SCIENTIFIC AMERICAN

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

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI.—No. 10. ESTABLISHED 1845. NEW YORK, SEPTEMBER 4, 1909. 10 CENTS A COPY $3.00 A YEAR.

This machine can handle 200 tons of limestone per hour. The grab bucket, 7½ feet wide and 17½ feet long, when open, can "grab" 100 cubic feet of limestone; hoist it at 275 feet per minute; and convey it to the desired position at a speed of 900 feet per minute.

POWERFUL ELECTRIC HOISTING AND CONVEYING MACHINERY.—[See page 156.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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

Published Weekly at

No. 361 Broadway, New York

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

TERMS TO SUBSCRIBERS.

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

THE SCIENTIFIC AMERICAN PUBLICATIONS.

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

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

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

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 4th, 1909.

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

LESSONS OF THE RHEIMS AVIATION CONTESTS.

The series of aviation contests held last week at Rheims must ever stand out conspicuously in the history of man's age-long attempt to achieve the "conquest of the air." In speed, duration of flight, and stability under unfavorable atmospheric conditions, the achievements have shown a wonderful advance in the art of aviation. It is safe to say that the most significant feature of the contest—the one which is most prophetic of the future serviceableness of the aeroplane—is the way in which the various aviators dared the elements by bringing out their machines and making some of their best flights when the wind was of a strength which hitherto has been considered prohibitive. It was the unfavorable weather conditions, rather than the distance which he covered, that constituted Latham's spectacular flight of 96 miles at a speed of 41½ miles an hour, the most remarkable performance since the Wright brothers made that first memorable half-mile flight in North Carolina with a power-driven aeroplane.

For it cannot be denied that the reluctance of the aviator to bring his machine from the shelter of its shed, except in the lightest airs, had shaken the faith of the public in the immediate, if not the ultimate, practicability of the aeroplane. That reckless daring of the Gallic character, which did so much to bring out the inherent high speed of the automobile, seems destined to work a similar result in the even more dangerous field of aeronautics. If the cabled accounts of Latham's flight are not over-seasoned with the inevitable enthusiasm of the moment, the behavior of his machine during the progress of a storm of wind and rain was indeed phenomenal. "For an hour," says the dispatch, "with fluttering wings it fought its way against the storm of rain and wind at an average height of 150 feet, mounting higher as the wind rose, until during the worst of the storm it was fully 300 feet above the spectators." But it was reserved for Farman, driving a biplane of his own design, to establish beyond all question the staying qualities of this type. His official record of 111.78 miles in 3 hours 4 minutes 56 seconds and his total flight of 118 miles in 3 hours 15 minutes has carried the long-distance record beyond the expectations even of the most sanguine.

At the present writing the results at Rheims seem to have established the superiority of the monoplane in speed and of the biplane in endurance. Bleriot with a monoplane holds the record for speed with a time of 7 minutes 47 4/5 seconds for a lap of 6.21 miles, although Curtiss in his beautifully designed and built biplane is a good second, with a record of 7 minutes 48 2/5 seconds. The compact little biplane of Curtiss, weighing less than half as much as those of his competitors, won the international cup, over a 12.42-mile course, in 15 minutes 50 3/5 seconds. Summing up the results, it may be said that the brilliant tournament at Rheims has established three facts: First, that the problem of stability has been solved; secondly, that an aeroplane motor has been produced which will run until the gasoline tanks are empty; and thirdly, that the problem of alighting without injury to man or machine is yet a long way from solution. Regarding this last feature, we offer the suggestion that, since the accidents are due largely to the widely extended and delicate wings or planes coming in contact with the ground, a great step toward the perfection of the aeroplane will have been achieved, if some method can be devised by which, at the moment of alighting, the planes can be thrown upward and backward, so as to imitate in some degree the folding of the wings when a bird alights. That the problem would present great mechanical and constructional difficulties, we admit. In a biplane, because of the rigid trussing, it would seem to be impracticable; but it is conceivable that the problem might be worked out in the monoplane.

A SANITARY DRAINAGE CANAL FOR BUFFALO.

The Chicago sanitary and ship canal, 22 feet deep, 160 feet wide, and 32 miles in length, which was cut through for the purpose of carrying the sewage of Chicago clear of Lake Michigan, and so preserving the purity of Chicago's drinking water, has proved to be a notable success. The city of Buffalo is now seeking permission to cut a similar drainage canal, to divert its sewage from the Niagara River, and thereby get rid of what is recognized to be a great menace to the inhabitants of the Niagara frontier. This good work is to be accomplished by the creation of certain artificial channels, into which the effluents from all the sewers can be discharged; and it is a fortunate fact that the geographical location of the city makes it possible to do this, by the construction of what is called the Erie and Ontario sanitary canal. It is proposed to draw 6,000 cubic feet of water per second from Lake Erie; reverse the flow in Buffalo River and Smokes Creek, and carry the diverted water to Lake Ontario through an entirely new canal, at a total estimated cost of $30,000,000.

The mean elevations shown on the United States topographic maps for Lakes Erie and Ontario are respectively 573 and 246 feet. Hence the total difference in level between the two lakes is 327 feet. The channel will be so located and constructed as to make the entire head of 327 feet, less a small loss in the necessary slope for flow, available for the development of power. This means that there will be an absolute conservation of the entire natural energy of the water; whereas most of the powers now existing along the Niagara River use less than one-half of the total head between the two lakes. That portion of the work which lies within the city limits will be built by the city itself. The rest of the canal will be built by private capital; and the residents on the Niagara frontier will be given the perpetual right to drain their sewage into the artificial channels thus created. Relief will thus be afforded to the people who live along the Niagara River, and are dependent upon that stream for their drinking water.

The excavation of the canal will commence at the point where Buffalo River crosses the city line on the east, and it will be excavated of sufficient depth and width to stop the crest of the south Buffalo floods by carrying off the waters of the Buffalo, Cayuga, Cazenovia, and Smokes creeks. The canal will be constructed below all the railroads that enter Buffalo from the east, and will pass through the divide at Williamsville through a tunnel four miles in length. After emerging from the tunnel it will be continued in open cutting as far as the State barge canal, below which it will be carried by a siphon. Here the two canals will be connected by a lock, through which the traffic of the barge canal can be floated to the freight yard at Gardenville and on to Lake Erie, thus providing a barge canal terminal at Buffalo in addition to that at Tonawanda.

If this ambitious scheme were being promoted simply for the development of the 150,000 horse-power for industrial purposes which is the estimated capacity of the canal, the chances of securing government consent to the withdrawal of additional water from the Niagara River would be very small indeed; for there is no question that the governments of the United States and Canada, and the people of both countries are strongly opposed to any further diminution of the flow at Niagara Falls. The hope of the scheme lies in the fact that it will effectually purify the supply of drinking water, not only of the second largest city of the State, but also of the country and towns adjacent to the Niagara River. It is estimated that the construction of the Chicago drainage canal has reduced the high rate of mortality in that city by 51.4 per cent, and similar results may be looked for in Buffalo. Though the SCIENTIFIC AMERICAN has always strongly opposed any further withdrawal of water from the upper Niagara River, we think that the withdrawal of 6,000 cubic feet per second to provide this important city with a pure water supply is a proposition which demands the separate and careful consideration of the Federal government.

WHY DO WATCH MAINSPRINGS BREAK?

Your watch has stopped without apparent cause, and you at once attempt to wind it. The crown turns with a new sense of ease; but the operation is endless. Then you learn that a fickle mainspring concluded to resign its task and, well—simply broke. Why? Here is a query that may stand in the company of "Who wrote the letters of Junius?" "Who was the Man with the Iron Mask?" and other unanswered questions of history. The best mainsprings have maintained their right to break ever since modern watches were invented, and they will do so until some secret of Nature, for which watchmakers are still searching, is revealed. Sudden electrical disturbance of the atmosphere, extreme changes of temperature, or contact with a cold substance, will occasionally result in a broken mainspring. Such contingencies are well understood by watchmakers. What is not so well understood is why a spring will sometimes snap in twain or in twenty pieces, despite the best of care. You may ascribe it to a fit of temper or to the dog days, or give any other reason that is neither logical nor horological. The fact and the mystery remain. This spring is a piece of tempered steel, usually about twenty inches long, coiled in a barrel between the upper and lower plates of the movement. It is the motive power of the watch. It is made in degrees of strengths, widths, and thicknesses suitable to the watch. As a mainspring is subjected to varying conditions, from that of highest tension when fully wound to that of comparative rest when the watch is run down, and as it is constantly undergoing a change in resistance as its coils unfold, it seems to be the only part of the watch, subject to casualties, against which even careful use cannot always provide.

It may be well to state, just here, that all watches of a given make and size do not properly take the same strength of spring. A variation in thickness of only two one-thousandths of an inch may be the measure of the difference between the right and the wrong mainspring for your watch. Here is the field of the qualified watch repairer. To fit a mainspring requires some deftness; but to fit the proper one demands practical experience and judgment. If your watch is worthy of a spring at all, pay a competent watchmaker a proper charge for a good one.

But the question, "Why do watch springs break?" remains unanswered, and the puzzle is still further complicated when we are informed by one of the largest manufacturers of watches in the world, that a sudden spell of hot weather is invariably succeeded by a noticeable increase in the number of complaints of broken watch springs. At first thought this information is puzzling. A sudden drop rather than a sudden rise in temperature would seem to be the natural predisposing cause. Cast metals show greater brittleness at low temperatures under all kinds of stress, and steel and iron, though at low temperatures they show but little loss of strength under static or under gradually applied stresses, show a marked loss under impact or sudden stress.

We can understand the breakage of a mainspring when, in very hot weather, the watch is taken from a heated trousers or vest pocket and laid suddenly on a cold marble or iron slab; but how shall we explain the sudden breaking of the spring while the watch is running undisturbed in the pocket? Here is a question which we commend to consideration and discussion by our readers.

THE FIRST VOYAGE OF THE "ZEPPELIN III."

The new "Zeppelin III." dirigible, after a trial flight of over two hours on August 26th, started on a trip from Friedrichshafen to Berlin at 4 A. M. August 27th. The journey was to be made *via* Nuremberg, Leipsic, and Bitterfeld, the total distance in an air line being about 400 miles. After covering 280 miles, the airship descended at Nuremberg, at 4:45 P. M., to effect repairs to one of the motors and also to one of the propellers. The first descent was made at Ostheim shortly before noon, for the purpose of taking on water ballast. The airship reascended at 2:30, and reached Nuremberg, 80 miles distant, in two and a quarter hours, an average of 35 miles an hour. From Friedrichshafen to Ostheim it averaged 25 miles an hour. Count Zeppelin awaited his new craft at Bitterfeld, which point it was expected to reach without a stop. It was his intention to pilot the airship himself from that place to Berlin, where the Emperor was awaiting him.

This new airship has two 150-horse-power motors, and is the most powerful air craft thus far produced.

In a new English gas works it was observed that incandescent gas mantles rapidly diminished in brightness and acquired a brown incrustation, which was found to consist of ferric oxide. By examining the gas at various stages of manufacture it was ascertained that the finished product contained the compound carbonyl of iron, formed by the action of the carbon monoxide of the gas upon the iron pipes through which the gas passed at comparatively low temperatures in the later stages of the process. No iron compound was found in the gas discharged by the retorts and the hottest pipes. Carbonyl of iron is not affected by dilute hydrochloric acid. When the gas is burned the carbonyl of iron is decomposed into iron and carbon monoxide. A few weeks later, the production of carbonyl of iron was found to have diminished considerably. Hence the conclusion was drawn that the interior of the pipes had become coated with tar and naphthalene which protected the iron from the action of carbon monoxide.

ENGINEERING.

The ferry bridge continues to find favor in Europe. One of this type, with a span of 910 feet, is planned for erection across the Rhine at Koblenz, Germany. The floor with its double tracks will be carried by a steel arch. Another ferry bridge of even greater length is to be built at Bordeaux, France, over the Garonne, which at the point of crossing has a width of over 1,500 feet.

The submarine is advancing steadily in size and capacity. France has recently launched the "Archimedes," whose displacement of 800 tons constitutes her the largest submersible boat afloat. She is 229 feet 8 inches in length, and is driven by twin-screw engines at a speed of 15 knots on the surface, and 10 submerged. Her steaming radius is 2,500 miles.

In view of the sudden rapid decrease in the freight-car surplus during the latter part of July and the first half of August, the American Railway Association considers that within a few weeks there may be a shortage of cars. In the second week of August there was a surplus of 207,173 cars, which represented a decrease of about 36,000 cars during the preceding two weeks.

During the year 1908, there were 470 boiler explosions in the United States, as compared with 471, 431, and 450 respectively in 1907, 1906, and 1905. The number of persons killed by boiler explosions in 1908 was 281; in 1907, 300; in 1906, 235; and 383 in 1905. During the intervening period since October 1st, 1867, the total number of boiler explosions was 10,051, in which 15,634 people were injured, and 10,884 were killed.

One of the most severely used portions of a city street is the row of headers which line the inside edge of car rails, for they are continually exposed to a particularly severe grinding effect from the wheels of drays and other heavy horse-drawn traffic. A test of iron-slag block paving is being made in the Borough of Richmond, New York, where a line of such blocks has been laid along the inside of the rails of streets paved with asphalt blocks. They are reported as showing excellent wearing qualities.

We have recently referred to the plan by which the United States government is now purchasing its coal on the basis of its heating value, which is ascertained by analyses of samples. The new system of purchase applies to forty buildings in Washington, over three hundred public buildings throughout the United States, the navy yards and arsenals, and the Panama Canal. Already the government has effected a saving of $200,000 on its annual fuel bill of $10,000,000.

Improvements in rolling-mill plants make it possible to roll in one section I-beams of a weight and size which were beyond the capacity of the mills of the last decade. Formerly, when an I-beam or other rectangular shape exceeded a certain size, it had to be built up of plate and angles riveted together. The Bethlehem Steel Works, which has been rolling unusually large shapes, has met with such success that Mr. Schwab is about to expend $5,000,000 in the erection of new furnaces and mills.

At last those two famous single-screw liners, the "Umbria" and "Etruria," holders of the transatlantic record in the 80's of the last century, have been withdrawn from service; not because they are by any means worn out, but because they cannot compete in economy with twin, triple, and quadruple screw engines of multiple-expansion and turbine type. These two vessels contain the largest single-screw marine engines ever built; they marked the close of what might be called the single-screw, compound engine period in the history of transatlantic travel.

Work is actively in progress on the construction of another mountain railroad across the Andes, this time from La Paz, Bolivia, to Aricas, Chili. The railroad, which is about 33 miles long, reaches an extreme height of 13,000 feet above the sea, and it will serve the important purpose of giving the commerce of Bolivia a port of exit. Sir John Jackson, of London, who has contracted to build the road for $15,000,000, on his way home from Chili, by way of New York, made a private inspection of the Panama Canal. He expressed his conviction that the work would be completed in six and possibly in five years from the present time.

The new Pennsylvania terminal station in New York is rapidly approaching completion, and the last piece of stone in the exterior finish of the station was recently put in place. The dimensions of this work are unusually large. The exterior walls are nearly half a mile in length, and they contain 490,000 cubic feet of granite. Adding to this 60,000 cubic feet of stone used inside the concourse, we get a total of 550,000 cubic feet of granite, weighing 47,000 tons, which required 1,140 freight cars to transport it from the quarries at Milford, Mass. Into the construction of the building there have also entered 27,000 tons of steel and 15,000,000 bricks, weighing 48,000 tons.

ELECTRICITY.

The British government is about to lay a telephone cable under the English Channel, to be connected with the present land lines at Dover and Calais. It will be equipped with Pupin coils, and is expected to materially improve communication between London and Paris.

The entire machine shop of the International Harvester Company at Sterling, Ill., is to be operated by electricity, for the generation of which turbines are now being installed. The substitution of motors at all the individual machines for shafting and belting is expected to reduce the power cost by one-half.

Many of the railways are arranging to employ telephones for train dispatching, the Northern Pacific having already 470 miles of telephone in service and 250 more projected, while the New York Central will have its whole route to Chicago under telephone control when 200 miles of equipment, in addition to the present 250 upon the Michigan Central, is complete.

A dressmaking establishment in Boston almost entirely operated by electricity has an electric cutter capable of cutting out 250 thicknesses of cloth at once, a button-sewing machine which puts on 3,000 buttons a day, a buttonhole machine making 400 per hour, sleeve sewers, tucking machines, waist and skirt machines making 1,800 to 3,500 stitches a minute.

A new hydro-electric power station has been completed on the Reedy River in South Carolina. It uses the entire flow of the river of 110 cubic feet per second, but has a storage reservoir of 1,600,000 cubic feet capacity retained by a masonry dam. Three turbines drive direct-connected generators, one of 300 and two of 600-kilowatt capacity, delivering 60-cycle three-phase alternating current at 2,300 volts pressure.

Prof. Gale of the University of Chicago is slowly recovering from his accident last March at the solar observatory at Pasadena, Cal., when he received a shock of 15,000 volts. He appears to have suffered less from the actual shock than from burns from a hot rheostat, upon which he was thrown by the shock and lay for a long time unconscious, but his recovery at all is remarkable and cause for congratulation.

The valuable work of the United States Forest Service has called attention, among many other matters, to the fact that damage to wooden telegraph, telephone, and electric-light poles by woodpeckers and similar birds may be prevented by creosoting. The value of this process for the preservation of wood both from decay and from fungous growth and wood-boring insects is well known. It has now been found that of poles of identical wood those which have been impregnated with creosote are immune from attack by birds of the woodpecker family in districts where untreated poles are severely injured.

The American Mono-rail Company announces that it will commence the construction of a mono-rail road through Pelham Park to City Island early this autumn. Engineers of the Public Service Commission, who saw the system in operation at the Jamestown Exhibition, say that a speed of 135 miles an hour may be expected over parts of the route where right of way has been granted away from highways, so that the train headway may be unrestricted. If this line meets with the approval of the public, application will be made for permission to operate mono-rail express trains on an upper deck over the present elevated railways in New York.

The destruction by fire of the long-distance wireless telegraph station at Glace Bay, Nova Scotia, just as it was completed and ready for service, is not merely a serious blow to the Marconi Company, but very much to be regretted by all interested in the advancement of radio-telegraphy. The towers and aerials were not damaged, fortunately, and the boiler room and manager's house also escaped; but all the valuable machines had been specially made and cannot be duplicated, while quantities of spare parts for them, stored in the burnt-out condenser room, were ruined. The loss amounts to thousands of dollars, apart from the loss of business due to the station having to stand idle until new machines can be sent from Europe.

The latest machine in which electricity has been substituted for steam power is the steam shovel, which from its cumbrous parts, rough usage, and irregular loads did not seem a likely appliance to be electrically driven. Two 110-ton machines are used in limestone quarrying by the Dolese & Shepard Company of Chicago, in which the hoisting and the digging movement are controlled by separate motors of 200 and 80 horse-power respectively. Each motor is separately controlled by an automatic magnetic switch controller, securing the greatest nicety of operation and protecting the motor from overload due to rock encountered while digging. A feed cable is carried on a reel in the cab connecting at a convenient point with fixed conductor, and the shovel moves under its own power. It has been found very simple and economical in operation, requiring fewer operators than a steam shovel and eliminating the carrying of coal and water.

SCIENCE.

The seventy-fifth meeting of the British Association for the Advancement of Science was opened on August 25th in Winnipeg with six hundred delegates present from the United Kingdom, the United States, and Canada. The twelve sections of the Association remained in session for a week. One of the principal addresses was delivered by Sir J. J. Thomson, the president of the Association, and is published in the SCIENTIFIC AMERICAN SUPPLEMENT.

Capt. Rowland V. Webster F.R.G.S., is to head an expedition of the Royal Geographic Society to the South Pole. He expects to employ an aeroplane or some form of flying machine in making the final dash, and to follow the route taken by the German expedition a few years ago.

An effort is to be made to stock the Hudson River as well as other northern rivers of the United States with sturgeon, a fish that once swarmed in their waters, but which has since been exterminated. The proposal comes from Mr. Horace G. Knowles, formerly American Minister to the Balkan States. Through Mr. Knowles's efforts the Roumanian government has promised a carload of sturgeon fry, some cans of young sterlet, and smaller food fish to populate our waters. The first consignment of several hundred thousand fry will probably be planted in the Delaware River. The native sturgeon have been all but exterminated by wastefulness.

The ancient Romans excelled in making pottery. They possessed regular muffle ovens and even a sort of producer-gas oven. Attempts to produce the beautiful soft gloss peculiar to old Roman pottery have not yet attained complete success. The best result is obtained by Fischer's mechanical process, in which the ware, before it is fired, is coated with a paste of clay and pigment, and is then polished. Fine imitations of ancient pottery are thus produced, but the study of defective portions of the genuine *terra sigillata* ware shows that it was made by a different process, the gloss having evidently been produced by the application of a superficial glaze, without mechanical polishing.

Stoklaga has published the results of experiments in inoculating soil with nitrogen-fixing bacteria, which possess great power of assimilating free nitrogen and are retarded in development by nitrates in the soil. The radio-bacteria, on the other hand, decompose nitrates, and liberate nitrogen, which is voraciously consumed by the azotobacteria. The results of the experiments show that inoculation with nitrogen-fixing bacteria increases the crop and improves its quality, provided that care is taken to supply the carbohydrates, potash, and phosphoric acid which these bacteria require for their growth, and to neutralize the free acids of the soil by applying lime in liberal quantities.

Ozone is the best agent for purifying water, because it adds nothing except oxygen, which assists in aeration. An ozonizing plant has recently been installed at Saint Maur, near Paris, where the water of the Marne River was found to contain many disease germs, even after it had passed through sedimentation basins and sand filters. The ozone generators are of the Siemens type and are operated by a high-tension alternating circuit obtained by transforming the current of a 110-volt alternator, which is driven by a 44-horse-power steam engine. The total consumption of energy is 1 kilowatt hour for each 1,200 cubic feet of water, and more than half of the energy is employed in working the compressing pumps. The cost of sterilization is less than 5 cents per thousand cubic feet. The temperature of the water is lowered by the operation, and not a trace of nitrous oxide, chlorine compounds, hydrogen dioxide, or metallic salts due to corrosion of the apparatus can be detected in the sterilized water. Of the ozone absorbed, 73 per cent is consumed immediately in sterilization, 7 per cent remains diffused through the water and exerts a subsequent sterilizing effect, and 20 per cent escapes into the atmosphere.

Walter Wellman's second attempt to sail over the North Pole in a dirigible airship was made on August 15th, and proved a failure. The airship met with a mishap about thirty-two miles from the starting point. The leather guide rope, to which was attached a thousand pounds of provisions and stores, broke away. Relieved of this great weight, the airship shot up to a great height, but the pilot succeeded in bringing it down to earth, and in turning it homeward against a strong wind. No one was injured. The airship has been described in these columns in detail, for which reason it is hardly necessary to discuss its construction at length. Although the attempt was a failure, it must be admitted that while aloft the craft was maneuvered with ease. That it was brought to earth after its swift upward rush, and safely landed, speaks well for the power of its engines. Mr. Wellman has been working for four years to carry out his idea of reaching the North Pole by an airship. His aeronautical idea is the result of two expeditions by sledge and boat into the polar regions.

