The Historical Background of New France," "The Explorer, Champlain," "The Missionary, Brébeuf," "The Colonist, Hébert," "The Soldier, D'Iberville," "The Coureur du Bois, De Lhut," "The Intendant, Talon," "The Bishop, Laval," "The Governor, Frontenac," and "The Woman." The chapters of this book represent lectures which were recently delivered in Ottawa. It is extremely well written, and conveys an immense amount of material which is not easily available except in special libraries.

SCIENTIFIC IDEAS OF TO-DAY. By Charles R. Gibson. Philadelphia: J. B. Lippincott Company, 1908. 12mo.; pp. 344. Price, $1.50.

This book is so fascinating that the reader almost feels like neglecting the author's warning that the chapters should not be read at random, no matter how interesting they are. This warning is fully justified, in any work of this kind, for it would be quite impossible to make each chapter complete in itself without a wearying repetition of facts. In the present volume, the author has endeavored to explain the scientific ideas of to-day without using language beyond the reach of any reader. His explanations demand no previous knowledge of science whatever and no acquaintance with mathematics. It is the most admirable book on amateur experiments that we have seen in years. Among the chapter headings are: "What Things Are Made Of," "The Stuff That Atoms Are Made Of," "The Construction of the Atom," "What is Electricity?" "What is the Æther?" "What is Magnetism?" "More About Electrons in Motion," "What is Energy?" "Waves in the Æther," "What is Light?" "The Explanation of Color," "Ideas Obtained from the Spectrum," "The Birth of a Star," "The Age of the Earth," "Whence Came Life?" "What Are the X-Rays?" "How Radium was Discovered," "What Are the Rays from Radium?" "Is the World Going to Pieces?" "The Cause of Radio-activity," "What is Gravitation?" This is a book that it will pay anyone to read from cover to cover. It would make an admirable Christmas gift.

ST. BOTOLPH'S TOWN. An Account of Old Boston in Colonial Days. By Mary Caroline Crawford. Boston: L. C. Page & Co., 1908. 12mo. Price, $2.

The author has produced a most delightful book on old Boston. We have not read a more interesting book of this nature in a very long time, making one understand a little better the part New England, in the person of its chief town, has played in the mighty drama of nations made up of thinking, feeling men and women. Up to the time of the Revolution, of course Boston was the biggest place in all the colonies, as well as the chief settlement in Massachusetts. This numerical prominence needs to be borne in mind if we would understand many acts on both sides of the ocean. To understand the America of to-day, too, we must needs know the Boston of the forefathers. The book is beautifully illustrated, printed, and bound.

LATHE DESIGN FOR HIGH AND LOW SPEED STEELS. John T. Nicholson, D.Sc., and Demster Smith. London and New York: Longmans, Green & Co., 1908. 8vo.; Pp. 402. Price, $6.

Until the advent of high-speed steel the necessity for a theoretical treatise was unfelt; but the new conditions imposed by the general adoption of the high-heat steel were found to have rendered obsolete the long-treasured experience and accumulated data of the tool maker. A recent statement of the problems involved in lathe design, and an attempt to solve them on a basis of experimentally ascertained fact, had consequently become imperative. The substance of the book has already appeared in large part in the columns of The Engineer, and has already awakened widespread interest. The tool designers will be glad to have such valuable matter in book form. The work is excellently illustrated by a large number of engravings, which are executed on a good-sized scale.

FLÜSSIGE KRISTALLE, MYELINFORMEN UND MUSKELKRAFT. Von O. Lehmann. Braunschweig: Druck von Friedrich Vieweg und Sohn, 1908. Pp. 321-330.

FLÜSSIGE UND SCHEINBAR LEBENDE KRISTALLE. Von. O. Lehmann. Leipzig: Verlag von F. C. W. Vogel, 1906. Pp. 10.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending November 10, 1908.

AND EACH BEARING THAT DATE

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

Abdomen compress and hose supporter, combined, T. P. Taylor..........903,623 to 903,629
Adding machine full stroke mechanism, R. E. Benner 903,536
Air and gas engine, H. T. Dunn.......... 903,689
Air brake, W. R. Heironimus 903,379
Air brake slack adjuster, W. R. Heironimus 903,378
Air, drying, L. Block 903,353
Amusement apparatus, E. Marrder 903,211
Amusement apparatus, G. C. Tilyou.......... 903,632
Amusement device, W. B. Leonard 903,208
Animal trap, T. Bushey 903,356
Automobile, C. J. Paulson.......... 903,762
Automobile danger signal, O. Herrmann.... 903,719
Axle, vehicle, H. B. Bush 903,447
Badge, F. R. Bignold.......... 903,537
Bag fastening device, hand, C. F. Kohlberger 903,202
Bait, artificial, Slocum & Hokamp.......... 903,333
Basket, washboiler, W. W. Wilkinson.... 903,649
Bath apparatus, vapor, K. Hickox 903,289
Batteries, forming plates for storage, W. Morrison 903,752
Bearing, ball, J. F. Springer 903,337
Bed, folding, L. Jensen 903,291
Belting clamp, rope, J. Kast 903,727
Bicycle crank hanger, G. H. Meiser.......... 903,392
Bicycle, handle bar, H. D. Griswold.......... 903,468
Bicycles, carrying attachment for, Jahnel & Grohmann 903,290
Bill hook, F. Lindemann 903,299
Binder, J. F. Tapley 903,621
Binder for sand cores, briquets, etc., E. D. Frohman 903,558
Block signal system, electric, P. J. Simmen. 903,796
Board. See Dividing board.
Boiler, J. J. Rohan.......... 903,781
Boiler draft regulator, steam, W. A. Kitts. 903,729
Boiler tubes, tool for spreading water tube, J. F. Dugett 903,550
Bolt, F. McInnerny.......... 903,397
Book, laundry record, E. W. Gray.......... 903,283
Book support and adjustable shelf partition, W. M. Poindexter 903,769
Bottle attachment, Healy & Galvin 903,716
Bottle closure, A. Dreyer 903,688
Bottle covering machine, W. P. Catlin.... 903,671
Bottle lifter, W. P. Catlin 903,670
Bottle, non-refillable, H. Nater 903,398
Bottle, non-refillable, J. H. Richard.......... 903,504
Bottle stopper, non-refillable, J. F. Fitzgerald 903,693
Bottles or glass receptacles, covering, W. P. Catlin 903,669
Box and shipping package, F. W. Barnes. 903,161
Box cover, outlet, G. B. McBean.......... 903,221
Box fastener, R. C. Bender 903,659
Box for soap, polish, pomade, etc., H. C. Simons 903,332
Box lid, H. E. Knaust 903,581
Breast strap neck yoke ring holder, A. Snesrud 903,335
Brick molding machine, S. T. H. Bradley... 903,663
Bridge, O. Thomas 903,630
Bridge or crane, traveling, H. P. Andresen 903,806
Bridle bit, H. W. Beckwith 903,351
Brush, cleaning, R. T. Gillespie 903,186
Buckle, A. Fasig 903,554
Buckle, N. Hughes 903,723
Bundle shocker, G. L. Leisner 903,207
Burial case, O. S. Russell 903,233
Burial casket rough box, P. D. Skahen.... 903,798
Burner, F. J. Albrecht 903,652
Butter separator, pneumatic, L. Lillard.... 903,298
Button fastener, J. Cohn 903,674
Button matcher, E. L. Buxbaum.......... 903,270
Button and shoe horn, combined shoe, S. J. Rivoire 903,320
Cabinet index, C. E. Flanders.......... 903,368
Cabinet, rural free delivery carrier's, B. C. Hamer 903,565
Cable adjuster. M. W. Beardsley.......... 903,656
Calendar, perpetual, W. F. Hunt 903,192
Camera, folding, F. A. Anthony 903,533
Candelabrum and flower holder, combined, W. H. Pruden 903,227
Car, box, M. C. Blest 903,438
Car construction, C. A. Lindstrom 903,488
Car coupling, S. Morris 903,220
Car door, J. A. Rickabaugh 903,406
Car, dumping, Treadwell & Astrom 903,245
Car, dumping, S. A. Larsson 903,295
Car end brace, railway, R. V. Sage.......... 903,408
Car running gear, railway, A. R. Angus... 903,654
Car stake, J. Bagley 903,655
Car stake, F. Shillin 903,418
Car truck column guide, C. F. Murray.... 903,490
Car truck, railway, G. G. Floyd 903,556
Car truck, railway, J. M. Hansen.......... 903,286
Car truck side frame, E. H. Benners.... 903,535
Carbureting plant, safety, C. M. Kemp.... 903,479
Carrier system, H. A. Jackson.......... 903,382
Cash register, T. Carroll 903,172
Casting furnace, ingot, Schmidt & Desgraz 903,511
Cereal cake or body, H. A. Lauhoff.......... 903,586
Chair, D. Schustek 903,790
Chair, child's, I. Unger, reissue.......... 12,879
Check mold, C. E. Herd 903,718
Chute, hog, W. P. Allen 903,157
Cigar cutter G. A. Arnold 903,431
Cigars, manufacturing, C. M. Berry 903,437
Cigarette case, B. Epstein 903,690
Circuit closing device, A. A. White.......... 903,251
Circuit controller, thermostatic, G. H. Bowen 903,165
Clamp, G. L. Hoffer 903,380
Closet seat, Martin & Grandpre 903,596
Clothes drier, J. Lowendahl 903,593
Clothes line and pin, C. Patterson.......... 903,402
Clothes washer, S. T. Black 903,661
Clutch, E. E. Norton 903,493
Cock for gas fixtures, automatic cut off, R. E. Staples 903,614
Coffee and tea infuser, R. Troemel.......... 903,634
Coffee machine, S. Sternau, et al.......... 903,801
Coke oven charges, machine for leveling, W. B. Morgan, et al.......... 903,604
Coke pushing machine, Rouse & Neemes.... 903,783
Collar pad, L. O. King 903,293
Column, distilling, R. Vallat 903,636
Column, distilling or rectifying, R. Vallat. 903,637
Comb cleaner, F. Fevola 903,691
Compressor, hydraulic, Themke & McCardia 903,420
Concrete building blocks, divided bond for two membered, L. B. Larsen 903,734
Concrete mixer, Wolter & Stottko 903,426
Concrete pile and forming the same, M. M. Upson 903,246
Concrete structures driven mold for sunken, L. H. Brace 903,441
Condiment holder, Nixon & Raven.......... 903,399
Conduit, W. Houghton 903,572
Control system, R. P. Jackson.......... 903,193
Controller construction, E. W. Stull.......... 903,338
Controlling apparatus, A. G. Wessling.... 903,348
Conveyer, J. H. Long 903,591
Cooker and evaporator, T. W. Wade.......... 903,520
Cooking utensil, R. Vaughan 903,803
Cop or yarn package, S. W. Wardwell.... 903,643
Copper leaching process, F. Laist 903,732
Corn husker, T. L. Brumback 903,446
Corset, M. J. Lang 903,204
Corset attachment back protector, G. F. Shankland 903,238
Cotton chopper riding attachment, N. S. Sodekson 903,336
Coupling. See Car coupling.
Crane, traveling, Miller & Newcomb.......... 903,601
Cultivating scrape, A. F. Davis 903,684
Cultivator, A. J. Compton 903,676
Current regulator, electric, Knapp & Cade.. 903,580
Curtain bracket, A. W. Appleton 903,159
Cutting apparatus, S. Davis 903,273
Cycle engine, double two, W. L. Morrow.. 903,753
Cycle, single wheel (monocycle), O. Schuhmann 903,789
Cycles, means for locking the steering heads of, H. Jansen 903,476
Dental gold inlays, appliance for casting, V. Macdonald 903,489
Dental lip protector, E. C. Wackler.......... 903,344
Derrick hoist, B. G. Cope 903,271
Disk shaping and sharpening machine, O. T. Fegert 903,365
Display apparatus, J., Jr., & A. A. Wiedemeier 903.253
Display package, C. J. Miller 903,600
Display rack, J. J. Karges 903,821
Ditching and grading machine, M. G. Bunnell, reissue 12,875
Dividing board, R. Loving 903,742
Dock, floating, Mehlhorn & von Klitzing, 903,215, 903,598
Dog bench, T. B. Middlebrooke 903,218
Doll eyes mechanism, A. C. Hover.......... 903,573
Door frame and vestibule member, combined reinforced, S. W. Fish.......... 903,281
Door stop, C. Schneider 903,409
Door stop and check, combination, T. R. Thorsen 903,243
Dough mixing machine, L. C. Sharpless.... 903,239
Draft equalizer, J. Siemsen 903,330
Draft equalizer, H. Watson 903,346
Drafting tool, C. H. Robins.......... 903,779
Dredger cutter, A. Lkievicz 903,210
Drying and treating lumber, Uphus & Chapman 903,635
Drying machine, J. C. Taliaferro 903,620
Dropper, E. C. Glines 903,467
Drum, hoisting, A. E. Holcomb.......... 903,819
Duplicating apparatus, A. B. Dick.......... 903,457
Dye and making same, orange or brown, A. Gressly 903,284
Egg beater and cream whipper, G. H. Snyder 903,515
Egg register, Anderson & Middleton.......... 903,430
Elastic distortion, apparatus for demonstrating the laws of, C. E. Albright.. 903,262
Electric circuit breaker, double pole, W. H. Scott 903,791
Electric light stand, J. F. Pierce.......... 903,499
Electric wire support, adjustable, A. W. Bensley 903,807
Electrical contact maker, J. H. Hart 903,568
Electrical protective apparatus, F. B. Cook. 903,812
Electrode for arc lamps, F. Janecek.......... 903,383
Electrolytic apparatus, P. Borgnet.......... 903,164
Electromedical apparatus, R. H. Wappler.. 903,640
Elevators or hoists, automatic friction brake mechanism for, A. G. Wuest.......... 903.805
Engine starter, gas, L. Burnham.......... 903,269
Envelop, T. J. Heath 903,717
Excavating apparatus, windlass and grapple device for moving, L. Mayer 903,597
Expansion pin, F. Rich 903,777
Exposures, means for preventing double, P. F. Rice 903,405
Extension table, B. C. Vincent.......... 903,638
Extension table, A. H. Stone 903,802
Eyeglass case, C. E. Lembcke 903.737
Eyelet, F. H. Richards 903,778
Faucet, C. Clark 903,451
Feed bag attachment, T. Brennan.......... 903,169
Feed trough, T. C. Ottinger.......... 903,309
Fence, E. V. Woodson 903,258
Fencing, apparatus for stretching wire, J. Fisher 903,367
Fifth wheel, I. Teeter 903,241
Filing case, F. C. Deinzer 903,180
Filter, H. A. Frasch 903.697
Filtration, I. H. Jewell 903,385
Fire extinguisher, chemical, P. L. Wilbur. 903,527
Fire fighter, prairie, W. F. Mikolasek 903,394
Fire pot, sectional, Baty & Perry.......... 903,534
Fire, protective device against the spread of, C. A. Pusheck 903,228
Flexible coupling, J. G. Callan.......... 903,171
Floor covering, A. C. Eggers 903,183
Floor finishing machine, C. Peter 903,311
Flue cleaner, J. W. Brown 903,664
Fluid actuated engine, E. J. Armstrong.... 903,264
Fluid gage, M. Martin.......... 903,212, 903,213
Fly paper holder. E. B. Fuller 903.701
Fly trap, J. Disdier 903,458
Fodder for animals, W. Darlington.......... 903,683
Fork and rake, combined, W. L. Copeland.. 903,678
Form of animal heads, B. Cohen 903,673
Frame. See Saw frame.
Furnace, S. T. Bleyer 903,163
Furnace, O. Hile 903,720
Furnace automatic explosion or bleeder valve, blast, Witting & Baer 903,425
Furnace charging apparatus, blast, Williams & Ahlen 903,423
Galvanometer, testing, Johnson & Avery... 903,195
Game apparatus, C. W. Courtney 903,679
Garment clasp, C. M. Hall 903,373
Garment fastener, J. K. Livingston.......... 903,590
Garment hanger, A. K. Bowman.......... 903,166
Gas burner tip, E. Kersey.......... 903,579
Gas controlling apparatus, H. Sieben.......... 903,794
Gas generator, acetylene, E. M. Rosenbluth, 903,506, 903,507
Gas lights by varying the pressure in the mains, device for automatically lighting and extinguishing, Tourtel & Mealing.. 903.633
Gas producing apparatus, G. F. Rendall.... 903.503
Gas retort feeding machine, C. Eitle 903,184
Gases and liquids, apparatus for producing interaction between, H. Koppers.......... 903,483
Gate, E. A. Foster 903.695
Gear case, B. L. Waters 903.522