A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

When the steamship "Perry G. Walker" collided with the lock gates at Sault Sainte Marie, causing the wreck of two other steamers and doing damage to the locks which required weeks for repair, the captain stated under examination that he had signaled to his engineer to go astern, but that his signal had somehow been misunderstood, and the engines had started full-speed ahead. Such an accident is conclusive and incontrovertible evidence of the need of a reliable system of indicating the direction and speed of rotation of the propellers of vessels. It is but one instance of a chapter of marine accidents occurring annually from either the incorrect interpretation of signals given to the engine room from the bridge or the execution of signals given by the bridge which, owing to mental stress from impending accident, are incorrectly given. It is always extremely difficult for a board of inquiry to determine just with whom the error lies.

In the above instance, it is claimed by the captain that the correct signals were given, but instead of the engines being reversed at the critical moment, they were sent ahead; and before the error was discovered, such headway had been gathered by the vessel as to preclude all hope of stopping her within the limited lock space.

There is no question of the importance of enabling the captain and pilot to be at all times familiar with the interpretation and execution of signals. Errors are thereby immediately discernible, and correspondingly corrected before damage is done.

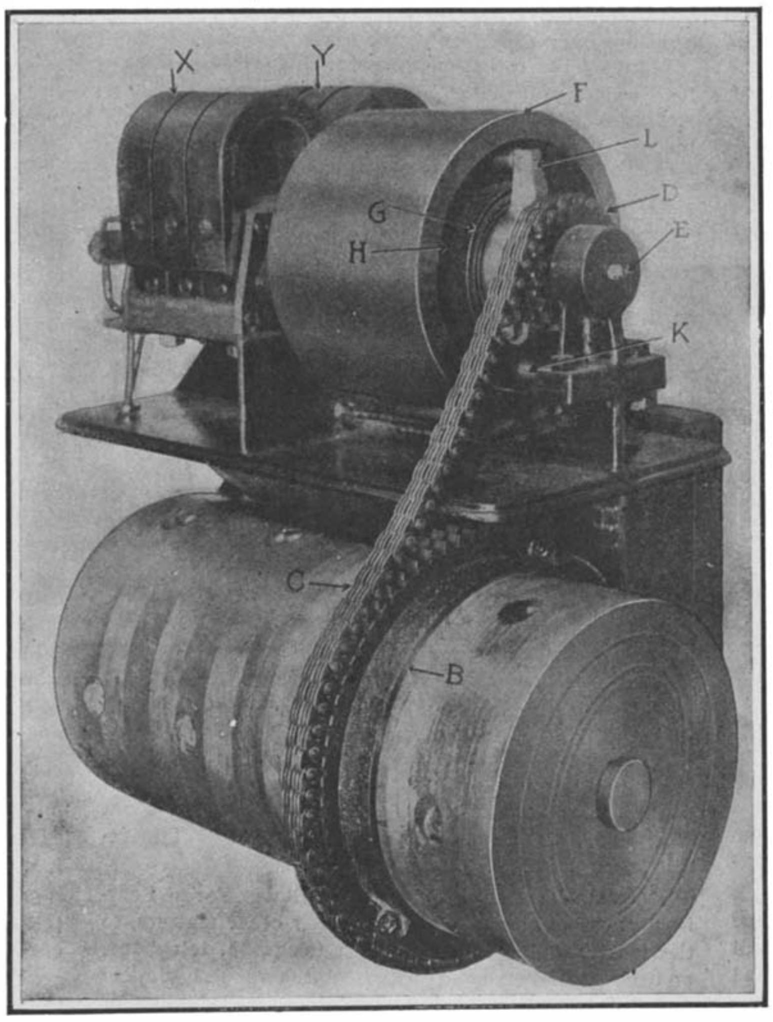
In the absence of a tachometer to show at a glance the rate in revolutions per minute at which the propeller shaft is turning, signals are executed by the engineer according to his best judgment. For instance, the execution of "half speed astern" may vary eight or ten revolutions per minute, and the pilot, depending upon a speed-checking effect, may be thrown off in his calculations by too slow a rate of turning of the engines.

When equipped with a tachometer system, however, the signals can be obeyed at an exact predetermined propeller-shaft speed, with corresponding increased accuracy and efficiency of handling the vessel. Warships in line or column formation must correctly execute the orders of the flagship, setting their speed to conform to the desired headway between ships, quickly and accurately. Otherwise a collision is probable.

The absence of an accurate and dependable tachometer up to the present, has made it necessary to arrive at the revolutions per minute by noting the turns successively by the revolution counter for preferably at least a half minute. If the speed of the shaft is too high, a rough guess must be made as to how much the throttle is to be closed, and another counting gone through. All this takes time, and is on too much of a cut-and-try system. With a tachometer to guide him, the man at the throttle has but to operate the throttle until the pointer of the tachometer rests on the desired R. P. M.

Range finding, for the accurate sighting of the guns, includes the determination of the distance of the object to be fired at, angle at which the warship is approaching or receding from the target, and the speed at which the vessel is traveling.

The first two factors are quickly and accurately determined by means of the modern range finder in the hands of skilled men, located on the masts or range towers of the warship. This is telephoned to the fire control sub-station. It then becomes imperative that the rate at which the engines are turning over at that instant be immediately determined, in order that the



A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

proper instructions may be telephoned at once to the turrets. The sooner the discharge of the projectile is effected after the range has been determined, the more accurate is the aim, and the greater the execution done.

In these calculations, the effect on ship speed by propeller speed, taking into consideration the extent and direction of wind and tide, is quickly and accurately calculated.

Relation between ship speed and propeller speed is frequently calibrated with due reference to increased fouling of the ship's bottom from marine growth, and is immediately available. Even when the engine-room forces are endeavoring to maintain an exact prearranged speed of rotation, this speed often varies, owing to the absence of accurate deadbeat tachometers for indicating at all times the rate of revolution.

Aside from the strategic advantages of a tachometer for indicating engine speed of rotation, the economic

(*Continued on page 167.*)

POWERFUL HOISTING AND CONVEYING MACHINE.

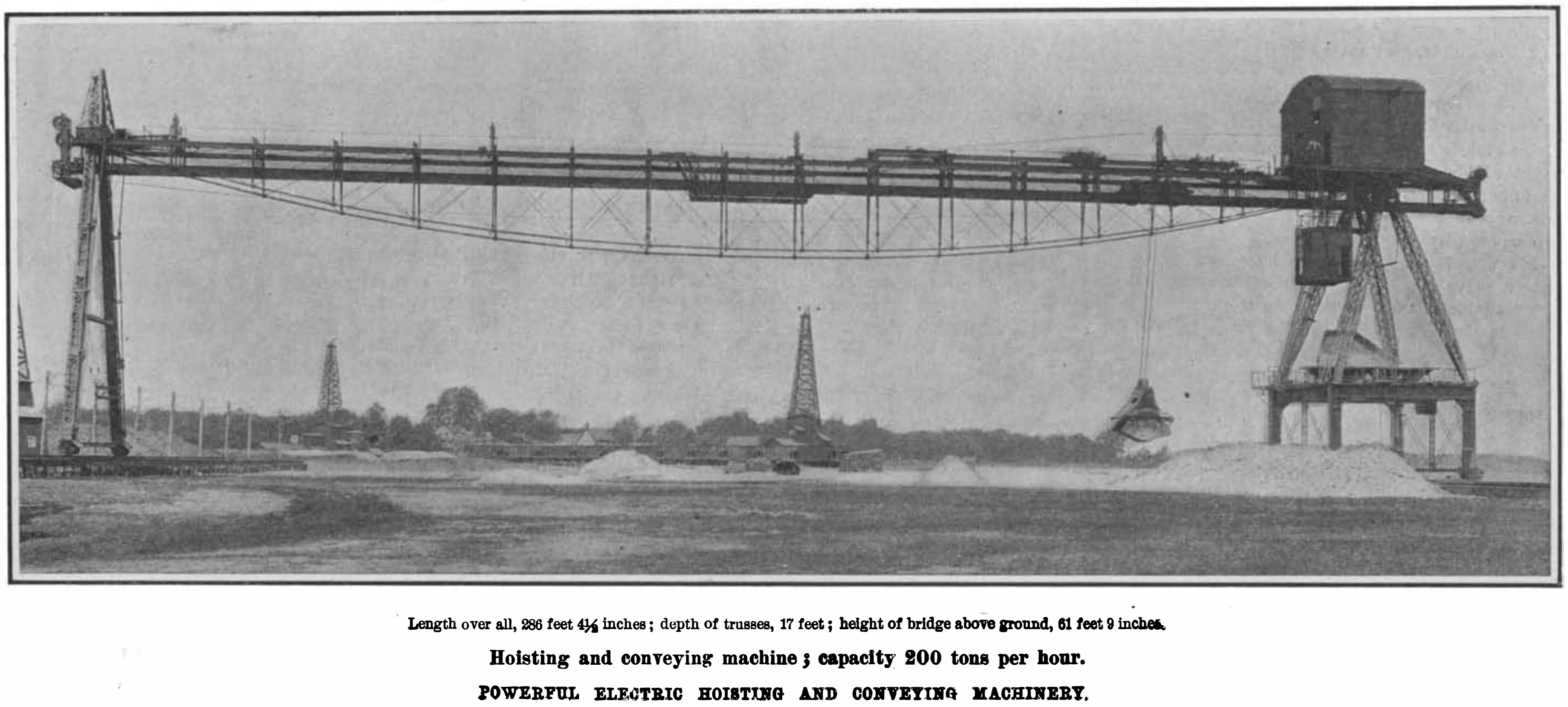
Nowhere in the field of mechanical engineering has American ingenuity in the design of labor-saving plants been shown to more striking effect than those great hoisting and conveying plants, which are such a prominent factor in our modern constructive and industrial operations. The rapid and cheap raising, removal, distribution and deposit of materials in large bulk is one of the most serious problems of the day; and it is the ingenious solution offered by American hoisting and conveying apparatus that has enabled our engineers to dig canals, build embankments, handle enormous loads of coal, iron ore, wheat, and corn with an economy undreamed of in an earlier day. We present illustrations of a powerful electric bridge tramway, designed and erected by the Brown Hoisting and Machinery Company for the Michigan Alkali Company, which is an excellent sample of the type of machinery above referred to.

The bridge, which is designed to handle the limestone in the stock yard of the company, has a span of 256 feet from center of pier to center of shear, with the center depth of 17 feet, and the total over-all of the structure is 286 feet 4½ inches. The height from top of rail to top of bridge at the shear is 59 feet 9 inches, and at the pier 61 feet 9 inches, the bridge being level. To the bridge span and its projection is attached a runway carrying a special trolley, arranged to handle either a two-rope grab bucket or a scraper bucket.

The pier consists of two specially designed shear legs mounted on a portal structure, arranged to straddle over two lines of railway track. The two shears are joined together at the top by a yoke connection, designed to carry the bridge structure. By this arrangement a free opening is allowed for the passage of the buckets through the pier support. The structure of the pier throughout is of medium open-hearth steel. The portal or lower portion of the pier consists of two pairs of legs joined together by girders and braces, and arranged to carry a bin for the reception and distribution of the limestone. The lower portion of the portal is mounted on four two-wheel equalizing trucks. These wheels are connected by bevel and spur gears to the driving machinery in the house on the bridge. The shear-leg support is of A-frame construction, mounted on two-wheel equalizing trucks, arranged to run on a single line of rail. At the top of the shear is a ball casting, upon which the main bridge is hung. The track wheels are connected with the moving gear in the engine by bevel and spur gears.

The bridge span consists of two parabolic pin-connected trusses, supporting the cross beams, from which the track stringers are suspended. The bridge span is supported on the pier support by roller bearings, and held in place by a vertical center pin. At the shear support it is hung from a ball-and-socket connection, in such a manner that the bridge may be skewed in either direction from its normal axis, so as to give an angle of one foot crosswise to nine feet lengthwise of the bridge span. The moving gear is operated from the main operating mechanism located

(*Continued on page 169.*)



Length over all, 286 feet 4¼ inches; depth of trusses, 17 feet; height of bridge above ground, 61 feet 9 inches.

Hoisting and conveying machine; capacity 200 tons per hour.

POWERFUL ELECTRIC HOISTING AND CONVEYING MACHINERY.

HIEROGLYPHS OF THE HEAVENS.

BY ESTHER SINGLETON.

The amateur astronomer, who takes delight in contemplating the starry skies, is as familiar with the constellations as he is with the continents and islands of the terrestrial globe. He rarely thinks of them, however, with regard to the images they are supposed to represent; but finds them by means of the quadrangles, triangles, circles, etc., by which they are distinguished, and by means of their relative positions. Rarely does he realize how long it took for the stars to become systematically classified and the constellations mapped out as they are to-day. The skies as we know them owe their arrangement to the Greeks and the Arabians.

The first reliable information regarding the Greek sky is obtained from Eudoxus of Cnidus, an astronomer who lived about 370 B. C. His work furnished Aratus, who lived a hundred years later, with material for his great astronomical poem. The Romans read this in many translations, one of which was by Cicero. Instead of Hercules, Aratus gives the figure of a kneeling man with outstretched arms, called the Kneeling One. Above him stand Ophiuchus holding the Serpent, under whose coils Boötes, the Ox-Drover, is seen with the brilliant Arcturus under his girdle. The other constellations of Aratus are Auriga, the Wagoner, carrying on his left shoulder the goat that nourished Jupiter, and on his wrist a kid; half the body of Pegasus with his wings; the chained Andromeda menaced by the sea monster Cetus (now the Whale); the King Cepheus; Cassiopeia in her chair; the kneeling Bull with the Hyades and the Pleiades; the Eagle; Dolphin; Wolf; Centaur; the Water Serpent winding across the sky with his head under the Crab and his wreathed body under the Lion, and bearing on his body a cup out of which a crow seems to drink; and Orion with his dog Sirius, here not a star but representing the whole constellation of Canes Major. "His body is dark," says Aratus, "but a star on his jaw sparkles with more life than any other star."

Beneath Orion is the Hare, which he is hunting, and behind the Dog the Ship "Argo" sails. The Tortoise, found by Mercury and converted by him into a lyre, here appears with the Lyre on his head; and the Swan is described as "spreading its pinions in gentle flight and sinking down perpendicularly into the western horizon, with its right wing turned toward Cepheus's right hand and its left to the Horse's foot."

The Manger and the Asses are also mentioned, and all the signs of the Zodiac.

"In great numbers," says Aratus, "and in various courses the stars incessantly move around the motionless skies. The axle stands immovable. In the midst the earth is suspended in equilibrium, while the heavens swing around it. The poles bound the axle on both sides. These are encircled by the Bears, that revolve around back to back separated by the Dragon's manifold coils."

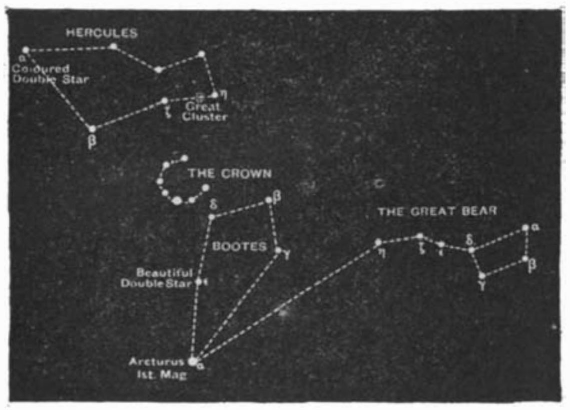
Eratosthenes (about 70 B. C.) enumerates these constellations and not only tells the mythological stories but indicates the positions and numbers of stars in every figure. He differs from Aratus only in a few particulars; the Centaur he calls Chiron; gives the Wild Goat and Altar other names; introduces Berenice's Hair; and speaks of Aquarius's stream of water and the Thyrsus wand of the Centaur.

Equuleus, the Little Foal, of the southern hemisphere seems to have been introduced by Hipparchus (160-125 B. C.), who compiled a catalogue of a thousand stars with their latitudes and longitudes.

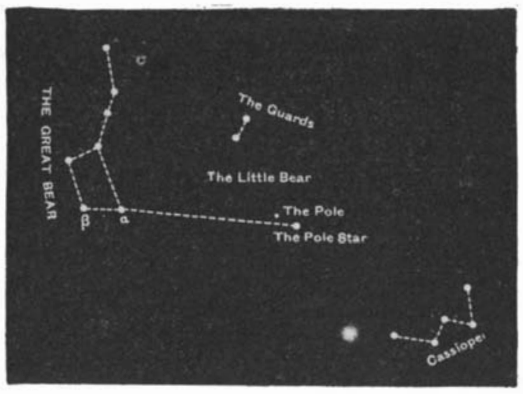
Ptolemy (130-150 A. D.), who extended many of the theories of Hipparchus in his great work, to which the Arabs gave the name of "Almagest," gave forty-eight constellations. The figures were the same as the old constellations of Aratus with a few additions. The stars, however, were marked in their proper places and defined as to latitude, longitude, and magnitude.

After Ptolemy a long period ensued during which the astronomical charts were unchanged. It is to the Arabs in the eighth century that the next advance is due. The Caliphs of this period, among whom was Haroun al Raschid of "Arabian Nights" fame, were friends to science, and gathered around them men of learning, such as the famous astronomers Ulug Bekh, Fergani, El-Batan, and Abdelrahman Sufi. To a great extent they were satisfied with Ptolemy's work, to which they gave the name "Almagest"; and, although they retained a great many of the Greek star names, they added a number derived by tradition from the ancient Arab names. Abdelrahman Sufi wrote a detailed and exhaustive account of the Greek constellations, carefully following Ptolemy, and at the same time he treated of the ancient Arabian heavens.

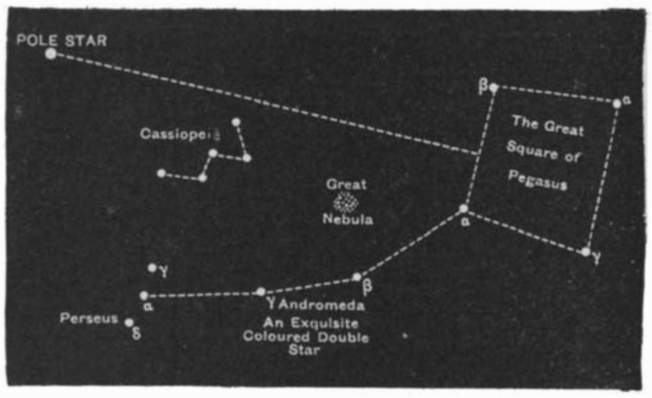
This great mass of uncharted Arabian folk lore is



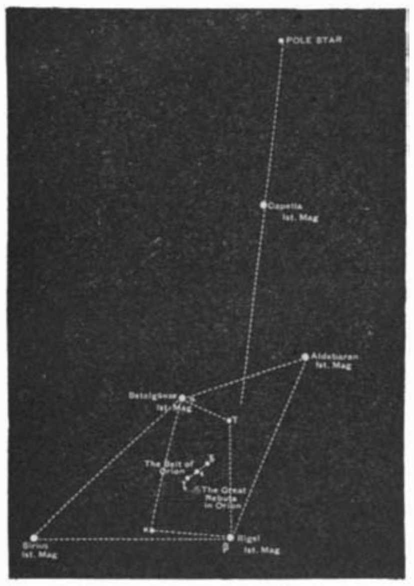
Boötes and the Crown.



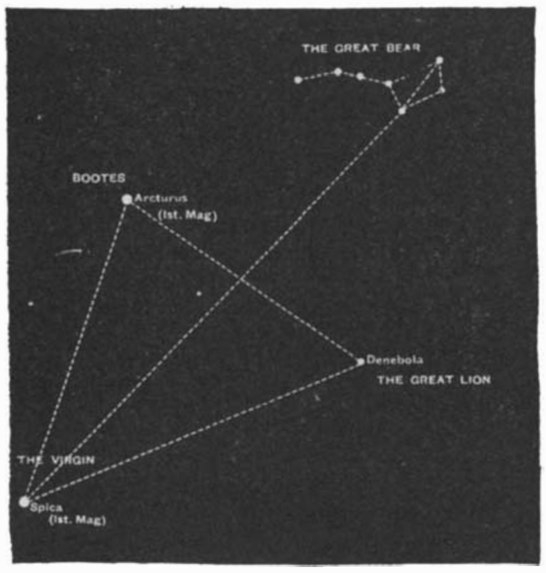
The Great Bear and Cassiopeia.



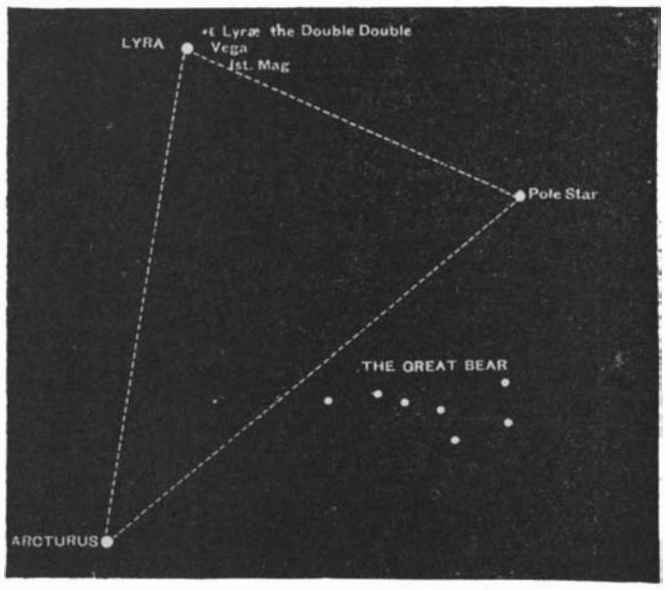
The Great Square of Pegasus.



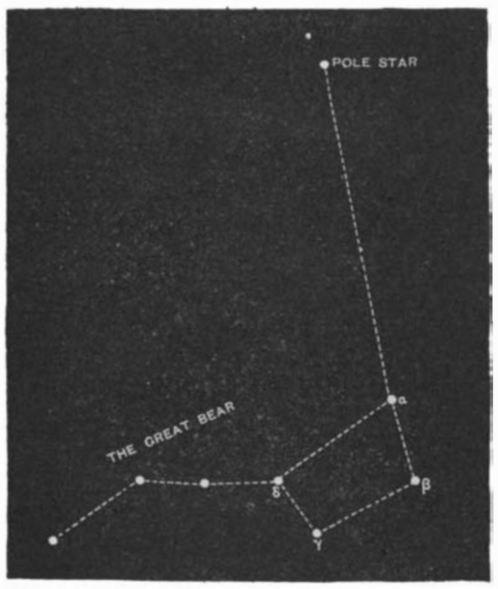
Orion, Sirius, and neighboring stars.