Gearing, J. Dawson 903,546
Gearing, A. V. Allen 903,653
Gearing, W. Lesemann 903,739
Gearing, oscillatory rotary, H. L. Staley.. 903,613
Gearing system, M. Harvey 903,817
Generator, E. R. Burroughs 903,665
Glove, J. J. Kennedy 903,578
Glutinous material, tank for treating, A. C. Rice 903,775
Grading machine, road, S. A. D. Bertrand.. 903,162
Grain drill, D. A. Schutt 903,235
Grain middlings, etc., separator for, A. Wolf 903,804
Grain separator and grader, F. G. Lyman.. 903,390
Guns of small and medium caliber, carriage for ships', E. Schneider 903,324
Hair pin, A. J. Paris 903,760
Hammock body, I. E. Palmer 903,494
Harness coupling, T. V. Wallace.......... 903,639
Harness driving rein attachment, double, J. Sutherland 903,619
Harrow, W. D. Young 903,651
Harrows, wheel truck for disk, F. K. Lathrop 903,585
Hat crowns, head gear for, F. J. Muhlfeld 903,396
Hat fastener, W. S. Seymour 903,237
Hat lining, J. G. Shepard 903,513
Hat ventilator, W. E. Miller 903,219
Hay carrier track, Maddrell & Swineford.. 903,594
Hay gatherer and loader, D. G. & J. A. Shreeve 903,329
Heating and ventilating device, Waterbury & Waterman 903,644
Heating furnace, ingot, Schmidt & Desgraz. 903,511
Heel, spring, F. P. D'Arcy 903,179
Hinge, L. H. Schwanbeck 903,236
Hinge, W. B. Rodman, reissue.......... 12,876
Hinge, adjustable door, J. M. Shepard.... 903,328
Hinge, gravity, J. E. Gloekler.......... 903,704
Hitching device for teams, automatic, E. Brownfield 903,445
Hoisting bracket, J. L. Wentz.......... 903,421
Hooks and eyes on cards, machine for fastening, G. Rowbottom 903,784
Horn for reproducing natural tones, C. C. Jadwin 903,575
Horseshoe, H. Paar 903,759
Horseshoe pad, J. B. White 903,422
Hose rack, C. F. Bowes 903,538
Hydrocarbon burners, system of fuel supply for, H. Lemp 903,738
Hydrocarbon motor, H. G. Reichenbach, et al 903,772
Ice cream disher, Graffort & Hoffman..... 903,563
Ice making plant, H. McChesley 903,755
Indicator connecting coupling, automatic, J. A. Devine 903,814
Injector, air, E. Werwath 903,646
Inkstand, J. L. Otero 903,308
Insulating covering for pipes, A. Reimann. 903,316
Insulating materials, manufacture of, H. v. d. Heide 903,287
Insulator, feeder wire, G. M. Finckel...... 903,692
Internal combustion engine, H. N. Edens: 903,182
Internal combustion engine, W. Remington. 903,774
Interrupter, C. E. Pearson 903,745
Irrigator, tree and plant, A. Cleveland.... 903,452
Jar and cover therefor, R. F. Honisch.... 903,571
Journal box, J. G. Smith 903,334
Justifying mechanism, F. B. Converse, Jr.. 903,677
Key seating machine, C. C. Newton...... 903,757
Knife and crimper, combination, C. Schultze, Jr. 903,234
Knitting machines, needle cylinder and operative mechanism for needles of circular, H. A. Housman 903,190
Knotter, L. R. Smith 903,240
Labeling machine, bottle, W. F. Ruwell.. 903,322
Lamp shade holder, electric, F. Overbagh, et al 903,401
Land roller and cultivator, J. Ross 903,782
Lead, making arsenate of, Luther & Volck. 903,389
Leather, etc., tool for setting or affixing pronged loops to, W. R. Medearis.... 903,747
Leather finishing machine, A. E. Dodge.... 903,181
Leather splitting machines, adjusting device for the lower knife supporting jaw beams of, Gay & Quigley.......... 903,560
Leather splitting machines, spring roll for, Gay & Quigley 903,559
Legging, storm, H. B. Fowler 903,463, 903,464
Lifter. See Bottle lifter.
Linotype machine, J. R. Rogers.......... 903,505
Liquid delivering machine, H. O. Johnson.. 903,196
Liquid dispensing apparatus, Mayo & Houlehan 903,214
Liquid drawing and measuring apparatus, J. J. Tokheim 903,244
Liquids and gases, apparatus for mixing, B. Leuschner 903,297
Lock, C. F. Broshkewitz 903,170
Lock, J. White 903,647
Lock, Kadar & Roth 903,726
Locking device, gate, R. J. Dill 903,687
Locomotive head and signal light, D. Burnfield 903,355
Loom, H. Lindsay.......... 903,589
Lubricating device, J. H. Rutherford 903,786
Lubricator, E. McCoy 903,306
Lubricator, B. E. Pinnell 903,766
Lunch box or bag, S. Bienenstock........ 903,808
Magnet, lifting, Eastwood & Fishback..... 903,552
Mail bag catching and delivering device, C. M. D. Dines 903,274
Mail bag delivering apparatus, J. B. Roddy 903,407
Mail box, J. T. Denny 903,362
Mail deliverer, automatic, W. B. Thayer... 903,242
Mail delivery device, W. Farmer........ 903,278
Mail pouch delivering and receiving apparatus, A. Hupp 903,473
Manhole cover, B. J. Morrison.......... 903,750
Manure spreader, S. H. Garst.......... 903,703
Maps, etc., means for reproducing, E. Aberle 903,531
Measuring hopper, C. Suiter 903,617
Musical instrument, Lane & Kenley...... 903,484
Measuring meter, liquid, C. C. Hammond... 903,566
Measuring vessel support, M. P. Moore.... 903,302
Metal wheels, making, A. G. Anderson.... 903,532
Metals from lead matrices, separating electrodeposited, C. Reverdys 903,404
Metallic ceiling or sheathing, P. Ebner..... 903,553
Metallic fastener, G. W. McGill 903,756
Metallic substances by volatilization and precipitation, reducing, G. F. Rendall.... 903,317
Milling cutter, C. D. Peck 903,496
Mine disasters, means for preventing, M. T. McDonough 903,492
Mining machine, electric pick, A. Sandstrom 903,508
Mixing machine, W. O. Stark 903,516
Mold, J. G. Coomer 903,453
Mold drying apparatus, J. E. Mathewson.. 903,391
Molding device, G. W., W. E., and G. F. Porter 903,770
Molding machine, Bonvillain & Ronceray, reissue 12,877
Moldings, machine for applying liquid to, C. F. Planett 903,313
Mop wringer, J. Weil 903,524
Mosquito net support, H. Bull 903,539
Motion device, intermittent, A. F. Hamacek. 903,469
Motor controlling system, C. T. Henderson. 903,288
Motors, system for controlling one or more electric, H. H. Cutler 903,177, 903,178
Mower, J. H. Siegfried 903,795
Musical instruments, cover for controlling devices of mechanical, P. B. Klugh.... 903,294
Necktie, M. Prager 903,607
Necktie and holder, E. P. O'Leary......... 903,400
Negatives for sand blast engraving, preparing, J. H. & E. Frey 903,699
Nest, hen's, J. Kirkham 903,822
Nitrogen compounds, making, O. F. Carlson 903,541
Nozzle, rotary, A. Schmidt 903,788
Nut lock, M. M. Wilkin 903,255
Nut lock, J. F. Lachman 903,388
Oil burner, A. D. Lee 903,735, 903,736
Oil cups, tool for cleaning, J. A. Knox.... 903,582
Oiler, contact, A. D. Wiswall 903,257
Ore feeder, A. McCombie 903,491
Ores, reducing, G. F. Rendall 903,318
Organ operating mechanism, reed, H. E. Chute 903,450
Package tie, C. E. Hoover 903,722
Packing for pipe joints, metallic, O. D. Hogue 903,188
Packing, metallic, S. Redfern 903,229
Packing or shipping box, J. T. Ferres...... 903,555
Padlock, permutation, J. A. Cowie 903,680

Concrete, Reinforced Concrete AND Concrete Building Blocks

Scientific American Supplement 1543 contains an article on Concrete, by Brysson Cunningham. The article clearly describes the proper composition and mixture of concrete and gives results of elaborate tests.

Scientific American Supplement 1538 gives the proportion of gravel and sand to be used in concrete.

Scientific American Supplements 1567, 1568, 1569, 1570, and 1571 contain an elaborate discussion by Lieut. Henry J. Jones of the various systems of reinforcing concrete, concrete construction, and their applications. These articles constitute a splendid text book on the subject of reinforced concrete. Nothing better has been published.

Scientific American Supplement 997 contains an article by Spencer Newberry in which practical notes on the proper preparation of concrete are given.

Scientific American Supplements 1568 and 1569 present a helpful account of the making of concrete blocks by Spencer Newberry.

Scientific American Supplement 1534 gives a critical review of the engineering value of reinforced concrete.

Scientific American Supplements 1547 and 1548 give a resume in which the various systems of reinforced concrete construction are discussed and illustrated.

Scientific American Supplement 1564 contains an article by Lewis A. Hicks, in which the merits and defects of reinforced concrete are analyzed.

Scientific American Supplement 1551 contains the principles of reinforced concrete with some practical illustrations by Walter Loring Webb.

Scientific American Supplement 1573 contains an article by Louis H. Gibson on the principles of success in concrete block manufacture, illustrated.

Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

Each number of the Supplement costs 10 cents.

A set of papers containing all the articles above mentioned will be mailed for $1.80.