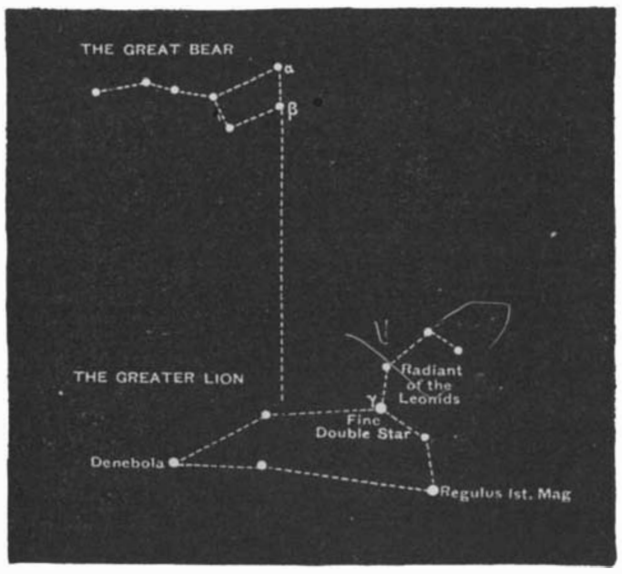
Virgo and the neighboring constellations.



The constellation of Lyra.



The Great Bear and Pole Star.



The Great Bear and the Lion.

Perseus and its neighboring stars.

HIEROGLYPHS OF THE HEAVENS.

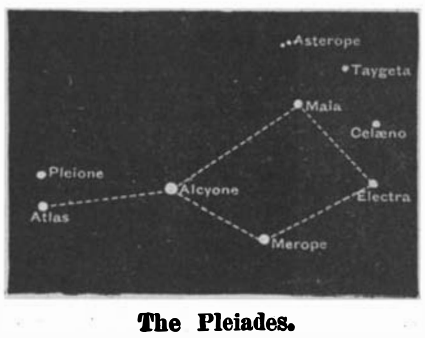
extremely picturesque. The stars in the vicinity of the North Pole are supposed to represent a shepherd, who with his dog is pasturing a herd of sheep. To this group belong also two calves, three goats, four camels, and a foal. These animals are all in the neighborhood of Cepheus. A single camel (one star in Draco) has strayed away to pasture alone. Two jackals and several hyenas are prowling around the herd with wicked intentions. The small stars in the region occupied by Hercules indicate another meadow, where another shepherd pastures his flock; and the long row of stars (in Hercules and Serpens) are fences protecting the sheep from the hyenas and jackals. The other side of the meadow is protected by the shepherd's two dogs. Many other shepherds with flocks of sheep and camels are scattered through the heavens; and amid these meadows runs a River (the Milky Way), which affords refreshment to various camels, sheep, and ostriches, some of which are in the act of drinking, or going to, or returning from the River, each represented by stars more or less close to the broad luminous band. The oval ring which we know as the Southern Crown is the Ostrich Nest, near which two pairs of Ostriches are supposed to stand. Another Ostrich Nest is situated in Eridanus, near which a number of small stars indicate male and female ostriches, young birds, eggs, and broken egg shells. Five yelping dogs are marked by five stars in Virgo; a pair of birds by two stars in Sagittarius; two frogs by a star in Pisces Australis and one in Cetus; four monkeys by four stars in Ursa Major; and two ravens by two stars in Columba. Near Ursa Major and Ursa Minor are a gazelle and its young. Three pairs of stars (below the feet of the Great Bear) are the footprints of several gazelles, which, according to the story, sprang from that spot when the Lion, also in the vicinity, lashed the sky with his tail, and which is now pursuing these gazelles, some of which have jumped for safety into the great Pond (a group of stars in Ursa Major).

We also find in the Arabian Heavens a Tent (three stars near Auriga); a Traveling Tent (near the Southern Crown); a Pot (a ring of stars in Cepheus and Cygnus); a Beggar's Dish with nicked rim (the broken circle which forms the Northern Crown); a Boat (in the Phœnix); a Manger (in Crater); a Dyed Hand (in Cassiopeia); a Mutilated Hand (in the head of Cetus); and Pearl Necklaces, Brooches, and Crosses are scattered in various parts of the sky. The quadrangle of the Great Bear forms the Bier, followed by three mourning women poetically called the "Daughters of the Bier." These three stars are what we call the tail of the Bear.

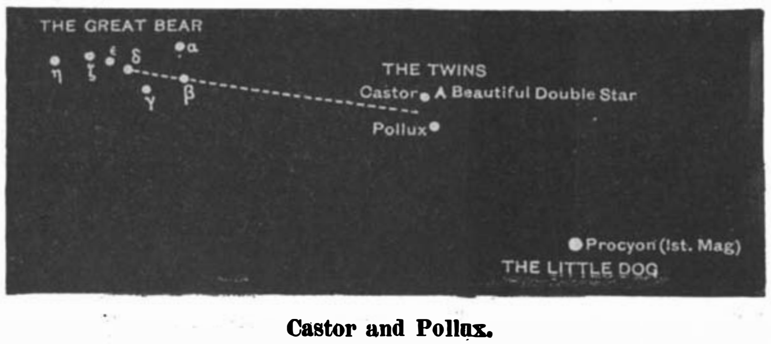
In many instances, as will have been noticed, the imaginary figures are not composed of a group of stars, but of a single star. Some individual stars, too, are of great importance; the three bright ones that form Orion's belt are the Three Kings; one in Andromeda is the Red Speckled Magpie; one in the Great Bear, the Black Horse, belonging, perhaps, to the neighboring Emir, and around the North Pole circle the Dancers. Besides these, the Arabs have a great many stars with such vague names as the Forgotten, the Touchstone, the Isolated, the Dim-eyed, etc.

So strong was their objection to the personal element, that when the Greek Zodiac was incorporated by the Arabian astronomers they indicated the names of the objects carried by the characters instead of the characters themselves. Thus Virgo was called the Ears, on account of the wheat she held in her hand; Sagittarius was not the Archer, but the Bow; and Aquarius, not the Water-Bearer, but the Well Bucket.

When the great mixture of Arabian folk lore was combined with the Greek sky, many of the star names were retained; but occasionally the Greek names were changed, for instance, the beautiful red Antares in Scorpio was appropriately called the Scorpion's Heart.



The Pleiades.



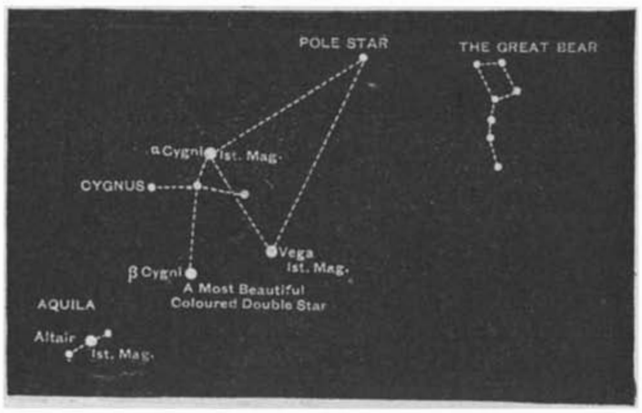
Castor and Pollux.

HIEROGLYPHS OF THE HEAVENS.

In 1433 Ulug Bekh made at his observatory in Samarkand the most correct catalogue of stars up to that period. The famous astronomical tables compiled under Alphonso X. of Castile date from 1252, and next in importance was the great catalogue of Tycho Brahé (1546-1601). In this occur two new constellations, Berenice's Hair and Antinous, which Ptolemy mentioned in speaking of the "informæ" of the Lion and the Eagle. Berenice's Hair was erased by Bayer, who depicted in his "Uranometrie" (1603), an authority for many years, a Sheaf in its place. Subsequently Berenice's Hair was replaced.

Two new figures occur in Jakob Bartsch's "Planispherum" (1624), the Tigris and the Jordan, which were repeated for many years on the French maps and globes, and are mentioned in a book by A. Royer (1679) in which a constellation in honor of Louis XIV. was introduced. This was the Scepter and the Hand of Justice, and was placed immediately over Sagittarius in the Milky Way. After the death of the grand monarch, it suddenly disappeared from the globes, its place being taken by the Lizard which originated with Helvetius. In Royer's book the Lily from the old French coat-of-arms occurs in the spot occupied by the Fly. A similar liberty was taken by Thomas, in his "Firmamentum Firmianum" (Augsburg, 1731), where he changed the Northern Crown to "Corona Firmiana," a device ornamented with two stag-antlers from the German coat-of-arms.

The southern hemisphere, which was uncharted by the ancients, is of far less interest than the northern, partly because the changes have been frequent and unimportant, and partly because the only constellation



Vega, the Swan, and the Eagle.

visible to us is the Dove, introduced early in the sixteenth century. In the old books it is called Columba Noæ because it is near the ship, represented sometimes at that period as Noah's Ark. The regions around the Ship and the North Pole have been subject to the most frequent changes since the seventeenth century. For a time the Cock was formed at the expense of the Ship, which, however, was soon restored. Halley introduced in his "Catalogus" (London, 1678) the figure of an Oak between the Ship and the Centaur, to represent the tree in which the King of England was hidden for twenty-four hours after Cromwell won the battle of Worcester (September 3rd, 1651). Helvetius and Flamsteed accepted this new constellation; but La Caille complained that Charles's Oak was formed out of some of the finest stars in the Ship and ruined this constellation. Therefore he left it out of his charts. Bode, however, used it. Halley also introduced another figure—the Heart of Charles the Second—which was finally adopted on all the modern charts and globes. It consists of a single star of the third magnitude on the collar of the Southern Hunting Dog.

Camelopardus is a young constellation, and was placed in the space between the Pole Star and Auriga about 1624. This is the only figure that remains of the many that were here, among which were the Reindeer introduced by Le Monnier when he returned from Lapland, between the Pole Star and Cassiopeia; a Harvest Keeper, between Cepheus, Cassiopeia, and Camelopardus, formed by Lalande when the comet of 1774 passed through that unclassified region and named by him for the astronomer Le Messier, who put it on his globe of 1780; and a third figure, formed by Bode as a memorial to King Frederick II., called Friedrichs-Ehre, consisting of seventy-six stars between Cassiopeia, Cepheus, Andromeda, and Cygnus. The figure includes sword, pen, and olive branch laurel-wreathed.

In 1624 the Fly was made out of the "informæ" of the Ram; and the Unicorn was placed between the Great and Little Dogs.

Helvetius is responsible for the Hunting Dogs (Canes Venatice) which run before Boötes; Monnat Mænalus, below Boötes; Cerberus in the left outstretched hand of Hercules; the Fox and Goose in the Milky Way, near Sagittarius; the Lizard, near Andromeda; the Sobieski coat of arms, above Sagittarius; the Lynx, between the Great Bear and Hercules; the Little Lion near the Great Lion; and a small Triangle and Sextant. These were published in 1690 after his death and were accepted.

Early in the seventeenth century an attempt was made to substitute Biblical names and characters for those of classic myth and legend. Julius Schiller, for example, published in 1627 a star map in which saints, popes, martyrs, and persons from the Old and New Testaments were figured in rich colors and gilded in the style of the illuminated manuscripts of the Middle Ages. Christ was represented as the sun and the planets revolving around him were called Adam instead of Saturn; Moses, Jupiter; Joshua, Mars; John the Baptist, Venus; Elijah, Mercury; and the Virgin Mary was substituted for the moon. David with Goliath's head was placed on the map instead of Perseus with the head of Medusa; Samson holding the jawbone of an ass, instead of Hercules; the ass on which Christ rode to Jerusalem instead of Pegasus; Noah's Ark for the Ship Argo; the Cross for the Swan; the dog of Tobias instead of the Great Dog, etc. The signs of the Zodiac were named for the twelve Apostles; the Ram became St. Peter; the Bull, St. Andrew; the Twins, St. John; the Crab, St. John the Evangelist; the Lion, St. Thomas; the Virgin, St. James the Less; the Scales, St. Philip; the Scorpion, St. Bartholomew; the Archer, St. Matthew; the Goat, St. Simon; Aquarius, St. Thaddeus; and the Fishes, St. Mathias.

In the latter part of the same century a second attempt was made by Weigel, who substituted the coats of arms of various families of Europe and other devices in his "Cœlum Haraldicum" (Jena, 1688), where we find the Brandenburg Eagle in place of the Eagle; the Elephant of Denmark in place of the Great Bear; a Cardinal's Hat instead of the Scorpion; the double-headed Roman Eagle for Orion, etc. Flamsteed's "Sky Atlas," corrected by Bode (Berlin, 1782), gives two new constellations: the Brandenburg Scepter near Eridanus and the Poniatowski Bull, named in honor of the King of Poland, near the Eagle including the Hyades. The youngest of all the constellations is the Cat, introduced by Lalande between the Cup and the Ship in the eighteenth century. After Napoleon's death some enthusiasts tried to place him in the heavens in place of Orion; but his figure appears in no map of the starry skies.

The accompanying illustrations are reproduced from Sir Robert Ball's "Story of the Heavens."

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1757, deals with the railway-car ferries between Germany and Sweden, and describes in particular the vessel called the "Drottning Victoria." Mr. A. Roze's excellent article on imitation arms and armor is concluded. In 1911 Rome is to be the center of a celebration of the fiftieth anniversary of the proclamation of the Italian kingdom. For that reason an article on Old and New Rome seems peculiarly appropriate. The paper read by Prof. Harold A. Wilson before the Royal Institution on the Electrical Properties of Flames is summarized. Mr. Percy Collins contributes an article on Ants and Bees as Pets. Mr. Snowden B. Redfield prophesies that in a few years a person who desires to call another over the telephone will not only make all the electrical connections for talking, but will deposit his money in an automatic meter, talk as long as he likes, and then have his change automatically handed back to him. This prophecy he bases upon the wonderful performances of an automatic telephone central, which is described at length. Mr. Arthur Watson contributes an entertaining article on Some Old Conjurers' Formulæ and Utterances. One of the most brilliant papers read before the British Association for the Advancement of Science at its Winnipeg meeting was that of Sir J. J. Thomson. In the current SUPPLEMENT will be found an abstract of that paper, entitled "Studies of Electricity and Matter."

Swarms of bees are sometimes compelled to take refuge in very remarkable shelters. A peculiar and instructive instance was observed by the writer in the spring of 1908. The swarm flew over a large vineyard which contained few buildings. One of these buildings was constructed of hollow concrete blocks. The swarm flew directly toward a small hole in one of the blocks and disappeared in the interior. No doubt the swarm had rested on a tree or shrub on the preceding day and had sent out scouts to seek a home. The scouts found the little hole leading into the great cavity of the concrete block, and reported their discovery to their comrades. This case furnishes indisputable proof that swarming bees really send out scouts, as they are believed to do, for the little hole could not have been discovered in the rapid and lofty flight of the swarm.

THE AVIATION MEETING AT RHEIMS.

The first real aviation meeting held anywhere in the world took place last week near the city of Rheims, France. The Betheny plain, which is several miles in length and a mile or more in width, was the scene of a triumph of aeroplanes such as even the most enthusiastic aeronauts did not believe possible. Not only were all records broken, but new ones were set up which are far in advance of the supposed state of the art at the present time.

Altogether there were thirty-eight aeroplanes entered in the various contests and races, for which $40,000 in cash prizes were offered. The machines which made flights were divided about equally between the monoplane and the biplane types, although the latter type was rather more in favor. Of the machines of this type, five were Wright biplanes, five biplanes of the Voisin cellular type with a tail, and three of the Farman type with a tail but without vertical partitions between the main planes. The Curtiss biplane represented America.

The monoplane type of flying machine was represented by three Antoinette machines, two Bleriot, and three Pelterie.

The course over which all the contests took place was a rectangular one, the total distance around it being 10 kilometers (6.21 miles). The judges' and timekeepers' stand was in the middle of one of the short sides, just opposite the grand stand. A row of aeroplane sheds was placed at one end of the grand stand.

The first day of the meeting, Sunday, August 22nd, was given up to trials of the machines entered in the International Cup Race for the Bennett trophy. On account of the seventeen entries, elimination trials were required in order to select three contestants to represent France in the race.

As there had been rain the preceding day and also early Sunday morning, and as the wind still continued to blow at the rate of about 12 miles an hour, the weather conditions were not propitious for the first flights. Soon after 10 A. M. Monsieur Maurice Guffroy attempted to get off the ground with his red-winged "R.E.P." (Pelterie) monoplane, but on account of the sodden condition of the earth, he was unable to rise in the air. M. Paul Tissandier was the next to make an attempt. He had a Wright biplane, and as this starts from a rail, he had a distinct advantage over M. Guffroy. It was with considerable difficulty, however, that everything was put in readiness about the starting apparatus in the fifteen minutes allowed for making a start. Then, too, he had trouble with his motor. Finally, however, he got away just as the time was up. The machine rose and made a two-minute flight, during which all the skill of the aviator was required to keep it right side up. At length it was caught by a stronger gust than usual, which caused it to make a dive. M. Tissandier stopped the engine and glided to earth. Thus was eliminated the second entrant for the International Cup Race.

M. Hubert Latham was the next one to attempt a flight with his powerful Antoinette monoplane. He rose in the air readily, but when once aloft the strong wind gusts caused his machine to pitch and roll in an alarming manner. After covering about a kilometer he quickly descended, landing safely. In a second trial later on, M. Latham qualified by making two rounds of the course (20 kilometers or 12.4 miles) in 18 minutes and 33 seconds. No sooner had M. Latham descended than M. Louis Bleriot rose in the air in his No. 22 monoplane fitted with a 45-horse-power Anzani motor. But even this skillful aviator had difficulty in keeping his monoplane on an even keel in the wind which was blowing. He covered the course once, and was making his second round when a sudden gust drove his machine earthward and damaged the tail in alighting. He had covered sufficient distance to be appointed one of France's representatives in the International Race.

Capt. Ferber, who flies under the pseudonym of De Rue, made a short flight with his Voisin biplane. He came very near running into a barricade opposite the grand stand. M. Lefebvre, with a Wright machine, succeeded in starting during a calm moment. He made a round of the course in 8 minutes and 8 1-5 seconds; and although he was obliged to descend during the second round, and after covering but 16 kilometers (10 miles) on account of the wind, he was appointed as the third representative in the cup race. M. Tissandier afterward made two rounds in 19 minutes and 26 seconds, and was appointed as a reserve pilot. M. Latham, on the "Antoinette II.," made two rounds in 19 minutes and 44 1-5 seconds. M. Paulhan made two rounds with his Voisin biplane in 21 minutes and 4-5 second, and M. Sommer in 23:32. Thus, although six reserve pilots were allowed, only three—Tissandier, Paulhan, and Sommer—were appointed.

As the weather cleared in the afternoon, and the wind ceased entirely, ideal conditions prevailed toward the end of the day, with the result that almost all the aviators brought out their machines and made flights toward evening. At 6 o'clock no less than five aeroplanes were flying simultaneously around the course, and the sight was one never to be forgotten. M. Lefebvre on his Wright machine performed the most daring feats; besides describing circles and figure eights, he would rush at the grand stand, and then quickly turn to the left and avoid it. M. Paul Tissandier and Count de Lambert made excellent exhibition flights upon their Wright aeroplanes. The latter at one time flew past M. Bunau-Varilla on his Voisin biplane, going below him and thus reversing Mr. Curtiss's maneuver of the day before, when he passed above M. Latham when flying at right angles to him.

The results of the first day's attempt to cover one and three circuits of the course (10 and 30 kilometers, or 6.21 and 18.63 miles) in the speed tests, were as follows:

	3 Rounds.	1 Round.
Tissandier (Wright biplane)	28:59 1/5	9:26 1/5
Count de Lambert (Wright biplane)	29:02	9:33 2/5
Lefebvre (Wright biplane)	29:02 1/5	8:58 1/5
Latham (Antoinette monoplane)		9:47 4/5
Paulhan (Voisin biplane)		10:50
Bunau-Varilla (Voisin biplane)		13:30 1/5
Sommer (Farman biplane)		11:24 2/5
Cockburn (Farman biplane)		11:44

The following day, Monday, Mr. Glenn H. Curtiss covered one round of the course in 8 minutes and 35 3/5 seconds. He succeeded in lowering this to 8 minutes and 11 3/5 seconds on Wednesday, although he was not able to equal M. Bleriot's record of 8 minutes and 4 2/5 seconds (46.15 miles an hour), made Tuesday by this aviator with a new monoplane fitted with an 80-horse-power motor. The third day of the meeting was notable on account of a visit paid by the French president, M. Fallieres, who inspected all the machines and showed great interest. The first flight this day was made by Bunau-Varilla, who flew in a breeze of 15 miles an hour, which caused his Voisin biplane to rock dangerously. He made one circuit of the course. Next M. Paulhan made a flight, rising first to a height of about 100 feet and afterward to between 300 and 500 feet. On the back stretch he raced a train for some distance, overtaking and passing it. Despite the strong wind, which caused the machine to pitch and lurch, he made the first round in 12 minutes and 13 seconds. After completing three rounds of the course, he made a sudden descent and a wide curve, but righted his machine when near the ground, and passed the grand stand on a level keel, making a couple of wide circles in front of it before he alighted. As an exhibition of daring his flight in the 15-mile wind at such a great height stands unprecedented. The time of his three rounds was 38 minutes and 12 2/5 seconds. M. Paulhan's performance indicated that he might yet do greater things, and it was only the next day that he succeeded in breaking all endurance records. On Wednesday, August 25th, he remained in the air 2 hours, 43 minutes, 24 4/5 seconds. He covered a distance of 134 kilometers (83¼ miles). After several other aviators had made short flights, M. Paulhan started about 4 P. M. in a wind of about 6 miles an hour, and circled the course continuously, notwithstanding that the wind blew at times as high as 24 miles an hour. While the speed of the machine was only about 30 miles an hour, it was remarkable for the ease with which it flew in the wind and for the steady running of the motor. This motor is the Gnome revolving-cylinder 50-horse-power engine, consisting of seven cylinders which spin around a fixed crank. The propeller is attached to the cylinders, which revolve in a vertical plane, the motor being placed in the rear of the lower plane.

M. Paulhan had already made several lengthy and excellent flights with his biplane, but that on the 25th ultimo is by far the longest, exceeding Wilbur Wright's 2-hour and 20-minute record by 23 minutes. The first round of the course was made in 12 minutes and 16 seconds. During the sixth round the wind increased to such an extent that M. Paulhan was blown inside the course, and in order to turn the pole at one corner, he was obliged to describe a complete circle. After alighting, when his gasoline gave out, at 7:30, he had the tank refilled, and then flew from the point where he came to earth across to the grand stand. He received an ovation from the spectators. M. Paulhan's flight was for the Grand Prix de la Champagne, the prize for which is $10,000 to the winner.

Another aviator to make his appearance on Wednesday was M. Rougier, who had a Voisin biplane. He made the first flight of the day, but his motor gave out, and he came to earth shortly after crossing the starting line. After two unsuccessful attempts, M. Latham flew once around the course at a great height with his "Antoinette XIII." at the same time that M. Paulhan was flying. He only succeeded in making one round, owing to motor troubles, and the wind at a high elevation appeared to bother him as much as it did Paulhan, who was flying lower down. M. Henri Fournier, in a Voisin machine, was another novice to attempt a flight. After getting three-quarters around the course, he was dashed to the ground by the strong wind, and escaped with a broken nose, although his machine was demolished. M. Latham also made a round at a great height with his No. 29 Antoinette monoplane. M. Lefebvre was the only Wright pilot to attempt a flight. He soon came to earth, owing to the breaking of the gasoline feed pipe. M. Delagrange made a short flight on a small Bleriot monoplane, and M. Bunau-Varilla made a good flight on his Voisin biplane. M. Latham's best performance this day was three rounds of the course. Between 6:30 and 7 P. M. eight or nine machines were quickly brought out, and attempts were made to better the 10-kilometer speed record. The Curtiss biplane was the last to start, which it did when no less than five aeroplanes were traveling around the course. The aviator took the first turn rather wide. He was obliged to fly above one machine, and he ran out of his course somewhat in order to avoid a collision with M. Sommer on his Farman biplane. He reduced his time to 8 minutes and 11 3/5 seconds in this flight. Short flights were made by M. Legagneux on Capt. Ferber's biplane, M. Rougier and Bunau-Varilla on their Voisin biplanes; M. Sommer on a Farman biplane, and M. Delagrange on the Bleriot monoplane. M. Bunau-Varilla rose to a height of more than 300 feet.

The record for speed and distance was made on August 26th by M. Latham with his No. 29 Antoinette monoplane. The weather conditions were favorable at the start, but during the course of the flight M. Latham encountered heavy wind and a rain storm. He nevertheless kept the machine flying until the fuel gave out. He succeeded in making over fifteen rounds of the course in 2 hours, 18 minutes, and 9 3/5 seconds. The total distance covered was 154.375 kilometers (95.88 miles). The average speed was therefore 41.63 miles per hour. The fastest round was made in 8 minutes and 20 3/5 seconds, at an average speed of 44.65 miles an hour. This record surpassed that made the day before by M. Paulhan, since the machine flew a considerably greater distance in less time, while it also demonstrated its stability in a wind of about 24 miles an hour, and its capability of traveling through rain. The flight was a complete vindication of the Antoinette motor which, it will be remembered, failed Latham twice when he attempted to cross the English Channel. This motor is of the V-type, having eight water-cooled cylinders. It is one of the lightest motors ever constructed per horse-power. Besides making this record flight in the P. M. Latham flew 70 kilometers (43.5 miles) in the A. M. with the "Antoinette XIII." Count de Lambert flew 116 kilometers (72 miles) late in the P. M. also, so that the long flights on Thursday totaled over 212 miles. M. Bleriot met with an accident on Thursday. In order to avoid alighting upon some dragoons who were traveling across the field on horseback, he steered his machine into a fence, breaking the propeller and damaging the monoplane considerably. He was making a flight with M. Delagrange as passenger when the accident occurred. M. Rougier also alighted upon some spectators, but fortunately they were not seriously injured.

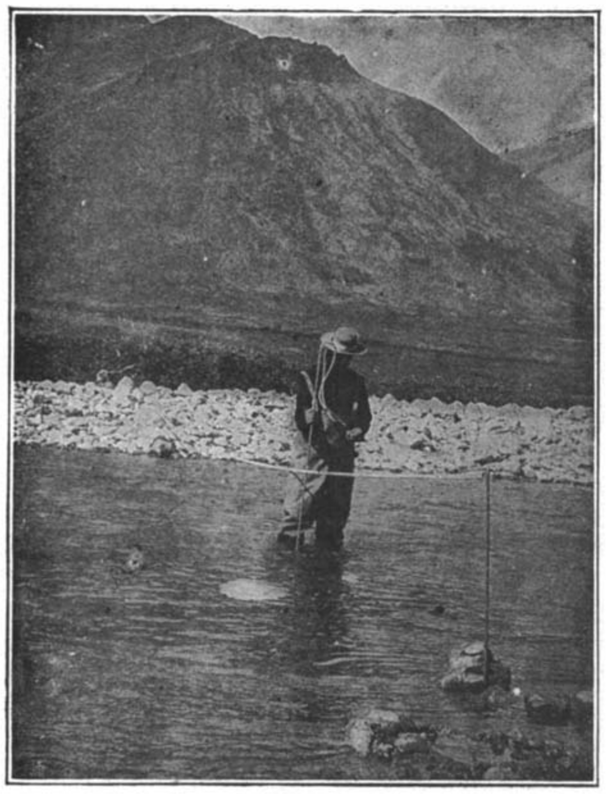
Latham's distance record of Thursday was a record of only a day, for on Friday, August 27th, Henri Farman surpassed it decidedly with his modified Voisin-type biplane now known as the Farman machine. The sixth day of the meeting was the last one in which the Prix de la Champagne could be competed for, and everyone took it for granted that Latham's record of 95 miles in 2:18 would remain unbeaten. About 4:30 P. M. Latham brought out the "Antoinette XIII." monoplane and started on another long flight. Some ten minutes later MM. Farman and Sommer started out quite unexpectedly upon Farman biplanes, and a real race at once began. At the end of Latham's second round, he passed high above Sommer and Farman, who were flying close to the ground at about the same level and only 50 feet apart, Sommer leading. The two biplanes made the last turn of the course only a second apart, and then Farman passed Sommer in front of the grand stand, while the latter's machine dropped and touched the ground just as it crossed the line. Sommer accordingly circled around the timer's box and crossed the line once more, according to the rules, which maneuver placed him far in the rear. Both biplanes flew at an average height of from 6 to 12 feet only, while Latham maintained an elevation of from 250 to 300 feet. His machine was considerably faster than the other two, and he lapped both of them several times. Latham covered 50 kilometers (31.05 miles) in 44:23 against Farman's 51:21. Eighty and 100 kilometers (49.71 and 62.14 miles) were covered by Latham in 1:11:20 1/5 and 1:29:20 2/5 respectively; but finally, after making 110 kilometers (68.35 miles) in 1:38:5 1/5, his fuel gave out and the monoplane glided to earth. After Latham ceased flying, Farman kept steadily on. Sommer stopped after making three rounds because of motor trouble. He afterward started again, but too late to make a record before the closing of the lists at 7:30. Shortly before 5 P. M. M. Tissandier started on his No. 4 Wright machine and made 11 circuits in 1:46:52 2/5. At about the same time, Bunau-Varilla made several circuits on his Voisin biplane, and Delagrange and Bleriot came out

(*Concluded on page 171.*)

MEASURING A RIVER'S FLOW.

BY S. MAYS BALL.

The increasing attention which is being given to the conservation of natural resources, particularly to water power and the irrigation projects of the United States Reclamation Service, renders timely some description of the manner in which the water supply is



Gaging the flow of a mountain stream with hand instrument.

measured and recorded. Through the kindness of Mr. H. C. Rizer, Chief Clerk of the United States Geological Survey at Washington, the writer has been given facilities for a study of the system generally adopted, which is as follows:

The quantity of water flowing in a stream is expressed in various terms according as it represents the drainage from a watershed of given area, the rate of continuous flow as for power purposes, or simply volume, and it may be as well to commence with a definition of these terms.

"Second-foot," an abbreviation for one cubic foot per second, is the quantity of water flowing in a stream one foot wide, one foot deep, at a rate of one foot per second. It is generally used as a fundamental unit, from which others are computed.

In connection with pumping and a city's water supply, the water is generally measured in "gallons per minute."

The "miner's inch" is the quantity of water that passes through an orifice one inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

The average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area, is given as "second-feet per square mile."

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

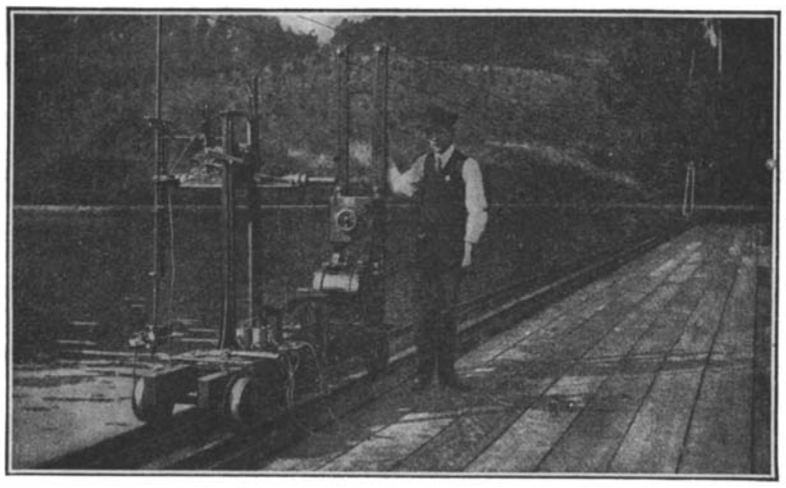
An "acre-foot" is equivalent to 43,560 cubic feet and is the quantity required to cover an acre to the depth of one foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot. One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet or approximately two acre-feet.

Gaging stations are located upon streams as far as possible at points above and below which the channel is straight, where there are no cross currents or backwaters and where the bed of the stream is smooth and its banks high. Their equipment consists of fixed gages graduated to show the vertical fluctuations of the water surface and permanent bench marks indicating the points of measurement up and down stream: when the channel conditions are satisfactory bridges are used, as from them observations may more readily be made and the cost of equipment is small.

Current velocity is measured sometimes by floats and sometimes by means of the meters illustrated herewith. In measuring by floats, of which there are several kinds, the simplest being a corked bottle weighted at the bottom and carrying a flag at the top, little affected by wind, observation is made of the time taken by the float to pass over a selected "run" of the stream 50 to 200 feet long. A number of velocity determinations are so made at different points across the stream and the mean velocity of the whole section estimated.

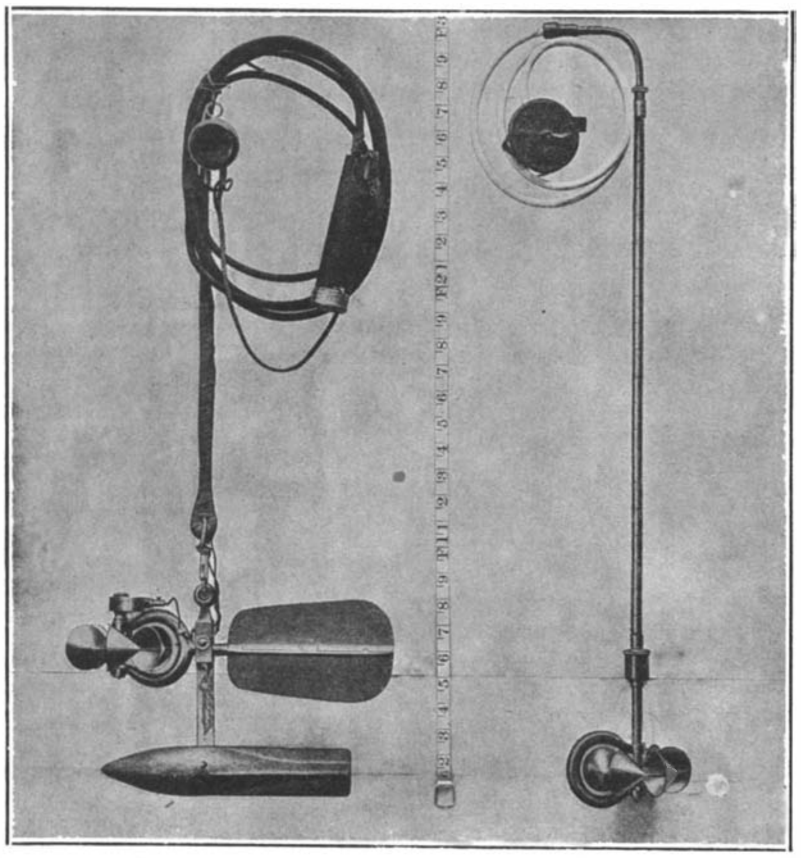
The discharge is the product of that mean and the mean sectional area of the run, which is determined by measurements and soundings of the two ends of the run and at intermediate points.

When meters are used they are held stationary in the current at a number of points across the width



A meter calibrating station: the meters are drawn through still water at a known speed, and the revolutions they make recorded.

of the stream and at different depths, and the velocities recorded are averaged as before. A typical meter much used in the government service is shown in the illustrations, designed by Mr. W. G. Price. Its submerged portion consists of a small wheel carrying five conical buckets similar to that of the smaller instruments; these are rotated by their offering more resistance to the current at their large than at their small ends, the axis of the wheel carrying an eccentric by means of which electrical contacts are made



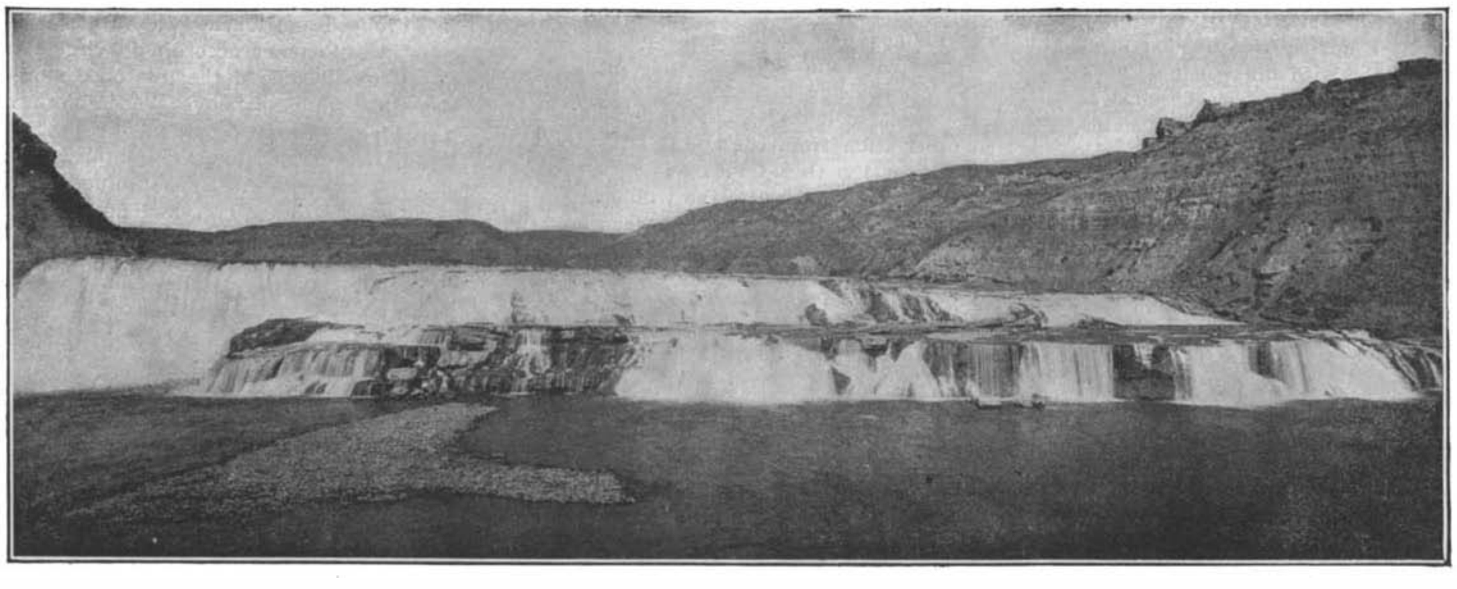
On the left a small Price electric meter, sounds received at the ear-piece being transmitted by current from the small battery shown; on the right a Price acoustic meter.

and broken in a suitably-protected water-tight compartment. The number of revolutions made by the wheel are thus electrically recorded by the current of a battery operating the clockwork of the indicator dials. Two of the small portable meters are also shown: in one the revolutions are recorded by the striking of a small hammer on a diaphragm, the sound being conveyed by a tube to the ear of the observer who counts the revolutions, and in the other an electric current from the small battery shown operates a buzzer when the contact is made and broken as has been described for the larger machine.

In each case the meter is supported above a pointed weight, provided with fins which keep it pointing straight upstream both in the vertical and horizontal plane.

To insure the coincidence of readings by different meters each individual instrument has to be separately "rated," to determine the exact number of revolutions it will make in a current of a certain speed. This is done by drawing the meter through a measured space of still water at a number of different speeds and noting the number of revolutions made, from which a rating table is prepared giving the velocity per second corresponding to any number of revolutions. Current-meter measurements may be made by an observer on a bridge, suspended from a cable, in a boat or wading, and gaging stations are classified in accordance with the method used. A wading station is shown in one of our illustrations.

The velocities indicated by the meters at different points in the stream are averaged by a variety of methods known as "multiple point," "vertical integration," etc. In the various multiple point methods the stream is divided theoretically into strips in the direction of its flow and (*Concluded on page 171.*)



Great Falls of the Missouri River in Montana: A hitherto undeveloped water power.

MEASURING A RIVER'S FLOW.

GERMAN MUSEUM OF MASTERPIECES OF SCIENCE AND INDUSTRY.

BY OUR BERLIN CORRESPONDENT.

Both England and France have long been in possession of a museum illustrating the evolution of science and industry and the mutual influences between engineering, scientific research work, and commerce and trade. The Conservatoire des Arts et Métiers of Paris (founded at the end of the eighteenth century), besides representing the significance of technical achievements in their relation to the factors above mentioned, is intended to propagate technical knowledge by the aid of popular lectures. The collections of the Kensington Museum (established toward the middle of the nineteenth century) on the other hand afford a comprehensive idea of the gigantic strides made by England in the field of mechanical engineering, without there being any more intimate connection between this part of the museum and its mathematical and scientific departments.

The German Museum of Masterpieces of Science and Industry, which was inaugurated a short time ago, is intended to become a national German institution of a similar kind, a special point, however, being made of the mutual influences of science and engineering. Apart from retrospective exhibits, the very latest achievements in the field of technical and scientific investigations were to be represented. Besides serving as a Pantheon to those men whose thought and work have been operative in fashioning modern civilization, this museum was thus to become a source of historical knowledge to the scientist, and a place to which both engineers and laymen could refer for fertile ideas and models.

As the Bavarian Academy of Sciences as far back as twenty years ago had made plans for extending its mathematical and physical collections on strictly historical lines, many useful instruments and apparatus of historical importance were already at the disposal of the founders of the new museum. The latter was inaugurated a few years ago (on June 28th, 1903) in provisional headquarters, the state having placed at its disposal the rooms of the old National Museum in Maximilianstrasse. As, however, these in the following years proved inadequate, an extension was granted by the Department of War, which at the beginning of 1905 authorized some collections of the museum to be installed in the Isar Barracks. The foundation stone of the definite building was finally laid a few months ago by the German Emperor. The museum comprises:

1. Collection of scientific instruments and apparatus as well as of remarkable technical products (both originals and models), which collections are well classified and provided with necessary information for the benefit of the visiting public.

2. An archive containing important documents, both scientific and technical.

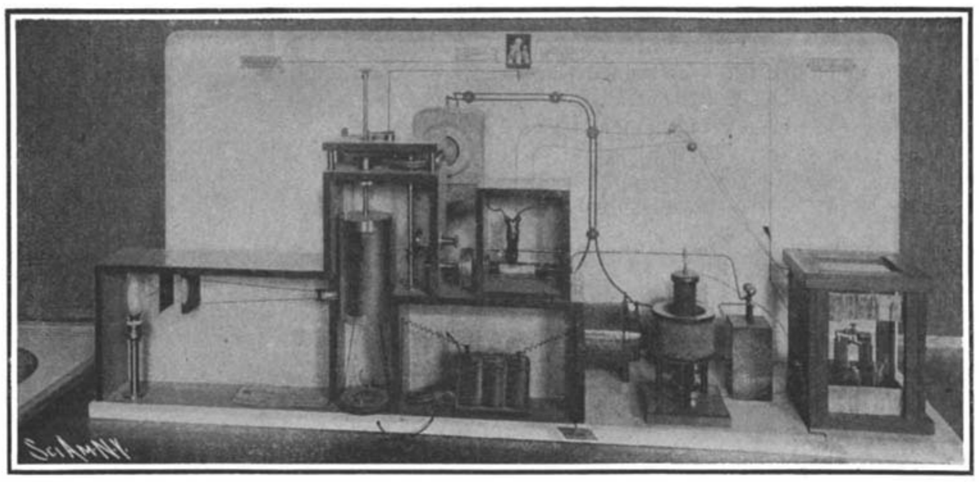
3. A technical and scientific library, containing manuscripts, diagrams, pamphlets, and books.

In order to preserve the memory of prominent workers in the field of engineering science, portraits and biographies of those Germans whose labor has been especially noteworthy in furthering the evolution of industry will likewise be incorporated with the museum.

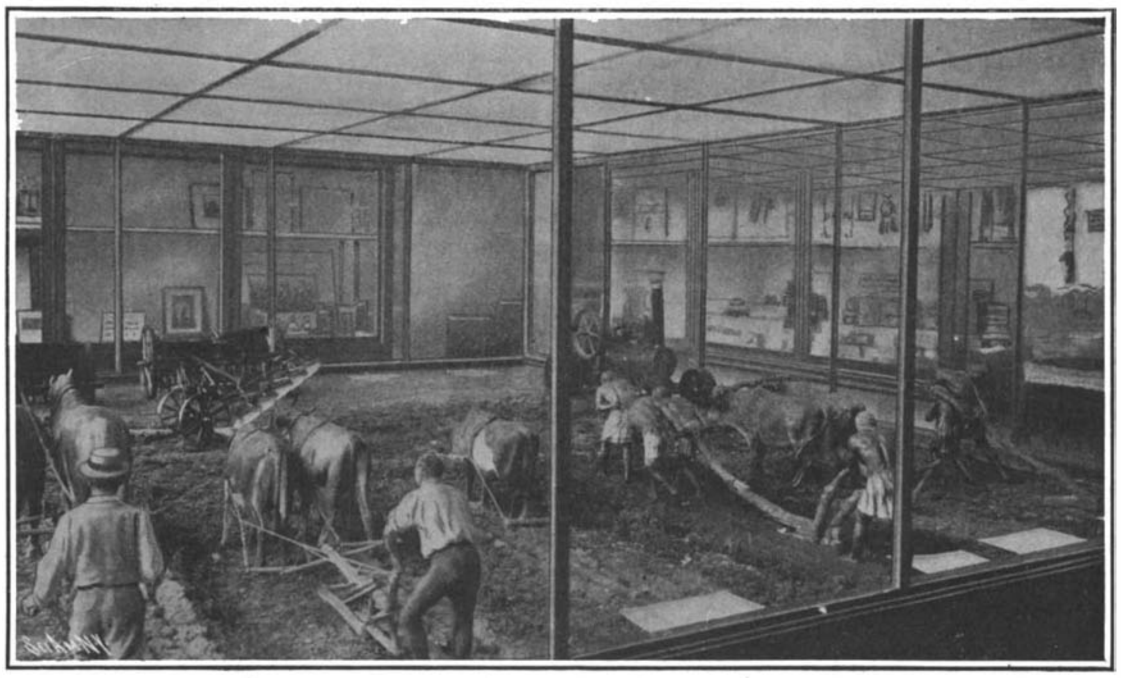
In carrying out the task laid before the museum, viz., to illustrate the evolution of any fundamental ideas and the influence of such ideas on the various economical factors, as well as to represent the ideal success of acquired knowledge and the importance of past experience, the most varied methods and means had to be resorted to. In fact, many fields, which apparently are strictly separated from each other, had to be classified and combined together, in order to afford an adequate picture of civilization as an offspring of science and engineering.

The historical aims of the museum are mainly realized by original machines and apparatus, in addition to records of the very first experiments in a given direction, and the earliest sketches and designs. These collections, in order to illustrate the achievements of science and industry in a really comprehensive manner, necessarily had to be international.