Order from your newsdealer or from

MUNN & CO.
361 Broadway, New York City

Paint, G. D. Coleman 903,675
Paper bag making machine, Hirsch & Eichberg 903,570
Paper clip, G. H. Cliff 903,173
Paper clip, D. Johnson 903,724
Paper drier, A. C. Rice 903,776
Paper holder, T. Harris 903,713
Paper pail, J. N. Davis 903,455
Paper pail, W. M. Kinnard 903,481
Paper roll holder and printing device, combined, W. B. Casey 903,542
Papering machine, wall, A. Chatelain 903,672
Pen, fountain, J. Board 903,662
Pen nib, C. G. Wertheimer 903,249
Pencil, E. L. Schmitz 903,509
Petticoat, E. J. Segrell 903,326
Phonographic records, producing, I. Kitsee 903,198
Phonography, I. Kitsee 903,199, 903,200
Photographic plates, daylight developing apparatus for, C. F. Aurich 903,432
Photographic printing machine, E. C. Webster 903,523
Piano, pneumatic, A. Nordeen 903,758
Pianos, clamping mechanism for pneumatically operated, A. G. Gulbransen 903,285
Pick, G. B. Yeaney 903,428
Pies, machine for making rims of soft, J. F. Kohler 903,584
Pipe. See Smoke pipe.
Pipe coupling, G. P. Youmans 903,260
Pipe fitting, R. J. Farrell 903,280
Pipe riveting machine, hydraulic, C. Wigtel 903,526
Pipes, etc., apparatus for cutting threads on, E. L. Lidke 903,209
Planter, J. B. Wiggins 903,254
Plastic ornaments, making, A. M. Holstein. 903,189
Platen operating mechanism, A. Schneeloch. 903.512
Plow, J. M. Sausser 903,323
Pocket knife, R. L. Guthrie 903,709
Pole cross arm support, E. C. Short, reissue. 12,878
Portable gate, C. W. Haben 903,564
Portiere, rope, W. T. Smith 903,612
Post brace, E. M. Devany 903,686
Postcard with folder, F. R. Snyder 903,514
Pousse cafe machine, J. Kriwanek 903,203
Power generating system, H. Lemp 903,487
Power generator, C. J. Low 903,592
Power storing apparatus, A. E. Gardner 903,372
Power transmission device, frictional, E. H. Manning 903,744
Press and filter, combined hop, A. G. Hupfer 903,574
Press gage, sheet, C. M. Morrison 903,751
Pressure limiting device, A. Wilzin 903,424
Printing surfaces, bending, B. F. Upham .. 903,342
Prospecting drill, A. W. Johanson 903,194
Pulley lubricating device, R. R. Yohey 903,259
Pump, air, A. S. Comstock 903,543
Pump, bicycle, J. S. Robinson 903,780
Pump, centrifugal, L. Bellot 903,658
Pump coupling, L. C. Hamel 903,712
Pump operating mechanism, Piskett & Sanders 903,312
Push button, electric floor, H. F. Keil 903,577
Quill substances, machine for preparing, W. Webster 903,248
Radiator shield, A. Atkinson 903,266
Rail joint, J. C. Rainey 903,315
Rail joint and brace, J. Farrell 903,460
Rail joint supporter, L. Winans 903,528
Railway brake shoe, I. A. Gibbs 903,816
Railway derailing system, W. R. McCollom. 903,303
Railway rail, W. F. & A. R. Keehl 903,292
Railway rail fastening clip, A. M. Gaines .. 903,702
Railway rails, device for preventing spreading of, J. Larivee 903,485
Railway road bed, W. H. Coffman 903,174
Railway switch, J. R. Goode 903.562
Railway switch, automatic, P. F. Kiefer .. 903,480
Railway switch and signal, automatic, Forster & Coan 903,462
Railway switch stand latch, W. R. McCollom 903,304
Railway tie, metallic, J. A. Widner 903,252
Railway trains, apparatus for the control of, J. P. Coleman 903,360
Railway trains, automatic control for, J. P. Coleman 903,359
Railway trains, combined signal and speed controlling mechanism for, Schreuder & Spicer 903,414
Razor blades, holder for use in sharpening safety, P. E. Shee 903,792
Razor safety attachment, A. Arbenz 903,160
Razor safety guard, H. Watson 903,347
Receptacle, A. Stavisky 903,824
Receptacle, knockdown, M. Hutchinson 903,381
Reclining chair, F. M. Davis 903,361
Reflector, searchlight, M. von Rohr 903,321
Refrigerator fastening means, V. A. De Canio 903,685
Rein catching device, N. T. Fogg 903,282
Reversing mechanism, J. F. McMahon 903,222
Ribbon plaster or other matter, case for holding, K. Wolf 903,650
Riddle, circular, S. H. Brand 903,168
Rocking horse, traveling, Calkins & Hammond 903,448
Roller attachment, steam, G. J. Neyerlin .. 903,223
Rotary engine, W. F. Bleecker, reissue 12,874
Rotary explosive engine, E. O. Hoell 903,470
Running gear, D. W. Connell 903,544
Sad iron, W. B. Simpson 903,797
Safe, L. N. Davis 903,456
Safe construction, T. S. Spivey 903,800
Safety switch, automatic, Thornton & Wertheimer 903,631
Salt and pepper shaker, O. O. De Hayes 903,548
Salt-making machinery, P. L. Clifton 903,358
Salt, manufacturing, P. L. Clifton 903,357
Sand molding machine, J. J. McClelland 903,605
Sash fastener, W. S. Atkins 903,265
Sash fastener, P. C. Mellichamp 903,393
Sash holder, R. T. Taylor 903,622
Sash lock, J. Vock 903,519
Sash, window, Stolp & Bowde 903,615
Saw, W. W. Mitchell 903,603
Saw filing device, H. F. Hill 903,721
Saw frame, coping, W. J. Parsons 903,495
Scaffolds, holders for swinging, C. F. Keil. 903,478
Scale chart, H. S. Hallwood 903,711
Screw driver, C. V. Dodd 903,549
Sealing and opening device for cartons, E. H. Ungemach 903,341
Segregation, A. Junghans 903.725
Self-lubricating wheel, W. M. Duncan 903,551
Separator, C. J. Reilly 903,609
Separators, feed device for centrifugal, E. A. Forsberg 903,369
Sewing machine, Bolton & Weiss 903,439
Sewing machine looper mechanism, W. V. Miller 903,749
Sewing machine looper operating mechanism, L. Onderdonk 903,226
Shade holder, W. H. Perkins 903,497, 903,498
Shades, curtains, and the like, support for, E. Jacoby 903,475
Shaft rotating means, O. W. Meissner 903.301
Shaft support, buggy, B. M. Perdue 903.764
Sharpener, lawn mower, J. H. Frey 903,371
Shearing and punching machine, C. J. Reiling 903,773
Shears, J. H. Frey 903,370
Sheet feeding machine, R. E. & A. Kemper 903,386
Shoe, J. Jensen 903,384
Shoulder brace, Quick & Armstrong 903.403
Sign receptacle, C. D. Platt 903,768
Signal. See Automobile danger signal.
Signal system, J. J. Ruddick 903,785
Siphon, pipe, S. F. Miller 903.395
Skate, roller, C. O. Wellnitz 903,525
Skating rink, portable, J. F. Laytham 903,486
Skeins and their holders, machine for making, J. G. Smith 903,610
Skip dump, J. Angove 903,263
Sled propeller, C. Kibat 903.387
Sleigh automobile, C. E. S. Burch 903,540
Smoke pipe, A. R. Haatvedt 903,710
Snap switch, rotary, Goodridge & Thomas .. 903,705
Soaking pit, Schmidt & Desgraz 903,510
Sodium arylamins, manufacture of, O. Liebknecht 903.588
Sole protecting plate for shoes, J. Edman .. 903,276
Sound reinforcing relay, J. H. Christensen .. 903,811
Speed indicator, R. Shipman 903,793
Spring, L. Y. Leon 903.587
Stacker, straw, W. F. MacGregor 903,743
Staircase, Kohn & Sugar 903,730
Stamp affixer, F. L. Jennings 903.576
Stamp pad or tablet, A. Sutcliffe 903,618
Stanchion, A. O'Connor 903,225
Stanchion, G. P. Youmans 903,261

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than ten 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.

BUSINESS OPPORTUNITIES.

WANTED.—Man with small capital to take charge of territory for merchandising business; write for particulars. Pope Automatic Merchandising Company, Corn Exchange Bank Building, Chicago.

Inquiry No. 8611.—Wanted to buy springs for light power purposes.

WANTED.—Parties to manufacture and sell on a royalty a splendid household article. Requires only $750 capital to make $10,000 or more per year. Address Royalty, Box 773, New York.

PATENTS FOR SALE.

FOREIGN PATENTS for meritorious and valuable inventions negotiated upon a contingent basis. Absolutely no fees accepted. References given and required. L. Henry, 141 Broadway, New York.

Inquiry No. 8650.—Wanted to buy file cutting machinery.

BREWERS' GRAINS and Beet Refuse Drying Machines U. S. Patent for sale. Large demand. Superior to all others. Most successful in Britain. Richard Simon & Sons, Ltd., Nottingham, England.

Inquiry No. 8667.—Wanted to buy needle, pin and pen machinery.

FOR SALE.—Patent for gas stove for America and England. Also patent for kerosene oil lamp extinguisher. For full particulars address Louis Wendnagel, 22d and Jefferson Streets, Chicago.

Inquiry No. 8685.—Wanted to buy 1⅛ to 2-inch No. 13 to 18 tempered spring steel.

PATENTS WANTED.

WANTED.—Information regarding good patent which would be money maker. Only inventor, who wishes to sell outright or on royalty basis, need answer. Give price and brief description. L. Darbyshire, Box 390 A, Rochester, N. Y.

Inquiry No. 8687.—Wanted to buy motor plows.

FOR SALE.

A GRAY IRON FOUNDRY, fully equipped and in operation, on account of the death of the managing partner, is for sale. The foundry is 50 x 150 ft., solid brick walls and iron truss roof, bay on the east side, 15 x 24 ft., used for core room, an addition on the west side 30 x 80 ft. with brick walls, partitioned off for cupola room, motor room, cleaning and shipping room. A brick pattern house, 30 x 50 ft., a frame office, 4 acres of land and a side track, located on the Soo Line, Minneapolis, Minn. For particulars address Mr. W. L. Chapin, attorney for the administratrix, New York Life Bldg., St. Paul, Minn.

Inquiry No. 8699.—Wanted to buy two-stranded soldered wire for heddles.

MANUFACTURERS ATTENTION.—For sale, state rights. The best automatic scales on the market. Two to six thousand dollars. A fortune in it for the right party. Address J. H. McLeod, Marietta, Kans.

Inquiry No. 8701.—Wanted to buy solar engines.

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., List Department, Box 773, New York.

Inquiry No. 8721.—Wanted unwelded tubing that is used for structural work.

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

Inquiry No. 8735.—For parties making a still for the purpose of extracting alcohol from saw-dust.

MISCELLANEOUS.

UNITARIAN LITERATURE, including sermons and weekly publications, sent free, on application to Miss Peck, 106 George Street, Providence, R. I.

Inquiry No. 8736.—For manufacturers of machinery for making matches, also machinery for making purses and hand bags.

Inquiry No. 8737.—For manufacturers of machinery for making tooth-brushes, shaving brushes, galvanized water buckets, locks, nibs and holders.

Inquiry No. 8742.—For manufacturers of water still, also of thermometer tubing.

Inquiry No. 8748.—Wanted to buy polished or lacquered brass in sheets 29 gauge, quarter hard in temper.

Inquiry No. 8749.—For makers of very large springs, used for running machinery.

Inquiry No. 8769.—For manufacturers of an appliance to attach to the old style razor blade to make same a safety razor.

Inquiry No. 8770.—For parties who make short link twist chains, links from ⅛ inch up.

Inquiry No. 8771.—Wanted to buy tune sheets for Criterion music boxes.

Inquiry No. 8774.—For machinery for making bags from sisal hemp.

Inquiry No. 8775.—Wanted to buy stock novelty or jewelry catalogues.

Inquiry No. 8779.—For parties manufacturing gas, gasoline, steam engines and boilers; also packing and mineral wool, steam supplies, iron and lead pipe, power transmission machinery and steam fitters' tools.

Inquiry No. 8780.—For parties who make gasoline stoves.

Inquiry No. 8784.—For manufacturers of alcohol burners for lights and stoves.

Inquiry No. 8786.—For parties to manufacture glass balls blown about 1⅛ inch in diameter with a ⅛ inch hole through the center, should hold about 200 pounds to the square inch of steam pressure.

Inquiry No. 8787.—For parties who manufacture cat-gut.

Inquiry No. 8790.—For the manufacturer of "Brooks improved hand pump."

Inquiry No. 8792.—For a firm that manufactures glass holders made of glass.

Inquiry No. 8796.—For concerns manufacturing stills adapted to the manufacture of denatured alcohol.

Inquiry No. 8798.—For manufacturers of micro lens used in small articles such as pencils, charms, etc.