The central library above referred to, and which is intended for serving the scientific purposes of the museum, contains both ancient and modern works, pamphlets, periodical publications, etc., on subjects of engineering, mathematics, and science. While furthering historical investigation, this library is intended to make accessible to both specialists and lay people the very latest scientific and industrial achievements. An archive of maps and diagrams of unsurpassed dimensions is connected with the library, and will allow both the engineer and workman to obtain useful information on subjects otherwise inaccessible. While the collection of documents and manuscripts is of mainly historical interest, it should be remembered that the museum, so far from being merely an archive of things of the past, is meant to be primarily an organization operating to further scientific research and popularize technical knowledge. This will be best understood from the accompanying illustrations, representing a few samples of the most extensive collections of the museum. One of the illustrations shows a model of the "Santa Maria," in which Columbus discovered America. The interior of the alchemistic laboratory forms part of the exhibit and will be found espe-

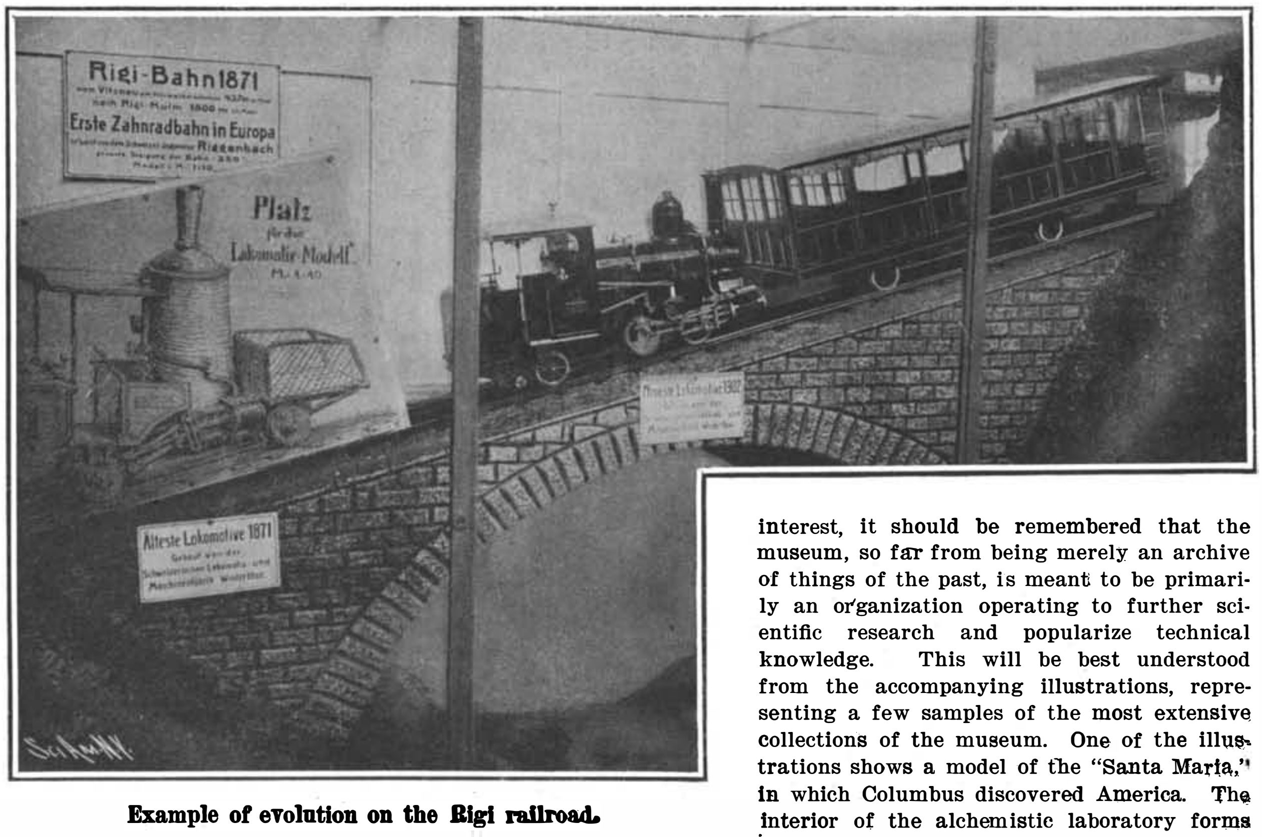


Apparatus used in Korn's picture telegraphy.



Successive stages in the evolution of the plow.

Evolution of the automobile.



Example of evolution on the Rigi railroad.

GERMAN MUSEUM OF MASTERPIECES OF SCIENCE AND INDUSTRY.

cially instructive, as compared with the examples of chemical laboratories in the eighteenth, nineteenth, and twentieth centuries. While on one hand a most striking progress from the primitive apparatus of alchemists to the improved instruments of modern chemists will be noted, it is interesting to observe that certain apparatus still retain their original, traditional form, in which they have been used by the predecessors of present-day chemists. The evolution of plows is figured from the most primitive implement, viz., roughly shaped trees drawn first by men and afterward by oxen, to the present-day steam plows, passing through many stages which had to be traversed in various ages and centuries. Another feature in evolution pertains to the development of automobiles, from the first motor-car constructed by Daimler in 1885, to the most improved modern types. In the same hall will be found a similar retrospective exhibition, relating to the various stages in the evolution of cycles. The strides made in a special branch of railway engineering, viz., the construction of mountain railway locomotives, are graphically rendered. Side by side with the latest type of locomotive used on the Rigi railway is a model of the earliest type used on the same railway line, the latter having been constructed in 1871.

In the exhibit representing the achievements in the field of electricity is shown the outfit used in the Korn picture telegraphy, of which a description was given some time ago in the columns of this journal. To the left in the illustration will be noted the sending apparatus with an electric lamp and the cylinder on which the photographic film is wound up, while the receiving apparatus is shown at the right. Diagrammatic views and descriptions, in addition to some samples of telephotographs, further facilitate the understanding of this apparatus, the importance of which will be fully gaged only after its introduction into general practice.

Black Diamonds.

BY GEORGE E. WALSH.

The term "black diamonds" is sometimes jokingly applied to ordinary coal which we burn in our furnaces, but the real "black diamonds" of commerce are among the most unique mineral products of the world, and they serve a purpose in the industrial world that makes them of great value. The black diamonds are pure carbon, and yet in no outward appearance resemble the diamonds which we are accustomed to wear as ornaments. They are slightly harder than the crystal or gem diamonds, and in fact about the hardest substance known.

Black diamonds or carbons are among the greatest curiosities of the mineral kingdom. They are without crystalline form, and are found in irregular pieces ranging in size from half a karat up to three, four, and five hundred karats. They are dark gray, black, or brownish in color, and opaque. The real diamond of the jewelry trade is also pure carbon, but translucent and crystalline in form. Two objects so alike in composition could not be found so opposite in appearance as these two forms of carbon.

Another peculiar thing about the black diamonds is that they are found only in one locality in the world. They come from a very small section in Brazil, not more than 225 miles square in area. Outside of this limited territory, no pure black diamonds have ever been found. In the Brazilian black diamond fields the natives dive in the river beds for them, and recover them from the gravel and washings of the rivers.

What peculiar freak of nature caused the deposition of the black diamonds in this section of the world and nowhere else, is one of the mysteries which science has failed to explain. None of them has been found in the great Kimberly diamond regions, where the crystal form of diamonds have for so long been mined, and likewise no fine specimens of the gem diamond have been found in the Brazilian black-diamond fields.

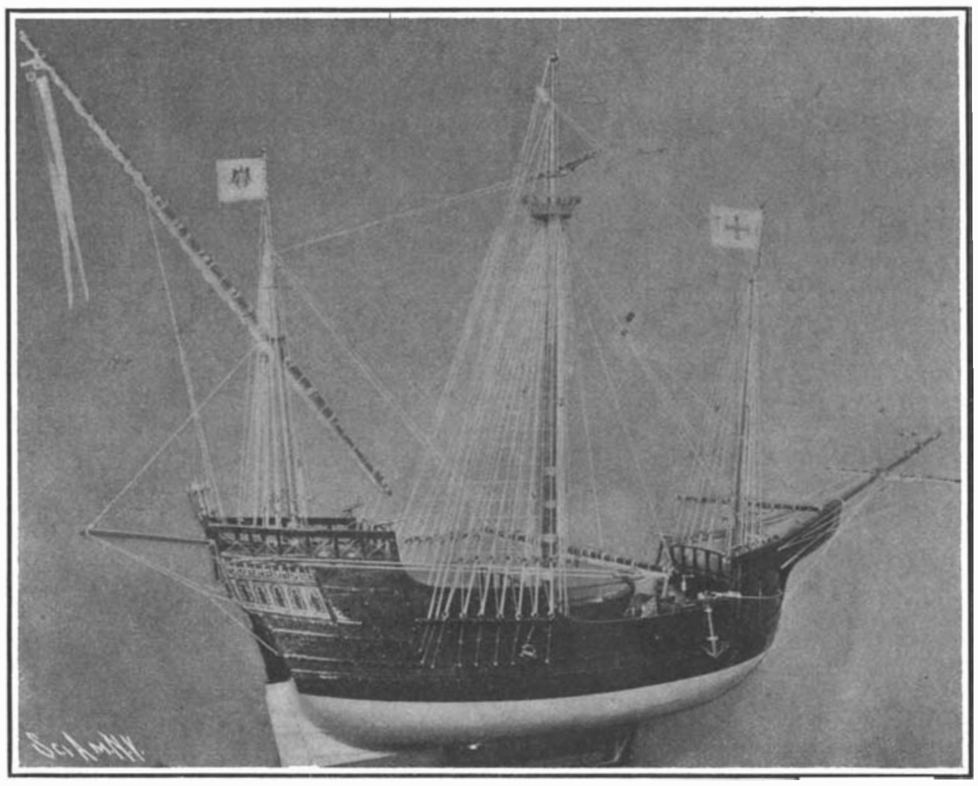
The whole origin of the black diamonds is therefore a scientific enigma. Naturally, the question is raised, "Of what use is a black diamond?" No one would care to wear one of these diamonds, which resembles a piece of coal more than a real diamond, and so far no one has popularized the black gems as the black pearl has been. Nevertheless, the black diamonds serve a most important and useful function in the industrial world.

This pure black carbon is not only harder than the real diamond, but tougher and not so brittle as the gem. Consequently, it is of great value for many mechanical purposes, and particularly for boring with diamond drills. In diamond drilling, the tips of the drills are studded with carbon or black diamonds, and when the bores are deep, the pressure is so great that the gem diamonds would be crushed in the process. But the carbon resists this continued pressure, and slowly eats down into the rocks.

In diamond drill work, the carbon is set in circular pieces of soft steel or iron, called bits, and these bits are attached to tubing. Armed with these black-diamond teeth, the drills push their way down under severe pressure to a depth of five and six thousand feet, cutting through the hardest kind of rock. Some black diamonds are much harder than others, and there is no way to determine by the color the difference in the degree of toughness.

Black diamonds or pure carbon are not by any means cheap, and the owners of the mines in Brazil where they are gathered are making a good thing out of their monopoly. In the last thirty years the prices of black diamonds have advanced from $5 to nearly $85 a karat, and the tendency is still upward. The arming of a drill with diamond points is thus a rather expensive matter. Usually a set of eight stones are placed in the head of a single drill. If each diamond weighs only three and a half karats, the total cost at $85 per karat would be about $2,380 for a single bit.

Great as this expense is, however, it pays, for the black diamonds are so tough that they last a long time, and they achieve results which could not be obtained in any other way. There is no known substance that can take the place of carbon in drills in boring for gold, silver, copper, and other mineral deposits.



The "Santa Maria," which carried Columbus to a new world.

GERMAN MUSEUM OF MASTERPIECES OF SCIENCE AND INDUSTRY.

Before the black diamonds of Brazil were discovered, it was impossible to make deep borings.

When the carbon was first introduced in our industries, it was used in diamond saws for cutting stones, marble, and similar substances. Then the price advanced so that the carbon was found too costly for such use, and bort was substituted for stone cutting. Bort is really an imperfect crystal or gem diamond, but it is too brittle for use in drills. Consequently, bort has taken the place of black diamonds for stone cutting, and the latter have been restricted almost entirely to diamond-drilling purposes.

The average size of black diamonds used in the drills ranges from two to five karats, but the larger specimens give much better results. They cost more, but they last longer. Consequently, there is a greater demand for the larger pieces of pure carbon, and the price is sometimes run up to premium figures for unusual specimens.

The fear that the supply of black diamonds may some day give out and paralyze the diamond-drilling industry has stimulated prospectors to systematic search for new deposits; but so far they have not been successful. On the other hand, scientists have been making a close study of the chemical conditions which have produced the black diamonds; but their manufacture is apparently about as difficult as the making of the gem diamonds. It is possible under certain conditions to make either, but not in sizes sufficient to be of any commercial value. Nature in some peculiar way has made these rare products, and then thrown the secret of the process away. If any man can ever unlock or find that secret, he may cause a panic in the diamond trade.

The Real Value of Steam Coal.

In general, it may be said that a furnace may be designed to burn almost any kind of coal with good efficiency, and that the real value of a coal depends very largely upon the number of British thermal units which it contains. So states Mr. D. T. Randall, engineer in charge of fuel engineering department of the Arthur D. Little, Inc., laboratory of engineering chemistry, Boston, Mass., in a recent paper. He points out that tests which have been made at the government fuel-testing plant seem to indicate that the most important thing to be considered in a coal is its heating value. Following this, the size of the coal may be considered next in importance, and when the moisture, volatile matter and ash are widely different they must also be considered. The results of more than 400 boiler tests at the government testing plant show that the average drop in efficiency for a range of coals between 14,000 B. T. U. and 10,000 B. T. U. is only about 6 per cent. This difference is due to the combined influence of the size of the coal and the moisture, volatile matter, and ash in the coal. It will be seen from these figures that the probable influence of any of these constituents is not as great for hand-fired furnaces as it is often thought to be. With certain boiler equipments in which a considerable overload is necessary at times, the effects of these constituents may be much more important, owing to the reduction in capacity which may be obtained, and it is for this reason that when coal is selected for a given plant it is important that the coal supplied should not vary greatly from time to time; otherwise, the fireman may have serious difficulty in maintaining the capacity required, and in burning coal with good efficiency.

With a furnace which is well designed, there should be a close correspondence between the heating value of the coal and the water evaporated. Small variations in moisture, volatile matter, and ash should make little if any difference in the efficiencies obtained.

The size of the coal may influence the results to a serious extent. Small sizes of anthracite coal pack together closely, and strong drafts are required to burn them. This results in holes in the fire and a leakage of air in the boiler settings. The loss is often estimated to be at least 10 per cent. This is also true of many of the bituminous coals. Other coals which coke readily, forming a loose bed of fuel, do not show much loss, due to the presence of fine coal, except such as is so small as to be carried off from the grate by the draft. With any character of coal there may be a loss of fine coal, due to sifting through the grates. That this loss may be large is well known. The carbon in the ash is an important item in determining the losses in a boiler room. In many plants care on the part of the firemen has reduced this loss to the equivalent of 2 and 3 per cent of the fuel fired. Occasionally, owners of power plants have purchased for testing purposes a coal of higher grade than they usually furnish for the boiler furnaces. The results obtained have often been disappointing, and without further investigation they have declared that the plan of purchasing coal on the basis of its heating value is at fault, and that corresponding results cannot be obtained from the higher grade coals. On the other hand, it has happened that others have tried coals of lower heating value than the coal regularly burned in their plants, and they often find a greater drop in the evaporation than they expected. This has led many people to believe that there is a great difference in the value of coals for only slight variations in the composition.

Boiler tests are a rather crude method of comparing coals, especially if the fireman is not accustomed to burning the coal to be tested.

A chemical laboratory test is conducted under conditions which may readily be duplicated, and the results are therefore more reliable than boiler tests.

The averages of a number of boiler tests on each coal on which the combustion is fairly good in all cases should show results which agree quite closely with the chemical results on the coals, provided they are of the same general character. If they vary in composition, a slight reduction in efficiency may be expected for the coals high in moisture, volatile matter, and ash.

The Mexican Central plant at Aguascalientes for preserving railroad sleepers with oil, which was started some years ago as an experimental plant to develop and perfect the Ebano oil process, is now treating about a carload, of 3,500 sleepers, daily. Each sleeper takes up about three gallons of oil.

HOW TO MAKE CONCRETE POTTERY.—VI.

BY RALPH C. DAVISON.

(*Concluded from the issue of August 14th.*)

In the previous articles nothing much has been said in detail in regard to the numerous and various materials which can be used in making concrete, such as the different kinds of stones, pebbles, etc. Nor has anything been said about the quantity of each ingredient necessary to make a fixed amount of finished material.

Concrete is made by mixing together with water various proportions of Portland cement, sand, and stone. The sand and stone which go to make part of the mixture are commonly known as aggregates. It is by the careful selection of these aggregates that we are able to produce numerous pleasing and artistic results.

In many cases, if the proper aggregates are used in the right proportion, natural stones such as limestone, granite of all colors, brownstone, and French Caen stone, etc., can be so closely simulated that it takes an expert to tell it from the real material.

The ordinary concrete or cement surface as usually seen is most uninteresting in appearance. As a general thing, it is smooth and lifeless and of a dull gray color. The same general appearance as just described for ordinary concrete will prevail in almost any concrete surface, no matter what the aggregate used, unless the surface is treated so as to expose or bring out the aggregates used. If, however, the surfaces of the concrete in which selected aggregates have been used are property treated, a marked difference between these surfaces and those obtained with ordinary mixtures will be noted. By varying the kind, size, and proportions of the aggregate used, surface finishes of practically any desired color and texture can be obtained, the possibilities being limited only by the number of different kinds of aggregates available and the combinations of the same.

In small work, that is, where the thickness of the finished product is to be ½ inch or less, never use any aggregate exceeding ⅛ inch in size, especially so if the mixture is to be made thin enough to pour. In larger work having a thickness of 1 inch or more, aggregates up to ¼ of an inch can be used with good results.

Some interesting textures for pottery work can be obtained from the following mixtures:

A mixture composed of 1 part white marble chips not exceeding ¼ inch in size, and 1 part of trap rock or other dark stone of the same size mixed with 1 part of Portland cement and 1 part of marble dust will produce a surface similar in appearance to a light granite. This mixture should be allowed to set for twelve hours after pouring, then the molds should be carefully removed, as the concrete is still green, and the surface of the concrete should be lightly brushed with a stiff brush.

As the concrete is not thoroughly set or hardened yet, this operation will remove the surface cement, and thus expose the aggregates of marble and trap rock. After having performed the above operation, allow the piece to harden a few days, and then treat the surface with a solution composed of 1 part of commercial muriatic or hydrochloric acid to 3 parts of water. Dash this solution onto the face of the concrete surface with a brush, and allow it to remain for at least fifteen minutes. Then thoroughly scrub it off with a good stiff brush and plenty of clean water. This operation will remove all of the surplus cement, and will leave a good clean surface full of life and sparkle. Instead of using white marble chips and granite, as above, one can vary the results by using white marble chips and crushed-up red brick; or various colored marbles crushed to the proper size can be used, and then by treating the surfaces as explained, the colors in the various aggregates will be exposed, thus producing some very interesting surfaces.

A good light-colored surface somewhat simulating limestone can be procured by using 1 part Portland cement to 2 or 3 parts of white marble dust. After this has become thoroughly hard, treat it with acid as described above. The acid will eat off any surface cement, and thus the marble dust will be exposed, producing a pleasing sparkle throughout the entire surface. To simulate white marble, use 1 part white Portland cement to 2 parts of marble dust, and treat surface with acid as described.

By incorporating in the above mixture a small amount of yellow ocher a pleasing buff tint will be given to the mass, which will then very closely resemble French Caen stone. To simulate red granite, use red granite chips or screenings. These can be procured at almost any stone yard where they cut granite. The pieces to use should range in size from ¼ inch down to dust. If the pieces available are too large, they can be crushed up with a hammer. The proportions of the mixture should be 1 part of Portland cement to 2 parts of the granite. After having set for twelve hours, brush the surface out and treat it with acid as already explained, and the surface thus obtained will very closely resemble the real red granite. From the above details the reader will have grasped the possibilities to be obtained by the selection of aggregates, and now by using a little ingenuity can without further instruction experiment along original lines, which will be found most fascinating work.

In regard to the amount of the various ingredients to use for a fixed amount of finished material, the uninitiated often think, and naturally so, that if an amount of finished material equal in bulk to three glassfuls is required, all that is necessary to do, if it be a 1 to 2 mixture, is to take one glassful of cement and two glassfuls of sand, and then by mixing these together they will still have an amount of material that will fill three glasses. This is not so. The particles of cement are ground so fine that the cement is practically one dense mass; but the particles of sand are coarser, and between each of the particles appears a space or cavity. These cavities are called voids, and it is in these voids that the larger portion of the cement finds its place when the mass is mixed. The majority of sands used in concrete work contain from 25 per cent to 40 per cent of voids. If we take the larger figure for an example, then in two glassfuls of sand we will have 80 per cent of one glassful of voids. As we only have one glassful of cement to add to the two glassfuls of sand, and as the cement fills the 80 per cent of voids in the sand, it is plain that we have but 20 per cent left upon which we can figure for bulk. Therefore, instead of having three glassfuls of material, as one might naturally think, we will only have two glassfuls and 20 per cent of one glassful over, or two and one-fifth glassfuls of finished material. The percentage of voids varies largely in different grades of sands. The finer the particles of which the sand is made up, the smaller the percentage of voids. It is always best to use sand in which the particles are not uniform in size, or in other words, use what is commonly termed a well-graded sand. By this is meant a sand in which the particles vary in size say from 1/32 inch or less up to 1/16 inch or a trifle more. The heavier the work, the coarser the sand that can be used. Be sure that the sand used is clean. By clean sand is meant sand that is free from loam or clay. One can readily detect dirty sand by placing same in the palm of the hand and slightly wetting it. Then if by rubbing it around the hand becomes discolored, there is more or less dirt in the sand. A little dirt will not do much harm, but it is always well to have it perfectly clean. It is often found necessary to wash the dirt out of sand by means of water. This can be done by placing the sand in a pail of water and agitating it, thus making the dirt rise to the top. To thoroughly wash the sand, keep running the water into the pail and agitating the sand until the water discharged is practically clear.

When using a stone aggregate in the mixture, the spaces or voids between the particles of stone are filled by the cement and sand in the mixture, as were the voids in the sand filled by the cement. As in sand, the larger the particles of stone used, the greater the percentage of voids in it will be. Therefore a greater amount of sand and cement will be required to fill them.

By a little experimenting along these lines, one will become experienced enough to judge fairly closely the amount of each ingredient to use in mixing up any amount of finished material needed. It is always well to mix a trifle more material than is needed rather than not enough. For when one once starts pouring a cast, he should continue to pour until the mold is full. If not, a mark is very apt to show in the finished cast where pouring was left off and started again. Never try to use any material that has been mixed and let stand for more than half an hour. For in this time the concrete will have commenced to get what is called its initial set. If the mass is now disturbed and worked up again, the product produced will never have the same strength as one made with freshly-mixed material. In mixing, always mix the cement and sand together thoroughly before adding the water. One can judge by the color of the mass, fairly well, as to whether the mixing is complete. If the color is uniform throughout, it is a pretty good sign that the aggregates are well distributed through the mass. When making a mixture containing cement, sand, and stone, always mix the cement and sand dry first and then add the stone, which has previously been well soaked in water. In this way one is assured of having each stone coated with the cement and sand; for as soon as the damp stone comes in contact with the dry cement and sand, they adhere to it and cover the stone completely; thus a compact matrix of cement and sand is formed between each and every particle of stone, which binds them securely together into a dense and compact mass.