Inquiry No. 8799.—Wanted to buy new or second-hand box nailing machine for small packing cases.

Inquiry No. 8800.—Wanted complete data in regard to pegamoid.

Inquiry No. 8802.—Wanted to buy machinery for cutting and polishing oilstones, whitestones or grindstones.

Inquiry No. 8803.—For manufacturers of files, screws, druggists' supplies, hardware in general, and agricultural machinery.

Inquiry No. 8804.—For parties dealing in windmills, wood split pulleys, wheelbarrows, cutlery and picks.

Inquiry No. 8805.—Wanted to buy outfits and supplies for brazing.

Inquiry No. 8806.—For manufacturers of drawing materials.

Inquiry No. 8807.—For dealers in second-hand cotton machinery.

Inquiry No. 8815.—Wanted to buy carriage and wagon hardware coal, iron and steel.

Inquiry No. 8819.—For manufacturers of Excelsior Welding Compound.

Inquiry No. 8821.—Wanted to buy machinery for making a rough composition board, something like a straw board.

Inquiry No. 8822.—For manufacturers of dredging machinery to be operated by gas engine.

Inquiry No. 8825.—For manufacturers of a new device to split wood.

Inquiry No. 8826.—Wanted to buy small fuel compression machines both manual and engine power.

Inquiry No. 8827.—For manufacturers of annealed glass.

Inquiry No. 8829.—Wanted to buy machinery for making pins, hair pins, hooks and eyes.

Inquiry No. 8830.—Wanted to buy machinery for making brushes and baskets.

Inquiry No. 8831.—Wanted to buy knitting machines.

Inquiry No. 8832.—Wanted addresses of high-grade label weavers, preferably in New York.

Inquiry No. 8833.—Wanted to buy a peanut shelling machine.

Inquiry No. 8834.—Wanted to buy a 2-horse-power gasoline engine for spray wagon working on hilly ground.

Inquiry No. 8835.—Wanted to buy toothpick machinery.

Inquiry No. 8836.—Wanted to buy decorticating machines for sisal.

Inquiry No. 8837.—Wanted to buy folding umbrellas.

Inquiry No. 8838.—Wanted to buy metallic targets similar to clay birds used in shot-gun shooting.

Inquiry No. 8839.—Wanted to buy cheap automobiles.

Inquiry No. 8840.—Wanted to buy portable hydrocarbon pressure lamps.

Inquiry No. 8841.—Wanted to buy lunch counter and restaurant fixtures.

Inquiry No. 8842.—Wanted to buy annealed glass.

Inquiry No. 8843.—Wanted to buy cigarette making machine.

Inquiry No. 8844.—Wanted to buy inkstands.

Inquiry No. 8846.—Wanted to buy an electric butcher hand saw.

Inquiry No. 8847.—Wanted laundry tubs.

Inquiry No. 8848.—Wanted to buy rust proof metal for parts of wash tubs.

Inquiry No. 8849.—Wanted addresses of Canadian makers of rifle sights.

Inquiry No. 8850.—Wanted to buy machinery for making canvas gloves or mitts.

Inquiry No. 8851.—Wanted to buy machine for weaving wooden lath and wire together.

Inquiry No. 8852.—Wanted to have made a concave brass or copper reflector with focus of four or five feet.

Inquiry No. 8853.—Wanted to buy wafer safety razor blades.

Inquiry No. 8854.—Wanted to buy air compressor pressure up to 1,500 lbs., the capacity ranging 500 to 3,000 cubic feet.

Inquiry No. 8855.—Wanted machine to punch holes, feed and set automatically solid copper rivets and washers and rivet together harness done with one stroke.

Inquiry No. 8856.—Wanted a machine or grinder for reducing soft wood refuse to a fine dust.

Inquiry No. 8857.—Wanted addresses of shoe string manufacturers.

Inquiry No. 8858.—Wanted to buy comb cleaning machine.

Inquiry No. 8859.—Wanted to buy steel gray paint suitable for gasoline engines.

Inquiry No. 8860.—Wanted to buy machinery for grinding, washing and drying gum chicle.

Inquiry No. 8861.—Wanted to buy machine for cutting out mittens.

Inquiry No. 8862.—Wanted to buy a feather pillow ventilator.

Inquiry No. 8863.—Wanted to buy machine to separate pecan nuts into sizes and dust the dirt off.

Inquiry No. 8864.—Wanted manufacturers of mechanical novelties.

Inquiry No. 8865.—Wanted to buy fireless cookers.

Inquiry No. 8866.—Wanted to buy instantaneous water heaters.

Inquiry No. 8867.—Wanted to buy plant for dry cleaning.

Inquiry No. 8868.—Wanted to buy nickeloid for buttons.

Inquiry No. 8869.—Wanted to buy straw making machinery.

Inquiry No. 8870.—Wanted to buy incandescent kerosene burners.

Inquiry No. 8871.—Wanted to buy chimneyless kerosene burners.

Inquiry No. 8872.—Wanted to buy a ball nozzle puzzle.

Inquiry No. 8873.—Wanted to buy a portable shower bath.

Stanchion, cattle, F. & C. Baker	903,267
Station indicators, actuating mechanism for, H. L. Keeler	903,728
Steam and hot water heater, J. E. Frost	903,700
Stool, piano, F. H. Meyer	903,599
Storage battery, J. L. & M. O. Smith	903,799
Stovepipe fastener, adjustable, J. W. Harold	903,567
Sugar cane in the field, apparatus for cutting, J. M. C. y Becerra	903,666
Supporter and protector, R. H. Huddleston	903,472
Supporter device, J. E. Rhodes	903,230
Suspender attachment, P. S. Hay	903,376
Suspenders, adjustment for, P. Zuckriegel	903,429
Swingletree, A. E. Levins	903,740
Switch operating mechanism, A. B. Allen	903,156
Switch stand lock, C. Fowler	903,696
T-square, E. B. Wiles	903,648
Tackle, C. W. Baker	903,433
Talking machine, Haug & Royal	903,375
Talking machine cabinet, W. L. Eckhardt	903,364
Talking machine records, album for flat, J. B. Rosenthal	903,232
Taximeter pawl transmission gear, C. Mascart	903,746
Telephone bracket, B. M. Lampert	903,733
Telephone system, W. W. Dean	903,547
Telephone system, J. A. & S. H. Geller	903,561
Telephone transmitter, W. Kaisling	903,197
Temple bending machine, S. Norden	903,224
Tenon joint fastener, J. H. Wray	903,529
Tension spool, O. S. Sturtevant	903,616
Terpenes from wood, producing, W. J. Hough	903,471
Thermal protector, contactless, F. B. Cook	903,813
Thermostat for electric heaters, E. H. Richardson	903,319
Thread from hair, manufacture of, A. Webb	903,645
Ticket, pin, W. D. Smith	903,611
Tile, F. N. Marvick	903,300
Tile, roofing, S. A. Jones	903,477
Tire casing, pneumatic, Hawley & Baker	903,714
Tire, cushion, W. P. & G. B. Everts	903,815
Tire remover, W. F. Hubbard	903,820
Tire tread, pneumatic, Hawley & Baker	903,715
Tires, manufacture of rubber, J. T. Gordon	903,707
Tobacco pipe, W. E. Elam	903,277
Tool chest, C. Carl	903,668
Tool holder, J. Prince	903,501
Tooth, artificial, J. A. Van Vleck	903,343
Top or diabolo, double, C. H. Skeer	903,419
Toy, wheeled, J. Becker	903,350
Trace support, J. Donavan	903,363
Traction wheel, J. M. Roberts	903,231
Training device, F. Kull	903,731
Trains, apparatus for automatically controlling mechanism for, Schreuder & Spicer ......903,410 to 903,413, 903,416,	903,417
Trap, M. Lawler	903,296
Trap, waste and overflow, combined, J. P. Heeney	903,569
Tray, O. Hebestreit	903,377
Tree transplanter, D. N. Santmier	903,787
Trolley pole, S. D. Fenimore	903,366
Trolley wheel, E. J. & D. R. Fredericks	903,698
Trousers stretcher, R. C. Mitchell	903,602
Truck, car, Howard & Pflager	903,191
Tube cleaner, boiler, J. Muirhead	903,754
Turbine, R. C. Frohlich	903,557
Turbine, L. S. Flatau	903,694
Turbine buckets, shrouding for, F. R. C. Boyd	903,167
Turbine discharging device, E. H. Farquhar	903,279
Turbine, elastic fluid, C. W. Dake	903,454
Turbine, explosion, C. Beckmann	903,657
Turn-table, vehicle, J. Boda	903,809
Turrets, etc., air pressure system for, H. Bensch	903,660
Twine holder, R. L. Craighead	903,272
Type casting and composing machine, O. V. Sigurdsson	903,531
Typewriter, S. Wanmer	903,521
Typewriting machine, C. H. Shepard	903,327
Typewriting machine, G. F. Ballou	903,434
Typewriting machine, Brown & Tomlinson	903,442
Typewriting machine, Brown & Barr	903,443
Typewriting machine, A. T. Brown	903,444
Typewriting machine, J. Felbel	903,461
Typewriting machine, C. Gabrielson	903,466
Typewriting machine, B. C. Stickney	903,517
Typewriting machine, E. L. Pfunder	903,765
Typewriting machine, H. A. Briggs	903,810
Typewriting machine ribbon mechanism, T. L. Knapp	903,823
Typewriting machines, paper guide for carriages of, T. L. Knapp	903,482
Umbrella supporting device, F. B. Cumpston	903,682
Valve, F. W. Kline	903,201
Valve, C. J. Benzenhafer	903,436
Valve and cock, J. Anderson	903,158
Valve, automatic cylinder relief and vacuum, Yearwood & Pattison	903,530
Valve, emergency, W. K. Rankin	903,502
Valve for compressed fluid motors reducing E. Schneider	903,325
Valve for faucets, pipes, etc., J. W. Collins	903,175
Valve for radiators, air, T. Wheatley	903,250
Valve, gate, J. M. Brown	903,354
Valve gear for internal combustion engines, H. F. Lloyd	903,741
Valve mechanism for explosive engines, L. A. Merk	903,748
Valve, mixing, H. D. Lauson	903,206
Valve, quick-opening, J. C. Pollock	903,606
Valve, steam throttle, T. A. Pitman	903,767
Valve, thermostatic, A. G. Paul	903,310
Vegetable cutter, W. Nieland	903,307
Vehicle folding step, C. Black	903,352
Vehicle gear, I. Cornwell	903,176
Vehicle steering gear, motor, C. O. Barnes	903,349
Vehicle wheel, M. L. Williams	903,256
Vehicle wheel, L. J. Crawford	903,681
Vehicle wheel, G. H. Groth	903,708
Vehicle wheel, motor, J. V. Pugh	903,608
Ventilator. See Hat ventilator.	
Ventilating system, W. E. Symons	903,339
Ventilator, M. J. Meyer	903,217
Ventilator, M. Townsend	903,340
Vise, double swivel, E. M. Walker	903,345
Wagon, reversible dump, C. A. Geiger, et al	903,185
Wall, flexible, W. M. Fulton	903,465
Wall plug, F. L. Dykema	903,459
Washbasin, F. T. Meyer	903,216
Washboard, J. F. Wood	903,427
Washer, R. W. Guilford	903,187
Watch retainer, C. L. H. Wagner	903,247
Watch support, L. D. Crossett	903,545
Watch heater, automatic, A. B. Chapman	903,449
Weather strip, H. Ingham	903,474
Web reeling mechanism, F. E. Strasburg	903,518
Wedge, R. Koban	903,583
Well drilling tools, ratchet lock for screw joints of, W. Barrott	903,435
Well plug, oil, E. Porter	903,314
Whiffletree, J. E. McCorkle	903,305
Windmill, G. Halverson	903,374
Window, D. Beebe	903,268
Window, A. C. Goddard	903,706
Window and door screen, D. D. Pinkham	903,500
Window frame, metal, R. Pursch	903,771
Wire puller, C. H. Herth	903,818
Wire tightener, L. E. Pedersen	903,763
Woven fabric, double faced, W. H. & A. E. Margerison	903,595
Wringer. See Mop wringer.	
Wrench, C. M. Larson	903,205
Wrench, W. S. Bowers	903,440
Wrench, H. Capellmann	903,667
Wristband, A. J. Paroubek	903,761
Wurtzilite, Doerflinger & Buck	903,275
Yarn package, S. W. Wardwell.....903,641,	903,642

DESIGNS.

Belt, A. Falbo	39,667
Lace, levers, C. W. Birkin.........39,668 to	39,670
Picture glass and frame, combined, H. D. Sterrick	39,665
Plate, prism, E. J. Dobbins	39,666

TRADE MARKS.

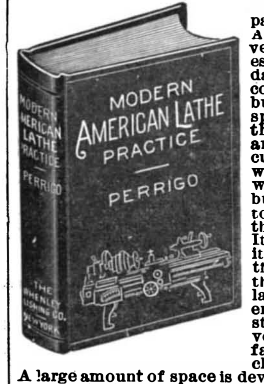
Ale, porter, and brown stout, Robert Smith Ale Brewing Co	71,213
Asthma, catarrh, bronchitis, hay fever, and colds, remedies for, Peck & Velsor	71,212
Beer, M. B. Foster & Sons	71,210
Beverages, cereal preparation for making, Postum Cereal Co	71,262

RECENT BOOKS

MODERN AMERICAN LATHE PRACTICE

By OSCAR E. PERRIGO, M.E.

Price $2.50

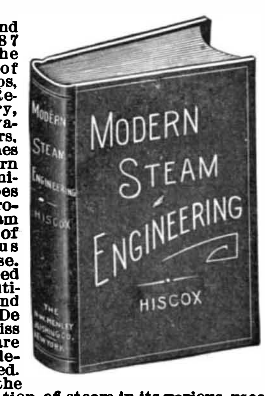


A complete book of 400 pages on The Modern American Lathe. Its development from the earliest times up to the present day; its modern form as constructed by up-to-date builders; its general and special classes of work; the quantity of its output, and its marvelous accuracy. Written by a man who knows not only how work ought to be done, but who also knows how to do it, and how to convey this knowledge to others. It is strictly up-to-date in its descriptions and illustrations which represent the very latest practice in lathe and boring mill operations as well as the construction of and latest developments in the manufacture of these important classes of machine tools. A large amount of space is devoted to the turret lathe, its modifications and importance as a manufacturing tool. Multiple spindle and automatic chucking lathes are fully considered, as are also special high power lathes for the use of high speed tool steel, and electrically driven lathes. In the treatment of the subject 315 illustrations and examples from the best practice have been made use of, as by illustration alone can many of the important details and methods be clearly presented.

Modern Steam Engineering in Theory and Practice

By GARDNER D. HISCOX, M.E.

Price $3.00



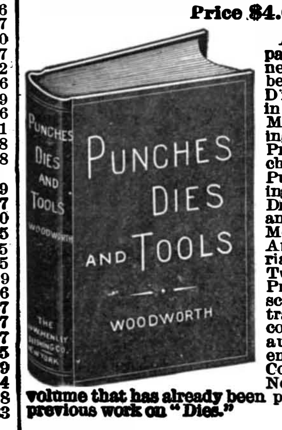
This is a complete and practical work of 487 pages, dealing with the care and management of Boilers, Engines, Pumps, Superheated Steam, Refrigerating Machinery, Dynamos, Motors, Elevators, Air Compressors, and all other branches with which the modern Engineer must be familiar. It fully describes and illustrates the properties and use of Steam for the generation of power in the various types of engines in use. Slide Valve, High-Speed Corliss, Compound, Multi-expansion engines and their valve gear, the De Laval, Parsons, Curtiss and other Turbines are included and fully described and illustrated. Forty two tables of the properties and application of steam in its various uses are included, which in themselves form a most valuable and instructive section of the work.

Nearly Two Hundred Questions with their Answers on Steam and Electrical Engineering likely to be asked by the Examining Board are included. These if studied by you will help you to procure a license. This book is thoroughly reliable and practical, and not only a guide but a teacher. As a text book it is the latest and best authority on the subject. It is fully illustrated with detail engraving, not to be found elsewhere.

Punches, Dies and Tools for Manufacturing in Presses

By JOSEPH V. WOODWORTH

Price $4.00



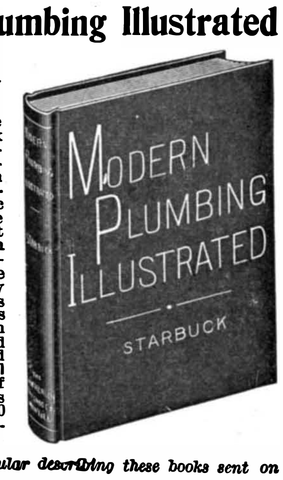
A practical work of 500 pages fully illustrated by nearly 700 engravings, being an encyclopedia of Die Making, Punch Making, Die Sinking, Sheet Metal Working, and Making of Special Tools, Sub-Presses, Devices and Mechanical Combinations for Punching, Cutting, Bending, Forming, Piercing, Drawing, Compressing and Assembling Sheet Metal Parts and also Articles of other Materials in Machine Tools. Two Hundred and Ten Processes are clearly described and fully illustrated. This work is a companion volume to the author's elementary work entitled "Dies, Their Construction and Use." Nothing appears in this volume that has already been published in the author's previous work on "Dies."

Modern Plumbing Illustrated

By

R. M. STARBUCK

Price $4.00



A comprehensive and up-to-date work illustrating and describing the Drainage and Ventilation of dwellings, apartments, and public buildings, etc. The very latest and most approved methods in all branches of sanitary installation are given. Adopted by the United States Government in its sanitary work in Cuba, Porto Rico, and the Philippines, and by the principal boards of health of the United States and Canada. 300 pages. 55 full page illustrations.