HOME-MADE CHEMICAL PERFUME.

BY GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Early in the nineteenth century, chemists generally thought it impossible to make organic compounds out of the elements found in them. Synthesis they believed to be practicable only in the case of minerals. Woehler, with his remarkable synthesis of urea, shook that belief at least as much as the Curies recently shook the common belief of chemists in the integrity of the atom. Other organic syntheses followed that of urea, and some of them, as that of the alizarin dye, were made in conditions so favorable that it became unprofitable to grow the plants from which the chemical had hitherto been extracted. Thousands of acres have thus been so far given back to the cultivation of food stuffs, and one may confidently expect a time in which most, if not all, of our drugs, dyes, and even food will be made through synthesis. Agriculture then will be a thing of the past. Factories will make for us sugar, starch, fats, proteids, that is to say bread, eggs, milk, fruits, besides some new foods which may prove as superior to the old ones as antipyrin and pyramidon have proved superior to the natural alkaloids formerly used in similar circumstances.

The most recent and greatest advance in the organic synthesis of industrial products can be observed to-day probably in the perfume industry. The fragrance of heliotrope, hyacinth, pink, rose, violet, hawthorn, lilac, musk, wintergreen, vanilla, cinnamon, bitter almonds, and that of many fruits, are now produced with chemicals which frequently have but a repugnant smell or no smell at all. Most of these syntheses require complicated apparatus as well as considerable chemical skill, but in one case at least, that of terpinol, an essence now sold sometimes under the name of lilac, sometimes under that of lily of the valley, the operations are simple enough, and the synthesis is but an enjoyable experiment easily performed at home or in the class room.

APPARATUS FOR MAKING ARTIFICIAL LILAC PERFUME.

Besides the vessels found in every kitchen, the only needed apparatus are a round-bottom flask (capacity about one pint), a rubber stopper with one hole, and two glass tubes united with a piece of rubber tubing. The preparation may be divided into two operations, i. e., the transformation of common oil of turpentine into terpin and the transformation of terpin into terpinol. The first operation requires much time and no care whatever. The second operation is made in less than a quarter of an hour.

One-half of a quart bottle is filled with oil of turpentine. Three-fourths of a pint of alcohol at about 80 per cent is mixed with it, and one-fourth of a pint of nitric acid is added to the mixture, which is left to itself for several days, until crystals are formed. These are collected, and dried with some blotting paper. They are pure terpin. To get the full amount formed in such circumstances, one should wait over three months; but, for experimental purposes, such a delay is, of course, unnecessary. Moreover, should the experimenter wish to prepare the perfume at once, he may get the ready-made terpin at the drug store, as it is prescribed by physicians for a kind of lung trouble.

To transform odorless terpin into fragrant terpinol, terpin must be heated with water containing a small amount of sulphuric acid. The round-bottom flask is half filled with water. Two or three large spoonfuls of terpin are thrown into it, and about as much sulphuric acid is slowly poured into the flask. There is no danger in pouring sulphuric acid into water, but water should never be poured into sulphuric acid, as the heat thus suddenly generated may cause some of the caustic liquid to be thrown out of the bottle.

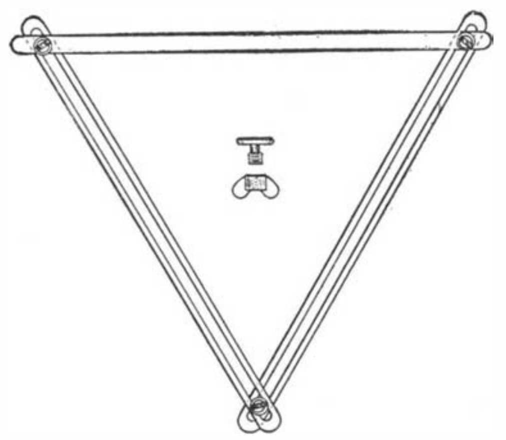
An alcohol lamp is now lighted directly under the flask. If a gas stove be used, a piece of wire gauze should be interposed between flame and flask. As soon as the liquid in the flask begins to boil, the glass tube is plunged into the water in a tumbler. There the steam and the terpinol carried along with it noisily condense. A delightful scent fills the room. To keep the tumbler cool, place it in a bowl of water. The operation is over when the liquid in the tumbler has become nearly hot in spite of the water in which the glass is immersed. A layer of liquid terpinol will then be found to float over the water. The fragrance, which is extremely strong while the essence is warm, becomes much more agreeable after it has cooled. Some odoriferous plants, such as marjoram, contain terpinol in their leaves, but the extraction of the essence from such sources is always much more expensive than its synthesis with oil of turpentine.

PAPER HANGER'S ADJUSTABLE TEMPLET.

BY I. G. BAYLEY.

This handy tool wil be found useful, and will save considerable time, in cutting wall paper up the rake of a stairway or where any roof slants, allowing the paper hanger to cut a number of lengths of paper on the paste board at once, where at present it is only customary to cut one at a time.

The tool can be made of wood, and satisfaction obtained, although a better tool can be made from saw steel. Each blade is about three feet in length, two of them being furnished with slots, running almost the full length. Three thumbscrews, detailed on a larger



PAPER HANGER'S ADJUSTABLE TEMPLET.

scale, will be necessary to hold the frame together after the proper adjustment is obtained. The paper should be hung in position on the wall, and one side of the tool held along the perpendicular edge of the paper, while one of the other sides of the tool is adjusted to suit the angle of the stairway or slanting roof, when the screws are tightened up, and the frame permanently set.

HOW TO MAKE A SIMPLE DRY BATTERY.

BY GEORGE F. WORTS.

Often the experimenter is in need of a good dry battery of a certain size or shape for some particular work, where the ordinary standard sized cell is either too large or not of the right shape for the same work. An inexpensive dry cell that will produce results, and can be made by anybody capable of handling a soldering iron, has long been the desire of every experimenter. The cell as described herein has been used for many purposes and with marvelous results by the writer, and has been used in other shapes where economy in space was desired, such, for instance, as in wireless telegraphy.

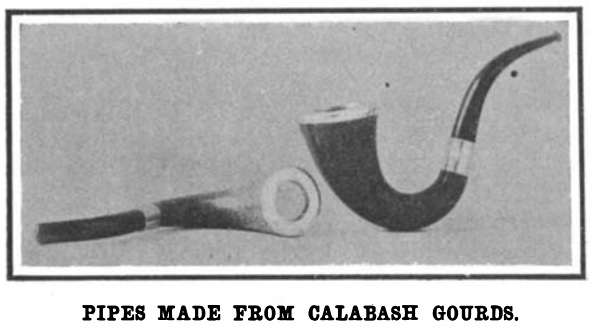
To make a cell of the standard size, a strip of zinc of medium thickness, 8¼ inches long and 6 inches wide, is necessary. The zinc is rolled into a cylinder 6 inches long and 8 inches in circumference, thus leaving a quarter of an inch which is to be tightly soldered. A zinc cap is next soldered on one end of the cylinder. Any solder showing on the inside is to be well shellaced. Do not shellac any zinc surface, as that will interfere with the action of the battery. Line the inside of the cylinder with a thin layer of blotting paper. For the positive pole of the battery the carbon from a wornout cell is the best if procurable, but if not, a bundle of arc light carbons with the copper surface well filed off is the next best. The chemicals for producing the action that generates the electricity are, ¼ pound of sal ammoniac, ¼ pound of chloride of zinc (paste form), ¼ pound oxide of zinc, and ¼ pound plaster of Paris. These salts should be thoroughly mixed with a mortar, and packed tightly in the cylinder about the carbon, which is a half inch from the bottom of the cell. This paste will fill the cylinder to within half an inch of the top, the rest being filled with paraffine. A copper terminal soldered to the zinc and a heavy copper wire scraped clean and bound about the protruding end of the carbon, form the negative and positive connections for the cell.

This cell can be easily formed in various other shapes to suit the experimenter's fancy. The cell herein described, if constructed according to specifications, will produce very satisfactory results, especially in ignition work or for wireless. It will register about 1 2/5 volts and between 10 and 15 amperes.

HOME-GROWN CALABASH GOURDS.

BY CHARLES A. SIDMAN.

The Department of Agriculture, through its office of foreign plant introduction, has brought to the notice



PIPES MADE FROM CALABASH GOURDS.

of the smokers of the country one of the most useful articles of their trade. This is the curious calabash gourd, a plant indigenous to South Africa, and from which the highest quality of pipe bowls can be made.

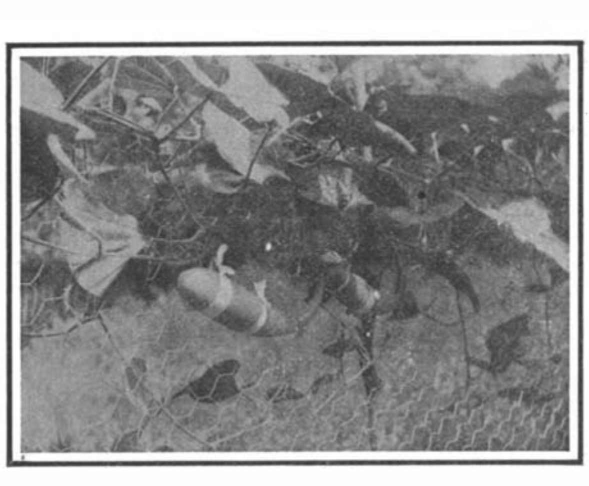
The plant is now being introduced into the United States for the purpose of pipe making, and it has been found by experiments to thrive perfectly in our climate. The perfect success with which the gourd can be grown in almost any part of the country warrants the belief that it will prove a good investment to import a large amount of seed from South Africa.

A curious feature of the calabash gourd pipe is its great resemblance to a certain capacious-bowled meerschaum popular in Germany. It is said that a Boer farmer first utilized the gourd as a pipe, and that the English shortly afterward recognized its merits and the use to which the plant could be adapted.

From the educated smoker's point of view, the calabash pipe not only yields a very sweet and cool smoke, but it colors beautifully, far surpassing in this respect the finest meerschaum. Besides taking on a high polish, its life is about as long as that of a French brierwood pipe. The usual lining is of plaster of Paris, usually known by the trade as pipe meerschaum.

The present market price of these calabash pipes is rather high, owing to the fact that there are but few grown in this country, and also to the fact that these gourds are never of the same shape and size, necessitating the making of the mountings by hand.

The writer was given a few seeds for testing, and his success was all that could be desired. The plant was of very hardy growth, and the fruit set very easily. As there was only one plant, each flower had to be pollenized. The plant was grown on a trellis about five feet high, but as the fruit began to get very heavy, it had to be tied to the wire. In growing the



THE GOURDS ARE TIED TO THE TRELLIS TO GIVE THEM THE PROPER SHAPE.

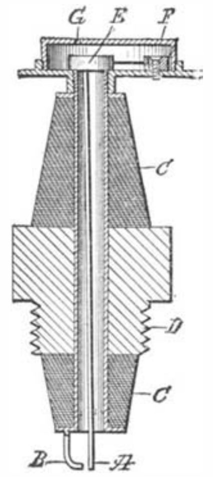
plant for pipes, it seems to demand a very hot and dry soil, with rain at the right season to bring the gourds to perfection. The curved stem end of the calabash forms a light and appropriate shape for the pipe. The majority of the gourds take their own shape, but for special shapes they must be tied.

Any man who has a small space in his yard can grow enough pipe gourds in a season to last him for several years.

THE HANDY MAN'S SPARK PLUG.

BY R. W. PEARSE.

The spark plug shown here is equally well adapted for high or low tension ignition. It may be made by a handy workman out of an old mica plug by taking out the steel wire down the center and putting in its place a piece of brass tubing, 3/16 of an inch ouside diameter and ⅛ of an inch inside diameter. *A* and *B* are the terminals forming the spark gap, *C* is the mica, and *D* the threaded body of the plug. The upper end of the terminal *A* is riveted to a small valve which is pressed down by a weak spring and thereby closes the upper end of the tube, as shown in the sketch. A valve chamber is screwed on the upper end of the tube, thus holding the mica together. The valve operates in the chamber, being fastened thereon by the screw *F*. The valve and its seat should be ground flat, and then the terminal *A* should be riveted to it. There is a small hole *E* in the cover of the air chamber. The cover should be fastened to the chamber with a screw or other simple means, so that it may easily be detached for the purpose of cleaning the valve. In use the terminal *A* vibrates with a noise like the trembler of a coil, and in this way strikes the terminal *B*.



THE HANDY MAN'S SPARK PLUG.

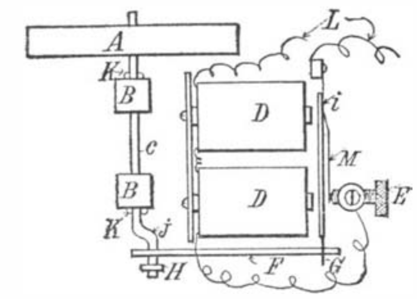
During the compression stroke the compressed gases travel up the central tube, lift the small valves, and instantly fill the valve chamber to the same pressure as the cylinder. With the same pressure on both sides of the valve, it will be forced down by its spring. But as the gases in the chamber *C* escape through the hole *G*, the pressures will be thrown out of balance, and the valve will again be raised by the pressure in the cylinder. This action will continue during the entire compression stroke. The hole *G* should be extremely small, and the amount of gas that will escape during compression will not perceptibly lessen the power of the engine. It will be clear that as the valve is raised, *A* approaches *B* and also that *A* moves away when the valve is closed, because the fulcrum is virtually at the screw *F*.

As *A* keeps striking *B* while it vibrates the low-tension contact, or touch spark, may be used with this plug. This plug gives many contacts, and therefore many sparks, instead of the single contact given by the usual hammer and anvil. This plug is far simpler than the hammer and anvil system, and besides it does not leak and lose compression like the latter does when worn. It will work with high-tension ignition with a trembler coil. As the terminal vibrates, it keeps itself clean, and an excess of oil or soot will not affect it like an ordinary plug. If used for high-tension ignition, the period of vibration should not be the same as that of the coil trembler, or an odd spark will be missed, owing to *A* being sometimes in contact with *B* when the high-tension current is in the act of flowing. The terminal *A* may be made to vibrate as rapidly or slowly as desired by strengthening or weakening the valve spring.

HOW TO MAKE A SIMPLE ELECTRIC ENGINE.

BY ROBERT H. BROCKMAN.

A simple electric engine may be made as follows: Take an ordinary electric bell and remove the gong. The striker arm should be cut off about ¾ inch from the armature, leaving the butt *G*. A strip of brass 1/16 inch thick and ¼ inch wide of suitable length is bored at both ends, one end to fit the butt *G* and the other end to fit the crank *J* of the shaft *C*. The shaft is made of ⅛-inch diameter brass or steel. Care should be taken to make the stroke of the crank *J* the same as that of the armature.



A SIMPLE ELECTRIC ENGINE.

The balance wheel *A* is fastened to the shaft *C*. Any wheel of suitable size and weight can be used. In the model made by the writer a valve wheel 2 inches in diameter was used.

The bearings *B* can be made of strip brass—in the model screw eyes were used. *K K* are wire rings soldered to the shaft *C* to keep it in place. *H* is a wire ring soldered to the crank to keep the strip *F* in place.

When the screw *E* is properly adjusted and the terminals *L* are connected to a battery the engine will run at a high rate of speed.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

MILLINERY DEVICE.—J. POPPER, New York, N. Y. This invention relates to a device by which one may determine the effect of any particular style of hat without having the actual hat at hand. A relatively large card or screen is provided having a display opening for the head, and a pictorial representation of a hat about the opening, a portion of which is adjustable to and from the screen in order that the effect of the hat may be obtained.

SKIRT-LIFTING DEVICE. — M. BECHER, Wilmington, Del. The object here is to provide a device arranged for attachment to the waist of a woman, to allow her to raise the skirt evenly all around and to support it in this position without requiring the use of the hand, and with a view to prevent the skirt from being soiled when walking in rainy weather, and to allow her to use both hands freely for carrying an umbrella or when entering or leaving cars and vehicles.

BOOT AND SHOE HANGER.—C. B. ROBUCK, San Bernardino, Cal. This device is adapted for use in suspending or supporting boots, shoes, and other foot wear having a sole or heel crease, the same being in the nature of a spring clamp adapted to embrace the heel portion of the article and thus hold it by friction in any position in such manner as not to obstruct the view of the same appreciably.

Electrical Devices.

MACHINE-TELEGRAPH. — G. C. READ, Davenport Station, Toronto, Canada. Mr. Read's invention refers to machine telegraphs, his more particular object being to provide a receiver system including mechanism whereby currents sent over an electric line and made up of dots and dashes, are caused to operate the keys and analogous parts of a typewriter, so as to print the letters corresponding to the telegraphic characters.

ELECTRIC GENERATOR.—E. F. WHITE, Spokane, Wash. This invention refers to electric generators of the portable manually-operated type, the more particular purpose being to provide an improved form of such generator especially suitable for blasting and having a high degree of efficiency with great mechanical strength.

ELECTROTYPE.—A. VAN WINKLE, Newark, N. J. The electrotype is for use in galvanizing iron or steel in such a manner that a very heavy and smooth deposit is obtained. For this purpose use is made of a solution containing fluosilicate of zinc, in combination with certain salts, and a small quantity of gelatin or other organic substance that improves the deposit.

Of Interest to Farmers.

CULTIVATOR.—D. J. ELLIS, Parlier, Cal. The invention relates to cultivators, and has for its object to provide a cultivator with teeth which may be adjusted as to depth and which may also be rotated in the teeth bar so that the cutting edge may be turned to any desired angle relatively to the said bar.

PLANTER.—J. H. MCCOY, Aberdeen, S. D. The aim in this improvement is to provide economic check row devices of novel construction and accurate in operation and that will avoid the use of ropes, wires, or equivalent guides, and wherein the working mechanism includes means for effectually laying off or marking the rows to be planted.

PIG-FORCEPS.—W. ROBERTSON, Vail, Iowa. This invention is an improvement in pig forceps. In operation it will be found that the forceps may be easily inserted and engaged with the presenting portion of the pig, and when once engaged will retain a firm grasp thereon. The different sized pairs of blades also provide for the use of the same instrument on large and small animals.

EGG-CARTON.—R. M. ODELL, Hoisington, Kan. One object of the inventor is to provide a device by which eggs may be shipped without danger of breakage, in separate cells which are so joined together as to form a single package designed to be placed in a case, and when so placed to form a rectilinear body which will act as a brace for the case itself.

POTATO-PLANTER.—G. W. NATION, Alliance, Neb. This potato planter attachment is for use in connection with the agricultural implement shown and described in a co-pending application filed by Mr. Nation. In operation a roller engages an arm thus swinging the latter out of a chute and dropping a potato cut into the furrow. As soon as the roller passes the end of the arm a spring immediately returns it into a pocket to engage another cut. The disks are provided with arms, which loosen the ground and cover the potato cuts deposited in the furrow.

STRAW-RACK FOR GRAIN SEPARATORS. —J. P. NESTE, Lake Mills, Iowa. The purpose in this case is to provide details of construction for racks, which are adjuncts of a grain separator, whereby positively continuous and regular speed and reciprocating motion of the racks is assured, and a reliable separation of the grain from the straw is produced while the threshing is being conducted.

PLOW-BLADE.—O. S. JEWETT, Lordsburg, Cal. The object here is to provide a blade, which in suitable number are radially arranged and secured in lapped engagement with each other and with clamping disks, whereby a spading wheel is produced that in series is secured on an axle at suitable intervals, said axle being journaled on a frame that is adapted for progressive movement.

CULTIVATOR.—A. BRIGDEN, Albertville, Ala. The object of the invention is to produce a cultivator of simple construction, the teeth of which may be adjusted so as to change their distance apart as may be desired, and further to provide a construction which will enable the teeth to be adjusted as to their elevation to adapt the implement for use on a hillside or ridge.

PLANTER. — A. BRINKOETER, Floresville, Texas. This planter is without springs inside of the seed box which are apt to be choked or gummed by the seed or dust. The invention provides bottom plates and feed plates of different sizes, which may be used with seeds of different sizes, and also for seed which are to be planted a greater or shorter distance apart.

AGRICULTURAL IMPLEMENT.—A. C. NELSON, Nelson Township, N. D. This invention relates more particularly to such implements as are known as potato forks, and each of which in general consists of a head having a fork integral therewith, the latter being provided with a plurality of tines, a shaft having a handle at its upper end pivotably secured to the head, and means for locking the shaft in a plurality of positions on the head.

Of General Interest.

CURRENT-MOTOR.—C. A. NEYLAND, Spokane, Wash. This invention relates to wave or current motors of a class that utilize the force of a moving body of water, such as a flowing stream or tidal action, for useful effect. The purpose of the invention is to provide novel features more particularly for the current motor formerly patented by Mr. Neyland.

RELEASING DEVICE.—C. HUNT, New York, N. Y. The intention here is to provide a device arranged to permit instant releasing of the boat-lowering means from the boat as soon as the latter reaches the water, thus allowing the crew to quickly pull away from the vessel and thus prevent the boat from injury by bumping against the side of the vessel, especially if a heavy sea should prevail at the time.

APPARATUS FOR CONSTRUCTING CONCRETE PIPES.—F. TEICHMAN, San Francisco, Cal. In this patent the invention relates to concrete pipe constructions, the more particular object being to provide certain general improvements in the molds for cheapening the building of concrete pipes. An advantage lies in the arranging of the plates of the inner mold into a general spiral form to facilitate the removal and replacement of the plates as the work proceeds.

FENCE-CLAMP.—P. GREEN, Wytheville, Va. This invention is an improvement in fence clamps and relates particularly to the means whereby the lines of the wire of wire fences may be held for connection with the stretching device. The construction is simple and by forming the opposing surfaces curved, the wire will be tightly and firmly held, and as the curve prevents slipping the clamp may be operated efficiently with fewer bolts than in ordinary constructions.

FASTENING.—I. COLEMAN, New York, N. Y. The invention refers to eye glasses and spectacles, and the object is to provide a device for securely fastening the frame and lenses together without use of screws, and use is made of a stud held in a post lug and extending through an aperture in the lens, the free end of the stud being engaged by a locking device having connection with the post.

PROCESS OF MANUFACTURING SOLUBLE COMPOUNDS OF MERCURIC SALTS WITH HEXAMETHYLENE-TETRAMIN.—A. BUSCH, Brunswick, Germany. The invention consists in the application of the discovery of a process in which, for instance, dry hexamethylene-tetramin-mercuric chlorid is mixed with an equal weight of an albuminoid, soluble in water, such as albumose, peptone, alkali-albuminate, casein alkali or the like, and the mixture is dissolved in a soap solution, the mercury of the solution is in an organic form and no longer to be precipitated by the usual reagents for precipitation of mercury.