☞ *A special circular describing these books sent on request.*

☞ *Any of these books sent prepaid on receipt of price.*

MUNN & CO.,

Publishers, 361 Broadway, New York

Boot and shoe shanks, metal, Keystone Shank Co. 71,233
Boots and shoes, leather, Roberts Johnson & Rand Shoe Co 71,191
Boots, shoes, and slippers, women's leather and cloth, Murray Shoe Co 71,188
Buttons, Emil Wahl Manufacturing Co., 71,180, 71,181
Canned fruits, certain, Armsby Preserving Co. 71,251, 71,252
Cement, adhesive liquid, Benjamin & Gee.... 71,218
Chemicals, certain, Western Grocer Co..... 71,268
Chocolates, Touraine Confectionery Co..... 71,244
Cigars, Deisel-Wemmer Co. 71,222
Cigars, F. Garcia & Bros. .... 71,225 to 71,229
Cigars, Jamaica Tobacco Co 71,232
Cigars, cheroots, and stogies, F. M. Hunt... 71,231
Coats, George W. Davis Co 71,184
Coats, Steefel, Strauss & Connor......71,195, 71,196
Coffee, blend of Java and Mocha, S. Hamill Co. 71,214
Coloring materials, anilin, Schoellkopf, Hartford & Hanna Co 71,242
Diagnostic instruments, electrically lighted, American Cystoscope Makers 71,197
Disinfective scouring compound, C. White... 71,247
Electrical apparatus and supplies, certain, Johns-Pratt Co. 71,259
Electrical apparatus and supplies, certain, Manhattan Electrical Supply Co 71,260
Felt and felt asphalt roofing, Cream City Roofing and Paint Manufacturing Co.... 71,203
Foods, certain, Foley Bros. & Kelly..71,256, 71,257
Foods, certain, Howell & Bursk 71,258
Foot protectors, M. Schultz 71,193
Furniture polish, F. L. Taylor 71,215
Glassware, certain, Anchor Glass Co 71,249
Gloves, kid, T. N. Foster & Co 71,183
Grape juice, Vineland Grape Juice Co 71,246
Hair remover, W. G. Korony 71,235
Hair tonic, A. S. Strouse Manufacturing Co. 71,243
Hair tonic, F. I. Carreas 71,254
Hardware, certain, Thomas Laughlin Co 71,266
Harness and leather polishing preparations, P. Jamieson .... 71,206 to 71,208
Heating apparatus, certain, I. A. Sheppard & Co. 71,265
Hosiery, C. Chipman's Sons......71,178, 71,179
Hosiery, Manheim Hosiery Mills Co 71,187
Hosiery, Lord & Taylor 71,201
Lamp bodies, burners, brackets, and wicks, Connecticut Trading Co 71,221
Lamp, miner's or driver's oil, W. Tunnessen. 71,245
Lawn, A. L. Reid & Co 71,175
Linoleum and oiled cloth, A. H. Slater 71,194
Lumber, vulcanized, National Wood-Vulcanizing Co. 71,211
Malt beverage, non-intoxicating, Decatur Brewing Co. 71,204
Medicated lozenges for coughs, Henry Thayer & Co. 71,230
Moccasins, Sawyer Boot and Shoe Co 71,192
Musical instruments, certain, Autotone Co 71,198
Packing, asbestos, New Jersey Asbestos Co.. 71,237
Packings, steam and hydraulic, Woven Steel Hose and Rubber Co 71,270
Paper bags, Union Bag and Paper Co 71,217
Paper, bond and writing, Blake, Moffitt & Towne 71,219
Paper, carbon, W. C. Lewis 71,185
Pencils, lead, Eagle Pencil Co 71,223
Pens, fountain, Mabie, Todd & Co 71,236
Petticoats, W. Epstein & Bro 71,182
Petticoats, Edwards Manufacturing Co 71,224
Refrigerators, Odorless Refrigerator Co 71,238
Rubber and leather boots and shoes, Binghamton Shoe and Rubber Co 71,176
Rubber boots and shoes, Regal Shoe Co., 71,189, 71,190
Rubber goods, certain, Hannoversche Gummi-Kamm-Compagnie 71,199, 71,200
Salve, W. Seeger 71,263
Sash-operating apparatus, American Machinery Co. 71,248
Sedatives and tonics, nerve, L. H. Leber.... 71,209
Sidewalk, vault, sky, and floor lights, Berger Manufacturing Co. 71,253
Soda, baking, Church & Dwight Co 71,220
Speed records, Recometre Company of America 71,239
Stogies, J. Richman & Bro 71,240
Suits and overcoats, men's and youths' Likes, Berwanger & Co 71,186
Syrup compound of corn, cane, and maple, Manierre-Yoe Syrup Co 71,261
Taffy, nut, Trowbridge Chocolate Chip Co.... 71,216
Thread, cotton, Blidgett & Orswell Co 71,177
Toilet preparation, semisolid, H. S. Wellcome 71,267
Toilet preparations, certain, V. B. Thomas.. 71,265
Tools, certain, Whiton Hardware Co 71,269
Trout flies, J. N. Kline 71,234
Undergarments, ladies' combination, A. Mayer 71,202
Washing machines, International Factories Co. 71,205
Wines, red and white, Rosenblatt Co 71,241
Woodworking machinery, Defiance Machine Works 71,255

LABELS.

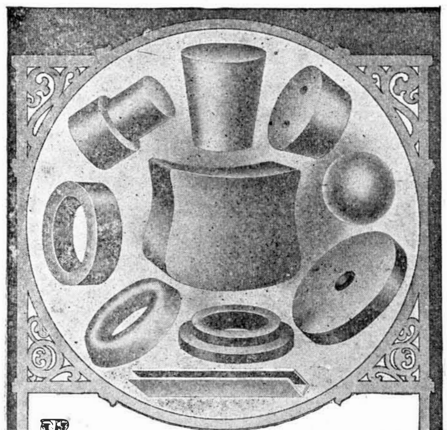
"Armour Clad," for cigars, G. Dottling..... 14,470
"Black Cup Leathers Mark 'Perfection,'" for cup leathers, Mark Manufacturing Co. 14,484
"Captain Alippo," for cigars, G. Dottling... 14,473
"Casa del Mundo," for cigars, G. Dottling.. 14,463
"Cigars," for cigars, American Lithographic Co. 14,462
"Comerciales," for cigars, G. Dottling.... 14,479
"Court Favorite," for cigars, G. Dottling.... 14,469
"Doc Gordon," for cigars, G. Dottling...... 14,464
"Donna Marietta," for cigars, G. Dottling... 14,474
"El Edo," for cigars, Schmidt & Co.......... 14,481
"El Sagaz," for cigars, G. Dottling......... 14,471
"Exceptionales," for cigars, G. Dottling...... 14,476
"Flor de Isla," for cigars, G. Dottling...... 14,465
"Govanas," for cigars, Schmidt & Co......... 14,482
"Gran Comercio," for cigars, G. Dottling... 14,466
"Invincible," for cigars, G. Dottling...... 14,475
"La Adarga," for cigars, G. Dottling...... 14,468
"Mark 'Quality' Cup Leathers," for cup leathers, Mark Manufacturing Co........ 14,485
"Mark 'Standard' Cup Leathers," for cup leathers, Mark Manufacturing Co........ 14,486
"Miss Primrose," for cigars, G. Dottling... 14,472
"Non Plus Ultra," for cigars, G. Dottling... 14,467
"Petit Bouquet," for cigars, G. Dottling.... 14,480
"Pour La Noblesse," for cigars, G. Dottling. 14,478
"S. B.," for cigars, Smith Bros. Co. Ltd.... 14,483
"Smoke Cigars," for cigars, American Lithographic Co. 14,461
"Superfina," for cigars, G. Dottling......... 14,477

PRINTS.

"The Alexander Belt," for belting, Alexander Bros. 2,379
"The Contrast," for bottles insulated for resisting change of temperature of contents, G. P. Altenberg 2,378
"The Winning Whiskey," for straight whisky, James Olwell & Co 2,376
"Turn failure into victory. Don't let your courage fade. And if you get a lemon, Just make the lemon-aid," for lemonade.. 2,377

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

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



WE MANUFACTURE MOULDED AND SPECIAL RUBBER GOODS OF EVERY DESCRIPTION AND CAN FURNISH ANY SPECIAL RUBBER ARTICLE TO YOUR SATISFACTION

NEW YORK BELTING & PACKING CO. LTD. 91-93 CHAMBERS STREET. NEW YORK

Calendar Watch

Registers the Second, Minute, Hour, Day of Week, Date of Month, and Phases of Moon. Changes Automatically. Stem-wind and set; jewelled pivot holes; expansion balance; accurate and reliable; richly decorated dial

(Cut two-thirds size)

Price, $7.45

Refunded if not as represented. Express Prepaid if remittance comes with order. Two or more, $7 each. References: Com. Agencies, N. Y. Banks or any Express Co. Fine Holiday Gift.

Gun-metal cases.

Dellhart Makers & Traders, Ltd., 1487 Bryant Ave., New York

DECARBONIZER

chemically removes carbon from cylinders, piston rings and valves.

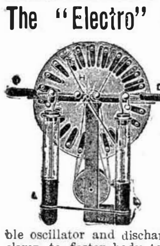
INCREASES POWER 20 PER CENT

Volatilizes carbon, in which form it passes out thru exhaust. Injury to metal impossible. Agents wanted in certain localities. Sample, quart can, $1.50. Write to-day for particulars.

General Accumulator & Battery Co

128 Second Street, Milwaukee, Wis.

The "Electro" Static (Wimshurst) Machine



Guaranteed to generate in any kind of weather, no matter foggy or rainy. First machine ever constructed which can truthfully claim this. We absolutely guarantee a fat, powerful 3-inch spark. Used successfully to operate Geissler and X-ray tubes, charging the biggest Leyden jars, firing powder, working wireless sets, raising a person's hair, etc. Anybody interested in electricity owes it to himself to possess one of these wonderful machines. Can be used to perform thousands of interesting experiments. Cut shows machine plainly. It comprises two 8-inch glass crystal plates revolving in opposite directions, two adjustable oscillator and discharging rods and balls D, collectors H, and iron clamp to fasten body to table. Size over all 11x14 inches. Weight, boxed, 8 pounds. Nothing to wear out, no batteries, no trouble, simply turn the crank, the machine does the rest. Price complete, boxed, $3.75. If you haven't got our 100-page cyclopedia-catalogue No. 4 send 2-cent stamp for it; contains 100 electrical experiments.

ELECTRO IMPORTING CO., 84 a West Broadway, New York City

"Everything for the Experimenter."

IF You Knew

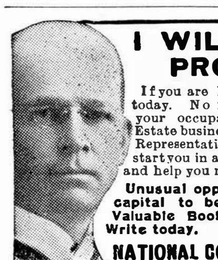
what our engine would save you in time—work—money—you'd find out **now** about our **big 30-day Free Trial Offer** on the

Waterloo Boy

the 5-year guaranteed gasoline engine

Write today for free catalogue and our big special offer.

Waterloo Gasoline Engine Company Dept 19 Waterloo, Iowa.



I WILL MAKE YOU PROSPEROUS

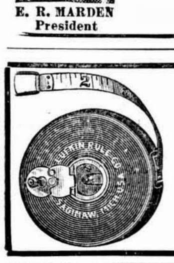
If you are honest and ambitious write me today. No matter where you live or what your occupation. I will teach you the Real Estate business by mail; appoint you Special Representative of my Company in your town; start you in a profitable business of your own, and help you make big money at once.

Unusual opportunity for men without capital to become independent for life. Valuable Book and full particulars FREE. Write today.

NATIONAL CO-OPERATIVE REALTY CO.

E. R. MARDEN President

120 Marden Building Washington, D. C.



LUFKIN

TAPES AND RULES

ARE THE BEST.

For sale everywhere. Send for Catalog No. 16.

LUFKIN RULE CO.

Saginaw, Mich., U. S. A.

New York and London.

HELMET OIL LUBRICATES ANYTHING SEND FOR SAMPLE FREE

15-21 S. CLINTON ST. C.H. BESLY & CO. CHICAGO, ILLINOIS, U.S.A.

The Howard Watch

The accuracy of his recorded time is a matter of life and death to Peary in his dash for the Pole—his only means, after leaving his ship, of taking his longitude or knowing where he is in relation to the Pole and to his base of supplies.

Peary depends solely on the HOWARD Watch on this expedition, as on his former one. The last thing before sailing Peary telegraphed:

"E. Howard Watch Co., Boston.

Get three your new 12 size extra-thin watches to me Sidney, Cape Breton, Nova Scotia by Monday sure. Shall use them in addition to three 16 size carried last voyage."

It is not the occasional performance of the HOWARD that makes men trust their lives to it, but its accuracy under *all conditions*—heat, cold, vibration, change of position and the jar and jolt of every-day use.

A Howard watch is always worth what you pay for it. The price of each watch—from the 17-jewel in a fine gold-filled case (guaranteed for 25 years) at $35; to the 23-jewel in a 14K solid gold case at $150—is fixed at the factory, and a printed ticket attached.

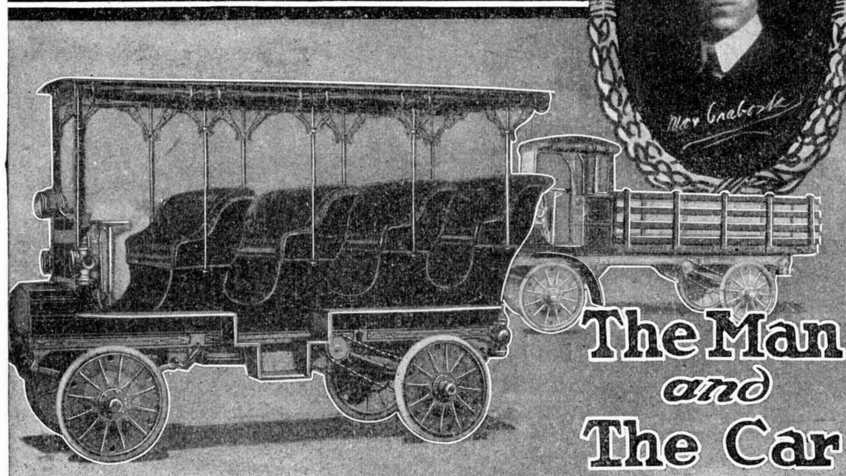
Find the HOWARD jeweler in your town and talk to him—he's a man worth knowing. Drop us a postal card, Dept. P, and we will send you a HOWARD book, of value to the watch buyer.

E. HOWARD WATCH COMPANY, Boston, Mass.

GRABOWSKY

WE GUARANTEE SERVICE

POWER WAGONS



The Man and The Car

Mr. Max Grabowsky, of Detroit, was the first automobile designer to produce a gas-propelled motor car exclusively for commercial use.

His first car, which was not only mechanically correct but proved an excellent money earner for its purchaser, is still in operation.

To-day there are more commercial power wagons of Mr. Grabowsky's design in active service than any other type of business motor car.

After years of experience in this field, after watching the performance of his own and other models, Mr. Grabowsky offers to the business men of America a power wagon that marks the highest standard yet reached in a commercial vehicle. The keynote in its construction is the quick detachable power plant which lessens the cost of maintenance and operation. In actual service it has proven its ability to give every-day, money-earning service to its owner with less delays and expense of upkeep than with any other method.

Our Expert Advice Without Cost to You

Power wagons are fast supplanting horse delivery wagons. You see them used today by the most progressive firms in every large city. You would use them too, if you realized how much they would save you, and how quickly they pay for themselves.

We have organized an Expert Service Bureau, with Mr. Max Grabowsky at its head, and will gladly advise any business man, without charge, regarding the actual saving he can make by using power wagons, either for delivery or passenger work. Valuable experience is at your disposal. Write today, outlining briefly your needs.

GRABOWSKY POWER WAGON CO., Service Bureau, 78 Champlain St., Detroit, Mich.

We will exhibit in New York, only at Grand Central Palace Auto Show, opening Dec. 31.

Engineering News

(ILLUSTRATED)

The Leading Engineering Paper of the World. For Civil, Mechanical, Mining and Electrical Engineers

100 to 125 pages, 9" x 13", weekly. Send ten cents for sample copy.

THE ENGINEERING NEWS PUBLISHING CO., 214 Broadway, New York

The HOLSMAN

High wheels travel all roads because all roads are made to be traveled by high wheels. The Holsman will go up any hill, over rocks, ridges or stumps, through deep mud, ruts and sand. Winner in greatest 1908 hill climb in America. Operation under one cent a mile. Up-keep under ten cents a day. Solid rubber tires. No differential gears or friction clutches. Built by the oldest and largest manufacturers in the world.

Sales Last Year $600,000

Get catalog and testimonials

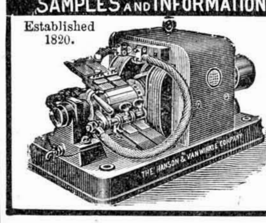
HOLSMAN AUTOMOBILE CO. 245 Monadnock Blk. Chicago, Ill.

Goes Anywhere

COLD GALVANIZING.

AMERICAN PROCESS. NO ROYALTIES.

SAMPLES AND INFORMATION ON APPLICATION.



Established 1820.

NICKEL AND Electro-Plating Apparatus and Material

THE Hanson & Van Winkle Co., Newark, N. J.

28 & 30 S. Canal St. Chicago.

New British Patent Act

RESPONSIBLE manufacturing firm operating large, up-to-date brass and copper rolling mills in Birmingham, England, is open to receive proposals from owners of American Patents protected in Great Britain, for the production of any of the under-noted articles or machines:

- Blanking Machines.
- Cupping Machines.
- Drawing Presses.
- Power Stamping Machines.
- Cartridge Piercing Machines.
- Heading Machines.
- Indenting Machines.
- Bullet Machines of every description.
- Cutting-off Machines.
- Automatic Feeds for the whole of the above.
- Machines for the Manufacture of Explosives.
- Paper Tube Rolling Machine for Sporting Case Work.
- Paper Tube Polishing Machines.
- Rivet and Nail Machines.
- Detonator Machinery.
- Wire Covering Machinery.

Apply in first instance to

J. H. LAU & CO.

P. O. Box 580, New York City, New York

DRAPER'S

Recording Thermometer

Traces automatically a correct and continuous record in ink of the temperature on a graduated weekly chart. Made in two sizes, and standardized and fully guaranteed. Also other weather recording instruments.

THE DRAPER MFG. CO.

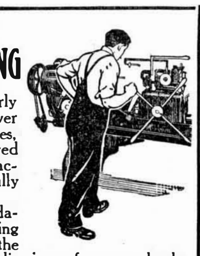
152 Front St., New York

GROBET Swiss Files

and other tools shown in catalog 27. Sent free if you mention this paper when writing.

MONTGOMERY & CO., 109 Fulton Street, New York City

CYCLOPEDIA OF MECHANICAL ENGINEERING



Seven practical volumes; nearly 3,500 pages, size 7 x 10 inches; over 2,000 illustrations, diagrams, plates, formulas, etc.; bound in half red morocco; contains a series of practical test questions and is carefully indexed for ready reference.

This Cyclopedia covers the fundamentals of Mechanical Engineering thoroughly, in addition to giving the latest instruction on the latest applications of new and advanced ideas; heavy technicalities and mathematical formulas have been avoided wherever possible. It embodies the accumulative results of practical experience in the machine shop, engine room, drafting room, factory, etc. Shop-room superintendents, foremen and machinists, foundry-men, iron and steel workers, boiler makers, automobilists, stationary engineers, gas and oil engineers and gas producer operators, sheet metal workers, draftsmen, etc., will find in it the means of advancement.

The Cyclopedia is admirably adapted to the needs of a beginner and self-taught practical man, as well as being an authoritative reference work, adequate to meet the demands of the most advanced workman and technically trained expert. To introduce our Home Study courses, from which the Cyclopedia was compiled, we make this special

FREE 5 DAY OFFER

Without deposit—sent by prepaid express for five days' *free* examination if you mention the name of your employer and occupation. If you wish to keep the books, send $2 within five days and $2 a month until you have paid the special price of $18.60; otherwise notify us to send for them at our expense. Regular price is $36. Order promptly and we will include *free* for one year as a monthly supplement, the

TECHNICAL WORLD MAGAZINE

a regular $1.50 magazine, full of special articles and interesting photographs on technical topics written in popular form.

TABLE OF CONTENTS

Machine Shop Work—Vertical Milling Machine—Motor-driven Shops—Shop Lighting—Forging—Electric Welding—Tool Making—Metallurgy—Manufacture of Iron and Steel—High-Speed Steel—Flaws in Castings—Electric Lifting Magnets—Magnetic Clutches—Making a Machinist—The Ideal Foreman—Pattern Making—Foundry Work—Automatic Coal and Ore Handling Appliances—Machine Parts—Construction of Boilers—Types of Boilers—Boiler Accessories—Steam Pumps—Air Compressors—The Steam Engine—The Steam Turbine—Indicators—Valve Gears—Refrigeration—Gas-Producers — Gas Engines — Automobiles — Elevators — Sheet Metal Work—Practical Problems in Mensuration—Mechanical Drawing—Drafting Room Organization—Machine Design.

AMERICAN SCHOOL OF CORRESPONDENCE

CHICAGO, U. S. A.

MENTION SCI. AMER. 11-21-08