CONCENTRATING-TABLE.—J. W. MEYERS and D. F. PAINE, Ely, Nev. The table is such as used in concentrating the crushed ores of precious metals. Simple means are provided for maintaining a cover such as linoleum, in a taut condition, the general object being to prevent buckling or formation of ridges or unevennesses in the cover, which usually necessitates the removal or replacing of the cover.

Hardware.

ANTISAGGING DEVICE FOR DOORS.—C. LEHMAN, Elgin, Iowa. The purpose in this case is to provide a device which may be manufactured at little expense, and which is adapted to lift the door to a normal position after the wearing of the hinges causes it to drop out of normal position, the support being so constructed that it is certain of operation although the pintles of the hinges are out of alinement.

LOCK. — H. C. WALDECKER, Austin, Minn. This invention pertains to locks such as used on doors. It concerns itself especially with locks which employ a latch bolt for latching the door, and a bolt for locking the door. The latch bolt is withdrawn by turning the knob, while the locking bolt is operated by a key.

SAW-HANDLE.—R. D. BOWER, Oakville, Wash. The invention relates to fastening means employed for securing saw handles to cross-cut saws, and the special object is to so construct the fastening means that the parts cannot become accidentally loosened; which presents no obstructions or sharp points which might injure the hand of the workman; and which can be readily disassembled to permit removal of the handle.

BRUSH.—S. A. VER BRYCK, Belleville, N. J. The purpose here is to provide a paint-brush or the like, in which the bristles are securely attached to the head of the brush, in which the ferrule holding the bristles in position is compressed and partly imbedded in the head to hold it in place, in which a comparatively small head can be employed for holding a large quantity of bristles, and in which the necessity of extensively nailing or otherwise securing the ferrule to the head is obviated.

PROTECTION-NOZZLE FOR FIRE-HOSE.—M. J. SANGER, New York, N. Y. The production is of a nozzle having a construction which will enable a protecting sheet of water to be thrown out from the nozzle and between the firemen and the fire, so that the firemen will be protected from the smoke and gases of combustion; and to arrange the nozzle in a way that the sheet will not have the effect of producing a draft toward the fire.

KEY-RING TAG.—H. E. MILLESON, Shelbyville, Ind. Mr. Milleson's invention consists in the forming of the tag of two separate plates, one constituting an identification plate and the other a stamp-bearing plate, the two plates being so connected together that the stamp is normally protected yet may be readily exposed to view.

BELT-LACING TOOL.—J. W. KANE and W. R. CHRISTIE, New York, N. Y. This tool is adapted to be used in lacing the ends of belts together. The invention consists in a gouge adapted to cut openings in the belt of any size desired, and a slicing knife which is adapted to cut lacings for the belt of a size such that they will fill the openings cut by the gage.

LUBRICATOR FOR SAW-BLADES.—G. E. HANZINGER and S. J. RONAN, Greenville, Miss. The aim in this instance is to provide a lubricating attachment which may be easily operated when required, whereby lubricant may be discharged at will upon the saw blade so that it is enabled to make a narrower and smoother kerf with less friction. Thus lubricated a blade requires less set or spread of teeth, and will do closer, smoother work with less force.

SICKLE-SHARPENER. — O. A. HAUBENREISSER, Little Rock, Ark. The sharpener is for use in connection with a grind stone and to provide means for clamping a sickle bar on a support mounted on the frame of the stone. A universal joint permits movement of the sickle to give it the proper angle to the stone, and a counter balanced sickle carrier is arranged to be raised or lowered and to be moved lengthwise along the stone, so that the sharpening can be performed with quickness and convenience.

STIRRUP.—G. W. HOOKS, Sourlake, Texas. The stirrups are made rights and lefts, the right being the exact opposite of the left, and they will always hang in proper position for the insertion of the foot without twisting the stirrup leather. The inner side will not chafe the body of the horse. It may be made of any suitable material and form of body or foot plate to accord with the saddle.

NUT-LOCK.—W. R. GARNER, Palestine, Texas. This improvement in nut locks is especially in that class of nut locks and plates designed for use on railroad joints, frogs, cars, bridges, and the like, as well as on engines, iron fencing, buggies, wagons, and otherwise where similar locks can be employed.

Heating and Lighting.

PETROLEUM-BURNER FOR INCANDESCENT LIGHTS.—E. HOLY, Berlin, Germany. This invention relates to burners which have a horizontal flange around the top of the outer wick. This flange is usually permanently connected with the outer wick tube, but according to the present invention, it is made independently thereof, and is supported by the burner gallery, for instance, by means of arms or feet which are mounted on a ring fastened to the gallery.

VACUUM-VALVE FOR HEATING SYSTEMS.—F. SHURTLEFF, Moline, Ill. In this patent the invention is an improved valve or combination of valves for maintaining a partial vacuum in a heating system. It is capable of use with any vacuum heating system or other apparatus where it is desired to prevent the return of air after it has been expelled.

Household Utilities.

MATTRESS.—P. KLIMOWICZ and J. S. WORZALLA, Stevens Point, Wis. This mattress is intended to provide a comfortable and healthful position to the person, and to this end is constructed with an approximately transverse groove or depression in which the shoulder is adapted to sink, and a number of substantially longitudinal grooves intersecting the transverse depression to receive the forearm and a loose covering over the depressions.

COFFEE-POT.—T. J. CLEMENT, Atlantic City, N. J. This pot has a percolator which can be readily introduced and removed. The construction of the percolator is such that it holds itself fixed within the coffee pot, the member which operates to hold the percolator within the pot operating also to hold the cover of the percolator in position.

SERVING-CUP FOR BEVERAGES.—T. J. CLEMENT, Atlantic City, N. J. The cup in this instance is for use in serving beverages, and it has improved means for refrigerating the glass containing the beverage, to the end that a beverage can be kept cold even if allowed to stand a considerable time after having been served.

DIPPING DEVICE FOR BOTTLES OR JARS.—B. W. MCGINNIS, Wichita, Kan. The device is for use in holding bottles or milk jars when they are being dipped to sterilize or scald them. It can be operated in a simple manner to hold a number of bottles in a convenient manner to enable them to be dipped in a vessel having a scalding or sterilizing bath.

DINNER-PAIL.—A. M. HUNT, Hampden, Maine. The invention refers more particularly to devices for carrying food and the like which includes a number of traps for liquid and solid contents and which have means for holding heat-supplying substances such as burning coke or charcoal, for maintaining the contents of the receptacle in a heated condition.

BED.—W. H. CLING, Charleston, S. C. This invention shows a form of invalid bed in which the mattress frame can be raised at the head and lowered at the foot to suit the necessities or convenience of the occupant. Efficient means are provided for actuating the parts and for maintaining the intermediate portions of the mattress and the head portions of the mattress under the desired tension regardless of the adjustment of the bed.

COVER FOR TEAPOTS.—T. J. CLEMENT, Atlantic City, N. J. This invention is a division of the invention described in a patent the application of which was formerly filed by Mr. Clement. The improvement is useful in connection with any pot on which a beverage may be brewed from leaves or grindings; or indeed, it may be used in any connection where the contents of a serving vessel should be strained before serving.

ADJUSTABLE SHADE-SUPPORT.—C. P. WESTHAUSER, New York, N. Y. In this patent the invention is an improvement in shade and such like supports, the present embodiment of which belongs to that class of such devices in which the shade-supporting arms are adjustable to and from each other to accommodate shades of different length.

Machines and Mechanical Devices.

STARTING DEVICE FOR THE COMPRESSED-AIR MOTORS OF SELF-PROPELLED TORPEDOES.—A. E. JONES, Fiume, Austria-Hungary. This invention consists in particularly connecting the delay action flap of ordinary construction with the reducing valve of the pressure reducer arranged between the compressed air reservoir and the motor, for dispensing with the moderating part of the air admission valve ordinarily arranged between the reducer and reservoir, and the auxiliary air supply valve for disengaging or operating the gyroscope, thereby simplifying the mechanism of the torpedo while rendering it more certain in its operation.

GRINDING AND PULVERIZING MILL.—J. J. KNIGHT, Alameda, Cal. The invention relates more specifically to a mill in which communicating rollers are arranged in concentric circles upon a supporting member, and have concentric pressure rings arranged upon each circle of rollers and held resiliently and adjustably in position thereupon to force the rollers firmly against the supporting member.

WASHING-MACHINE.—R. TWOHIG, Salina, Kan. The intention is to provide a machine which can be driven by hand or by power, in which clothes, household linen, etc., can be laundried efficiently, in which the cleansing is effected by the pounding action of a beater upon the articles, which are immersed in a washing fluid such as soapy water, and in which the articles are positioned preferably upon a perforated, false bottom.

ROTARY VALVE.—S. YANKAUER, New York, N. Y. An object of this invention is to provide a valve in which the valve plug is resiliently held in place, so that leakage is effectively prevented, and in which the rotation of the valve in opening and closing the same tends to continually grind the valve plug and seat and maintain a perfect fit.

GRADER OR DITCHING-MACHINE.—W. L. DAVIS, Wabbaseka, Ark. The invention comprises a pair of blades or boards which are disposed at an acute angle to each other, the arrangement being such that when the implement is advanced one of these blades or boards presents itself in an inclined position so that its lower edge will operate as a scraper on the surface of the earth.

MOUNTING FOR BOTTLE-WASHING BRUSHES.—A. N. DAVIS, New York, N. Y. In the present patent the invention has reference to mechanism to be used in connection with bottle-washing brushes, the inventor's more particular purpose being to produce a mounting provided with a spring-controlled mechanical movement for holding the brushes in good position for washing the bottle.

WRAPPING, TWISTING, AND POLISHING MACHINE.—W. J. CAREY, Trenton, N. J. The purpose here is to provide a machine, arranged to cover a plurality of wires or cores with paper or like wrapping material, and then polish the covered cores and twist the same into a single strand, in an exceedingly simple manner and in one operation.

PARACHUTE.—T. L. ZOOK, Lima, Ohio. In

this parachute rigid guys or braces operate in conjunction with a sail or kite to extend it; and the inventor's objects are to provide means for effecting the opening of the parachute in descent; to afford facilities for folding and stowing the device, and to provide a durable and simple construction of the several parts of the parachute and its entirety.

CAPPING-MACHINE. — C. A. Youngman, Louisville, Ky. The intention of the inventor is to provide a machine, arranged to press the cap or capsule snugly onto the head and neck of the receptacle, without danger of marring the cap or capsule, or scratching or removing the paint, wax, or other material with which the cap is decorated.

Railways and Their Accessories.

SWITCH MECHANISM.—F. F. Young, Lowell, Ohio. The invention pertains to railway switches, and particularly to the switches of light railways such as trolley tracks. The inventor's aim is to provide means for operating the switch from the car platform so as to obviate the necessity for operating the switch by hand.

AUTOMATIC SWITCH-STAND. — E. E. Staggs, Hachita, New Mex. An object here is to provide a switch in which the target will always indicate the true condition of the switch. This obviates a grave danger which arises from the use of switch stands of the ordinary kind since with this invention there must be a positive movement by some one who wishes the switch to be changed before the target will indicate such change. The change made, the target will be shifted to indicate the change and will be positively locked in its shifted position.

LOCOMOTIVE ASH-PAN.—J. S. Downing, Atlanta, Ga. The inventor's object is to provide a novel positively operating construction for discharging ashes from the ash pan. This is an automatic self-cleaning ash pan having a system of hoes attached to the piston rod, and a cylinder adapted to receive fluid pressure for reciprocating the hoes in the ash pans for discharging the ashes thereon.

RAIL CHAIR AND BRACE.—E. Jandreau, Cherry Valley, N. Y. The object of the invention is to provide a chair and brace, by means of which railroad rails can be securely held in place upon the cross ties, and which serve to brace the rails against lateral movement at curves and other points of the track where such bracing is necessary.

METALLIC CROSS-TIE AND RAIL-CLAMP. —H. S. Kilbourne, Washington, D. C. An object of this invention is to provide a cross-tie of light weight but strong and durable. In carrying this out I-beams of standard sizes and shapes are used, thereby reducing cost of manufacture. The tie requires but few bolts, the main connecting member being a clamp of a peculiar form.

Pertaining to Recreation.

MOVING-PICTURE DEVICE. — W. Hendrick, New Haven, Conn. The object of the present invention is to provide certain improvements in chaplets and shrines of the holy rosary, whereby actuating mechanism is employed and the endless web containing pictures is properly actuated, to accurately display one of the pictures at a time and to display the several pictures in the proper order according to the intended devotional exercise.

Pertaining to Vehicles.

THILL-COUPLING.—V. B. Henby and H. Fintel, Jr., Hardy, Neb. The main object in this case is to provide an improved means for enabling the draft eye to be detached or inserted, while at the s : time means are provided for holding the draft eye in close contact with the coupling pin to prevent rattling of the various parts.

POLE-TIP.—J. W. Deam, Geary, Okla. The invention relates to tips for wagon poles and the like, and more particularly such as have resiliently controlled means for securely holding a neck yoke in place on the pole. In operation, the latch cannot drop out through the slot of the casing, as the stop with its shoulders, which are transversely disposed with respect to the slot, is covered by the end of the pole.

PNEUMATIC TIRE.—P. I. Viel, 37 Rue de Rivoli, Paris, France. This invention relates to a tire characterized by the use of a lining formed of a metal cable of wire. This packing or lining is intended to entirely do away with ruptures resulting from excessive pressure or excessive weight, or overheating and punctures. This lining diminishes in no way the flexibility of the tire.

BOLSTER.—J. Heimlicher, Defiance, Ohio. The aim in this instance is to provide a bolster for wagon bodies and the like, which is light in weight and inexpensive to manufacture, and which can be easily fabricated from standard structural iron or other metal pieces, such as I-beams and channels.

Designs.

DESIGN FOR A CUT-GLASS DISH.—T. B. Clark, Honesdale, Pa. This highly ornamental dish is of a circular form and its height is about one-half the diameter of the top and open part. The pattern cuttings are of great variety and exquisite design.

DESIGN FOR A TOBACCO-PIPE.—J. M. Tatum, Athens, Texas. The bowl in this ornamental design represents the body of a tree with several roots sawed off close at the base. The handle has a symmetrical curve. The words Dum Tacket Clamet are inscribed across the bowl and also large initial letters W. O. W. arranged vertically.

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

NEW BOOKS, ETC.

The Commercial Products of India. By Sir George Watt. New York: E. P. Dutton & Co., 1908. 8vo.; 1,189 pp. Price, $5.

This work is an abridgment of "A Dictionary of the Economic Products of India," which was published in 1893-4, and which has been out of print for some time. The government of India therefore decided that a correct and abridged edition should be brought out. The instructions provided that the work should be limited to a single volume, the arrangement of which should follow that of the dictionary and should be confined to products which are at present of prospective industrial and commercial importance. The book is a monumental work, and represents a vast amount of labor. It will prove valuable to those who are in any way identified with Indian industries.

The Photographic Manual. Edited by H. Snowdon Ward. London: Dawbarn & Ward, Ltd. New York: Tennant & Ward. 12mo.; 287 pp. Price, paper, 50 cents; cloth, $1, postage extra.

This is the fifth edition of an excellent English manual which incorporates the figures, facts, and formulæ of photography, and is a guide to their practical use, and is intended for all photographers. This collection of formulæ is one of the best that we have ever seen. It is a book which should be in the hands of every photographer.

The Angler's Guide. A Manual for Campers and Anglers. Edited by Wainwright Randall. New York: The Field and Stream Publishing Company, 1909. 18mo.; 242 pp. Price, 50 cents.

This little volume contains a description of all popular fresh-water and salt-water fish. It describes tackle and bait for the expert angler; it gives complete information on how, when, and where to fish, and a summary of the fishing resorts of the United States and Canada. The book is admirably arranged, and is very well printed. Its form is so convenient that it can be carried in the pocket. Among the features which appeal to us particularly are the views and plans of bungalows, the fishing charts, and the directions for preparing food suitable for a fishing camp. The book should be in the possession of every fisherman.

The Directory of Directors in the City of New York. New York: The Audit Company, 1909. 12mo.; 860 pp. Price, $5.

The tenth edition of this useful work has just come from the press, and maintains the reputation of its predecessors for completeness and reliability. The Directory this year contains over 32,000 directors, each director's name being followed first by the name of the firm or company with which he is directly associated, and then by all the companies in which he is a director. Select lists of corporations in banking, insurance, transportation, manufacturing, and other lines of business, alphabetically arranged, accompanied in each case by the names of the company's officers and directors, are to be found in the appendix, as well as a list of the principal exchanges in New York, with their officers and managers. This is a book which no business house dealing with a large number of companies or their stocks and desiring to know by whom their clients' interests are controlled, can afford to be without.

The Implement Blue Book. St. Louis: Midland Publishing Company, 1909. 8vo.; 460 pp.

This is a very useful book of reference for all users of or dealers in vehicles of all kinds, agricultural machinery and implements. A remarkable feature is the simplicity with which one can find any name or subject heading one wants, the book being described as "self-indexed, double-indexed, and cross-indexed." It begins with a classification of manufacturers in the alphabetical order of the implements they make, following with vehicles in the same manner. Then comes a list of manufacturers in alphabetical order, with lists of the specialties they make, and then a list of branch jobbing and transfer houses in geographical order, with the names of manufacturers whose lines they handle.

Engine Lathe Work. By Fred H. Colvin. New York: Hill Publishing Company, 1909. 16mo.; pp. 180. Price, $1.

The writer is Assistant Editor of the American Machinist, and is the author of many well-known books on mechanical subjects. The present volume gives practical suggestions which will give the young machinist or apprentice the foundation principles of engine lathe work. The illustrations number 127, and are well executed. The author states that while the suggestions have been written especially for those with a limited experience, it is quite probable that many of the ideas and suggestions may be new to some of the older men who have not had a chance to see what other shops were doing.

Radford's Artistic Bungalows. Unique Collection of 208 Designs. Chicago and New York: The Radford Architectural Company, 1908. 4to.; pp. 221. Price, $1.

In the last three years the number of bungalows which have been built in the United States has increased by leaps and bounds, and whole farms are being split up into lots for the erection of bungalows consisting of from two to five or more rooms. The work before us consists of a collection of wash drawings and floor plans. Plans and specifications for any of them are furnished by the publishers at moderate rates. The illustrations are hardly as attractive as they would be if they were made from photographs of bungalows which have actually been built.

Third Report of the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. Andrew Balfour, M.D., B.Sc., F.R. C.P. Edin., D.P.H. Camb., Director. Published for Department of Education, Sudan Government, Khartoum, by Balliere, Tindall & Cox, 8 Henrietta Street, Covent Garden, London. Depot for U. S. A.: Toga Publishing Company, 45 Lafayette Street, New York city, 1908. 4to.; pp. 476.

The admirable work conducted in the Wellcome Research Laboratories is undoubtedly familiar to our readers. The laboratories were established to promote technical education in general; to further the study of tropical disorders, especially the infective diseases of both man and beast peculiar to the Sudan; to render assistance to the officers of health and to the clinics of the civil and military hospitals; to aid experimental investigations in poisoning cases by the detection and experimental determination of toxic agents, particularly the obscure potent substances employed by the natives of the Sudan; to carry out such chemical and bacteriological tests in connection with water, food stuffs, and health and sanitary matters as may be found desirable; to promote the study of disorders and pests which attack food and textile produce and other economic plant life in Sudan; and to undertake the testing and assaying of agricultural, mineral, and other substances of practical interest in the industrial development of the Sudan. The two volumes of reports previously issued by the laboratories cover the period from the foundation of these laboratories in 1903 to 1906. The third report completes the record up to 1908. The work of the laboratories has been so far extended that the latest report contains some 480 pages or detailed records of many interesting experiments, and researches principally connected with tropical medicine. The volume is profusely illustrated, and includes many valuable colored plates. Simultaneously with the Third Report, and as a Supplement to it, is published a Review of the Progress made in Tropical Medicine during recent years, compiled by Dr. Balfor and Dr. R. G. Archibald.

Dictionary of Chemical and Metallurgical Machinery, Appliances, and Material Manufactured or Sold by Advertisers in Electro-Chemical and Metallurgical Industry. First Edition. New York: Electro-Chemical and Metallurgical Industry, 1909. 12mo.; pp. 182. Price, 50 cents.

La Morphologie de l'Insecte. Par Charles Janet. Limoges, France: Imprimerie-Librairie Ducourtieux et Gout, 1909.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 17, 1909,

AND EACH BEARING THAT DATE

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

Adding machine, O. W. Gooch 931,410
Addressing machine, W. F. Kellett 931,619
Advertising device, M. H. Singer 931,509
Advertising machine, F. W. Remer 931,218
Aerodart, C. R. Bannihr 931,026
Air brake, Turner & Farmer 931,237
Air brake system, E. M. Swift 931,234
Air motor or locomotive, Pittman & Harrison 931,643
Air ship, R. Schmiechen 931,225
Amusement device, F. W. Nall 931,139
Annunciator board, J. Zickel 931,548
Armatures for alternating current motors, winding of, B. C. Shipman 931,150
Atomizer, Venner & Brown 931,240
Automobile lock, Crim & Loy 931,684, 931,685
Automobile rear axle, F. C. Miller 931,451
Automobile wheel, J. A. Fleming 931,403
Awning, M. L. Bond 931,259
Axle bearing device, car, J. W. Stephenson 931,658
Axle box lubricating device, car, H. C. Gamage 931,053
Bag bundling device, G. J. Nuessen 931,468
Baker's goods, milk, postal packages, newspapers, and the like, arrangement for receiving, W. Eichelkraut 931,285
Baking powder, W. A. Beatty 931,027
Baking utensil, potato, J. F. Fairbanks 931,587
Basin, toilet, W. Rieck 931,489
Batteries, preparing alkaline electrolytes for storage, D. P. Perry 931,082
Battery elements, preparing storage, D. P. Perry 931,081
Bearing for upright shafts, step, W. H. Larrabee 931,069
Beater, M. A. Valy 931,100
Bed bottom, W. Shannon 931,149
Bed or douche pan, Williams & Scott 931,539
Bedstead lock or joint, M. D. L. Martin.. 931,447
Beer drawing apparatus, Handy & Phillips.. 931,297
Bell ringer, E. Wilson 931,108
Bell striker, T. L. Wilson 931,172
Bilge drainer, C. W. Moore 931,633
Biscuits, machine for making shredded wheat, W. E. Williams 931,243
Bit. See Boring bit.
Blast and pressure meter, E. H. Schulz... 931,348
Blasting device, J. Phillips 931,341
Blowpipe, E. S. Kimball 931,623
Boat, W. N. Bell 931,177
Boat and tent, convertible, J. Vag:hi 931,529
Boiler tube cleaner, J. Zilliox 931,245
Boll weevil exterminator, J. W. Evans 931,401
Bolt and nut lock, Egenas & Chapman 931,187
Book holder, E. S. Antisdale 931,111
Book, loose back, C. Chivers 931,679
Boring bit, expansible, L. W. Garner 931,593
Bottle, L. V. Phillips 931,216
Bottle cap, A. M. Miller 931,450
Bottle filling and capping head, G. Kirkegaard 931,624
Bottle filling and capping machine, T. G. Redington 931,649
Bottle filling machine, T. Roberts 931,344
Bottle stopper, G. Kirkegaard 931,625
Box, S. Bachmann 931,373
Box, A. Sabor 631,655
Box strap reel, A. Griesbeck 931,294
Braid, cord making, and similar machines, carrier for, A. Petersen 931,083
Braiding machines, etc., carrier for, A. Petersen 931,084
Brake shoe adjuster, O. S. McCurdy 931,212
Bread raiser, J. M. McIntosh 931,075
Brick molding machine, C. Simpson 931,154
Brine cooling apparatus, G. F. Dickson 931,687
Broom, S. F. Frazier 931,290
Brush, F. M. Hanaway 931,602
Brush, rotary tooth, C. L. Phillips 931,143
Brush stud support, B. A. Behrend 931,376
Building block molding machine, A. L. Post 931,644
Burglar alarm, G. J. Deffner 931,395
Burglar screen, E. A. Wayland 931,360
Cabinet for the sacristy, R. A. McEachen.. 931,462
Cable hanger clamp, S. B. & G. B. Dusinberre 931,399
Cager and sump guard, G. Holmes 931,203
Calorimeter, C. J. Emerson 931,189
Can capping machine, G. W. E. Brooks 931,262
Can filling machine, C. S. Bucklin 931,561
Cans and their heads, machine for clenching sheet metal, Adriance & Calleson 931,022
Cans to operating mechanisms, device for feeding, Krummel & Taliaferro 931,434
Candy, sugared nut, McDonald & Hopson.. 931,137
Cap, miner's, I. M. McPherson 931,463
Caps, device for applying protectors to fulminating, W. E. Miller 931,454
Capping machine, C. A. Youngman 931,244
Capping machine head, G. Kirkegaard 931,626
Car coupling, G. E. Tomlinson 931,097
Car coupling, E. F. Pendexter 931,338
Car draw bar and extension shank, M. A. Garrett 931,193
Car fender, G. W. Mahan 931,326
Car framework, E. C. Anderson 931,555
Car side bearing, railway, J. F. Courson... 931,681
Carbureter, M. D. Colbath 931,386
Carton, G. Mortson 931,074
Carton, egg, R. M. Odell 931,637
Cash register attachment, O. K. Sletto 931,349
Casket lamp for hearses or funeral cars, adjustable, Roe & Antes 931,490
Celery bleaching sleeve, C. W. Mark 931,628
Cellulose article, colored, O. Muller 931,634
Cement and making same, package of sticky, A. Thoma 931,350
Centrifugal apparatus, H. E. Warren 931,707
Centrifugal screen, W. R. Cunningham 931,280
Characters on sheet material, machine for impressing, C. B. Stilwell 931,158
Chasing mill working in looped paths, G. Eirich 931,585
Check receptacle, C. Boulard 931,260
Chenile strip manufacturing mechanism, W. P. Zimmermann 931,365
Chilian mill, W. B. Easton 931,186
Chuck, drill, C. W. Manzel 931,327
Chuck release, lathe, W. L. White 931,167
Churn, M. V. Dudley 931,583
Cigar, F. Meyer 931,629
Cigar machine, F. E. Kelsey 931,314
Cigarette detachable and collapsible tip, C. A. Drucklieb 931,582
Circle divider, N. Perris 931,080
Circuit breaker, Browne & Howell 931,264
Clasp. See Veil clasp.
Clasp, Albertoni & Tropeano 931,023
Clock, electric self-winding, Steiger & Besancon 931,157
Clock register, nautical, T. Cunningham 931,278
Clutch, J. Schneider 931,500
Clutch, M. H. Fischer, reissue 13,009
Clutch, car cable, H. S. Robinson 931,089
Clutch mechanism for printing, stamping, and die presses and the like, friction, M. Rockstroh 931,651
Coal scuttle, D. O. Hedges 931,300
Coat fastening means, W. S. Barker 931,250
Coating articles, dipping process for, W. G. Scott 931,503
Coating composition, receptacle, W. R. Long 931,324
Cock, safety gas, O. R. Hasty 931,197
Coin controlled mechanism, B. M. Davis... 931,574
Coke loader, Wright & Monroe 931,110
Collection box, E. E. Adams 931,549
Colliery and other inclines, safety appliance for, J. Morton 931,078
Combination rack, Haas & Giles 931,059
Commutator, dynamo electric machine, J. E. Webster 931,105
Commutator, dynamo electric machine, B. G. Lamme 931,130
Compasses, attachment for, A. E. Washburn 931,359
Compound, H. M. Sinclair 931,094
Concrete construction, reinforced, Foster & Schulz 931,049
Concrete construction reinforcing bar, P. T. Large 931,320
Concrete mixing machine, Scott & Dilgard.. 931,657
Concrete mold, D. E. Tingley 931,351

Concrete post. E. U. Down.................. 931,396
Concrete post. H. H. Johanning.............. 931,616
Concrete reinforcing bar, J. M. Dudley...... 931,185
Connection for co-operating members, flexible, J. E. Webster.................. 931,165
Container, safety. W. Asbury................ 931,370
Control switch and system, H. D. James, 931,126, 931,205
Conveyer, cross, C. L. Gardner.............. 931,054
Cooker, steam, F. C. Roberts................ 931,088
Cookers, food tray for steam, M. A. Warner.... 931,533
Cooking utensil, I. E. & R. Q. Lincoln...... 931,209
Corn cabinet, seed storage, S. Babcock.... 931,669
Cotton folder, F. Phelps.................... 931,474
Coupling, J. G. Zimmerman................... 931,173
Croquet arches, socket post for supporting, H. B. Collier 931,568
Cross tie and rail clamp, metallic, H. S. Kilbourne 931,622
Crossover, removable, C. B. Ryan............ 931,493
Cultivating attachment, C. S. Norcross..... 931,333
Cultivator swivel wheel attachment, S. Seitner, Jr. 931,504
Culvert flexible joint. J. Doyle............ 931,581
Current motor, variable speed alternating, R. D. Mershon 931,136
Current rectifying apparatus. R. P. Jackson. 931,124
Currents having limited strength, process and apparatus for producing, M. M. Osnos 931,336
Cutter thimble for grape and other picking, A. M. Southworth 931,511
Cutting off machine. L. D. Davis........... 931,043
Cycle change speed and back pedaling brake mechanism, C. T. B. Sangster......... 931,656
Damper regulator, G. Steele................. 931,095
Deodorizer, C. E. Blood..................... 931,029
Depth gage, L. B. Benton.................... 931,253
Derrick platform and turntable, J. W. Page 931,703
Desk, R. T. Jackson, Jr..................... 931,311
Dish, butter, F. Schille.................... 931,497
Dock, dry, L. M. Cox........................ 931,182
Door attachment, screen, A. R. Gordon...... 931,411
Door closure, J. Newsam..................... 931,701
Door, double action double, W. P. Armstrong 931,247
Door, grain, G. S. Ney...................... 931,467
Door hanger, flush, G. Fristad.............. 931,052
Door lock, W. S. Clawson.................... 931,567
Door, storm, F. A. Schureman................ 931,502
Douche pan protector, E. Reynolds........... 931,219
Draft ventilator, B. E. Cummings........... 931,183
Draw gear apparatus. J. F. Courson......... 931,682
Drawbridge gate, automatic, A. Lichtfuss.. 931,439
Dress shield, E. N. Gillard................ 931,591
Drier, W. E. Koop........................... 931,695
Drilling machine, stay bolt. J. Hocking.... 931,119
Drop light bracket, adjustable, P. L. Tenney 931,162
Drying and heating apparatus, L. Turk.... 931,098
Dye and making same, anthracene, F. Kacer 931,618
Dye and making same, sulphur, L. Haas.... 931,598
Dye, azo, L. Hesse, et al..........931,423, 931,424
Dynamometer, F. N. Connet................... 931,274
Edge protecting clamp, G. Stiehle.......... 931,233
Electric ground clamp, F. Stevens.......... 931,706
Electric machine connection board, J. G. Crawford 931,573
Electric machine, dynamo, J. D. Forrer.... 931,116
Electric machine, dynamo, B. A. Behrend.. 931,375
Electric machine, dynamo, E. Mattman.... 931,448
Electric machine, dynamo, Balcome & Freier 931,556
Electric machine, dynamo, F. E. Hirt 931,606
Electric machine, dynamo, W. S. Kelley... 931,620
Electric machines, winding for dynamo, H. C. Specht 931,156
Electric motor, H. C. Grant................ 931,416
Electric signaling, J. Mladek.............. 931,632
Electric time switch, J. & J. Jones, Jr.... 931,617
Electrical appliance, J. S. Stewart......... 931,518
Electrical distribution system, B. Frankenfield 931,404
Electrode, H. Specketer 931,513
Electrode, arc lamp, G. M. Little.......... 931,133
Electrode, arc lamp, S. P. Wilbur.......... 931,169
Electromagnet coil construction, A. A. Low. 931,445
Electromagnet coil construction, Wohl & Hertzberg ....931,540 to 931,542
Elevator. See Pneumatic elevator.
Elevator, W. E. Courtney 931,570
Elevator car and well door operating mechanism, H. Rowntree 931,224
Elevator gate automatic latch, automatic, Gilson & Beattie 931,693
Elevator mechanism. safety. H. O. Barnes.. 931,175
Elevator safety device, E. E. Moulton..... 931,211
Emulsion and producing the same, J. Stockhausen 931,520
Engine electrical interrupter, explosive, G. Honold 931,065
Engine electromagnetic igniter, explosion, G. Honold 931,066
Eraser holder. C. Frederick 931,405
Ether. santalol, J. Callsen, reissue........ 13,008
Exercising apparatus, P. S. Medart......... 931,699
Exercising device, A. Day................... 931,394
Explosive engine, W. F. Beaton............. 931,176
Fabric, E. H. Outerbridge................... 931,469
Fanning mill, L. O. Hage................... 931,060
Fastening device, Layman & Bouthillier... 931,131
Fastening, self-locking, G. Adams.......... 931,665
Faucet, R. Bell 931,252
Faucet, J. P. Urbanek 931,528
Feed regulator, Hall & Holmes....931,195, 931,196
Feed water heater, W. S. Ferguson......... 931,040
Feeding harnessed draft animals, W. H. & J. H. Granbery 931,596
Fence clamp, woven wire. W. N. Squires.. 931,516
Fence construction, W. M. Rankin........... 931,486
Fence post, R. Toennes 931,236
Fence post. F. E. Saunders.................. 931,495
Fences. wire entanglements. etc.. standard or support for wire, L. Andersen...... 931,554
Filter, E. Burt 931,267
Filter. Pendergast & Hinsley................ 931,472
Filtering bed. P. F. Bussman................ 931,032
Fire alarm. automatic. P. Bonini............ 931,377
Fire alarm keys, device for holding, A. & A. Iske 931,123
Fire escape, E. J. Cooke.................... 931,040
Fire escape, G. W. Brooks................... 931,031
Fire escape, traveling. L. Otter........... 931,702
Fire extinguisher and other air pressure liquid ejecting vessel. H. T. Blake...... 931,255
Fire extinguisher. automatic stationary, W. Esty 931,190
Firearm. W. L. Marble....................... 931,328
Firearm. revolving. O. W. Ringqvist...... 931,146
Fishing rod, E. H. Crane.................... 931,277
Flatiron, G. H. Heindselman 931,198
Floor scraper, F. J. King................... 931,432
Floor scraper, F. F. Hase. reissue.......... 13,011
Flue collar and pipe supporter, adjustable. A. L. McElvain 931,213
Flushing apparatus. C. A. Wulf............. 931,546
Folding machine, R. C. Seymour............. 931,230
Folding table, J. A. Keck, reissue.......... 13,013
Fork and spade fulcrum attachment, S. L. Conde 931,387
Friction block or shoe, C. C. W. Simpson.. 931,093
Furnace, J. Caygill 931,565
Furnace, W. C. Wilbur....................... 931,663
Furnace feeder, L. P. Bolander............. 931,258
Furnaces, firing, G. L. Prentiss........... 931,645
Furnaces, flame indicator for, F. Gelstharp. 931,594
Furniture, convertible, F. H. Henning...... 931,304
Fu joining, R. Theuerkauf 931,235
F inclosed. F. P. Poole......931,476 to 931,478
Game table. J. L. Patton................... 931,470
Garbage and like can. H. C. Buchmaier.... 931,266
Garment, W. S. Barker 931,248
Garment sleeve, J. G. Hochtuhl............. 931,711
Gas burner, W. G. Frazeur.................. 931,051
Gas burner, H. Ruppel....................... 931,654
Gas engine, A. S. Krotz..................... 931,319
Gas engine, C. T. Wade...................... 931,531
Gas generator. N. Goodyear.................. 931,293
Gas igniting device, electric, H. Jameson.. 931,427
Gas producer, F. Muller..................... 931,460
Gas purifying apparatus. F. Sepulchre.... 931,229
Gaseous fumes or smoke, treating corrosive, C. B. Sprague 931,515
Gear, change speed, P. Evans......931,288, 931,289
Grate, J. W. Webb........................... 931,534
Grate, electrically heated, Hermansen & Tygerson 931,605
Grease cup, A. F. Taylor.................... 931,659
Grinder head, Puffer & Hayes................ 931,483
Grinding mill, G. S. Emerick................ 931,045
Grinding mill, W. R. Cunningham........... 931,279

A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

(*Continued from page 156.*)

function enters largely. Each marine plant has its most efficient cruising speed, and in the case of cargo-bearing merchant marine vessels, every pound of coal saved means increased earnings, also increased cruising area to warships. When this economical speed had been determined, with a tachometer system consisting of a plurality of indicators distributed about the vessel to guide, the engines can be kept at this rate of speed accurately and with but slight effort. The captain, in his cabin or on the bridge, the chief engineer when off duty—all can keep track of exactly what rotation speed is being maintained.

The accuracy of dead reckoning is greatly facilitated by an exact knowledge of what engine speeds have obtained during stated and frequent intervals of time, instead of having to take the total number of revolutions over a protracted period and guess roughly at the distance traveled; because the distance traveled per minute by the ship at say 100 R. P. M. is not increased in proportion when 125 R. P. M. obtains. Therefore, during long periods the rate of speed of the shaft may vary considerably with no tachometer to guide the man at the throttle.

Efforts along this line have been made for a number of years, but have been productive of no dependable and accurate device prior to the invention of the system which is the subject of this article.

Centrifugal devices are not susceptible to mechanical transmission to various remote parts of the vessel, and lack extreme accuracy over protracted periods of operation. Pneumatic devices, operated by air-pumps actuated by the propeller shaft, are less accurate. Electrical tachometers have failed in accuracy heretofore because of the error introduced, and varying from day to day, by rubbing or abutting contacts becoming foul, thereby introducing a resistance in the circuit with corresponding inaccuracy of reading of a voltmeter operated by the dynamo, calibrated in R. P. M. of the propeller shaft. Owing to the former use of direct-current instruments, commutators and brushes were necessary on the magneto. The spring tension of these brushes varied, the commutator became oxidized and covered by oil from the bearings, and considerable error crept in. As a warship going ten knots per hour with engines turning over 72 R. P. M. is not traveling ten knots at 71 or 70 R. P. M., it is seen that a tachometer, to be of value, must be accurate to a fraction of a revolution, and maintain its calibration.

All reciprocating engines, owing to the use of connecting rods between the crank and the piston, impart rotation to their shafts of constantly varying angular velocity. The fewer the number of cylinders or the slower the speed of rotation, the greater this variation. These variations are smoothed out more or less by the flywheel on the stationary engine, but a marine engine has no flywheel except a propeller, the weight of which is not sufficient to possess flywheel action to any extent. Therefore, any tachometer actuated by the propeller shaft by gearing or otherwise, has imparted to it an unsteady rate of speed. If the tachometer is geared up to the shaft so that it will rotate faster than the shaft, any momentary irregularity in the revolution of the main shaft is multiplied in the tachometer proportionally to the ratio of gearing between the main shaft and the tachometer. Therefore, whatever indicating device is used in connection with the tachometer will pulsate, and the reading of the pointer on the scale of the instrument will be largely a matter of guesswork between two values of low and high. Hence it is evident that some sort of compensating device must be used to take up these momentary fluctuations of the propeller shaft, and impart to the generator of the tachometer a steady av-

(*Continued on page 168.*)

Grinding mill, S. Lieberknecht 931,321
Hame connection, J. A. McClellan 931,461
Hame fastener, W. L. Roper 931,652
Hammer, fluid pressure, L. E. Howard 931,609
Handle loop, W. S. Maxwell 931,698
Harvesting machine, grain, J. B. Deeds .. 931,575
Hay hook, Pennington & Chilton 931,339
Hay loader, S. M. Wixcel 931,109
Head rest, W. P. Clugsten 931,181
Heater. See Feed water heater.
Heater, C. H. Henzel 931,422
Heating apparatus, hot water, O. Oster 931,337
Heating device, orchard, F. E. Barney 931,557
Heating system, J. Collis 931,037
Heating system, car, E. H. Gold 931,395
Heel for boots and shoes, composite, E. C. Leahy 931,438
Heel protector for rubber shoes and the like, metal, F. W. Boxer 931,261
Hinge, W. S. Maxwell 931,697
Hinge and bracket, combined, L. Bertrand. 931,028
Hinge, pintle, F. Meyer 931,630
Hitching device, E. L. Harmer 931,419
Horn, amplifying, W. Tatelbaum 931,161
Horseshoe, C. T. Humes 931,067
Hose, flexible metallic, W. Schulz 931,091
Hot air wall pipe, J. W. Zuch 931,174
Hub, wheel, G. H. Du Bois 931,283
Hydraulic power apparatus, A. C. Ferguson 931,402
Incubator, Perkins & Davis 931,142
Indicator, H. P. Quick 931,484
Induction motor, R. E. Hellmund 931,302
Ink supplying apparatus, M. M. Buckler 931,560
Insulator for electric wires, A. V. Siler 931,507
Insulator, section, H. B. Clarke 931,385
Internal combustion engine, E. A. Rundlof. 931,346
Internal combustion engine, G. L. Crook .. 931,389
Ironing table, W. T. Potter 931,217
Jar, G. T. Barr, Sr. 931,672
Jarring machine, W. Lewis (reissue) 13,012
Jetting mill, W. Adams 931,021
Jewel setting, H. Hess 931,306
Journal box lid, C. A. Lindstrom 931,442
Kneading machinery, W. H. Rippin 931,087
Knives, making table, C. E. Peck 931,471
Knuckle opener, F. H. Wendt 931,708
Knuckle opener, car coupler, F. H. Wendt. 931,709
Ladder, step ladder, and scaffold, combined extension, P. Bucco 931,265
Lamp, L. Schepmoes 931,496
Lamp, arc, S. P. Wilbur 931,168
Lamp burner, Paul & McGinnis 931,642
Lamp chimney, W. S. Wiley 931,538
Lamp lighting and extinguishing system, gas, A. Grossmann 931,412
Lantern burner, A. F. Prahm 931,342
Last, E. Y. Austin 931,372
Lasting machine, second, H. F. Loewer .. 931,443
Latch, gate, T. R. Varnell 931,163
Leech, vacuum, J. E. Walter 931,102
Lens, bifocal, E. A. Covelle 931,571
Light protector, W. H. Geddes 931,407
Lightning arrester, W. E. Butler 931,033
Lightning arrester, W. Gifford 931,408
Limekiln, R. Buder 931,180
Liquid fuel supplying apparatus, F. Rademacher 931,647
Litharge, making, J. E. Sullivan 931,522
Load binder, R. L. Boyd 931,710
Lock, J. Blaszczyk 931,256
Lock, L. J. Harris 931,603
Locomotive ash pan, J. S. Downing 931,580
Logging apparatus, J. H. & M. H. Dickinson 931,576
Loom, haircloth, G. S. Cox 931,276, 931,683
Magnesium, electrolytic production of, Seward & Von Kugelgen 931,092
Mail and newspaper box, J. M. Lentz 931,696
Mail bag catching and delivering apparatus, H. R. Ladd 931,436
Mail bag delivering and receiving apparatus, W. L. Thompson 931,524
Mail pouch receiving and delivering apparatus for railway cars, etc., C. W. Broughton 931,263
Mailing machine, J. W. Orr 931,639
Mattress, I. J. Weinberg 931,361
Mattress strap, W. W. Allen 931,024
Measuring apparatus, whey and milk, J. Livingston 931,071
Measuring instrument, M. Picard 931,475
Measuring surface areas, machine for, L. O. Ramsdell 931,144
Meat tenderer, M. E. French 931,590
Metal shearing machine, Roesch & Wright. 931,220
Metals, welding, H. Goldschmidt (reissue). 13,010
Metallic material, apparatus for treatment of, G. M. Heskamp 931,599
Metering panel board, A. C. McWilliams .. 931,464
Mine door, C. W. Carman 931,035
Mine prop, F. Nellen 931,466
Mining apparatus, M. Goldsmith 931,057
Mirror adjusting device, E. A. J. Germain .. 931,291
Mold ramming apparatus, H. Henderson, 931,199 to 931,201
Motive fluid, producing, H. Maxim 931,135
Motor brush holder, H. C. Grant 931,415
Motor controller, H. W. Cheney 931,384
Mower attachment, lawn, O. S. Tuttle 931,527
Music leaf turner, H. T. E. Covert 931,572
Music recorder, A. Saumell 931,494
Musical instrument, brass wind, C. G. Conn. 931,273
Musical instrument, electrical, G. H. Davis. 931,281
Musical instruments, rotary valve for wind, C. G. Conn 931,039
Nailing machine, J. M. Wiggin 931,107
Negotiable instrument, H. A. Anderson 931,246
Nut cracker, W. M. Burkle 931,562
Nut lock, C. Girardot 931,409
Optical instrument, C. B. Boyle 931,673
Ore crusher, C. O. Michaelsen 931,210
Ore granulator or pulverizer, J. G. Kirksey. 931,316
Ore reducing furnace, G. F. Rendall 931,145
Ore separating apparatus, W. H. Silberhorn. 931,153
Organ, folding, Caulkins & Wienand 931,678
Outlet box construction, E. W. Stull 931,521
Oven heat regulator, G. A. Stewart 931,232
Package fastening member, W. M. Conrad. 931,569
Package tie, E. W. Milhado 931,631
Packing, cinch, R. R. Keith 931,128
Pail, H. E. Kerr 931,315
Paint and varnish remover, L. Ornstein .. 931,335
Paint, varnish, and lac, composition for removing dried, R. G. Stewart 931,519
Pan. See Douche pan.
Paper bags, etc., machine for making, A. Darvas 931,041
Paper holder, toilet, F. H. Hoberg 931,118
Paper pasting machine, wall, A. C. Ross .. 931,492
Paper shell making machine, J. Chesney .. 931,269
Partition or book support, movable, Wheeler & Hilckman 931,362
Pasteurizing holding tank, J. E. Amend 931,025
Pavement heating and rolling machinery, bituminous, Prescott & Kerns 931,085
Pegging machine, J. F. Davey 931,042
Penholder fountain attachment, D. O. Vaughan 931,530
Percussion engine, W. Mauss 931,449
Permutation lock, W. Erhardt 931,287
Phonograph needle receptacle, W. E. Watson 931,103
Phonograph records and indexes combined therewith, cabinet for holding disk, W. A. Hobbs 931,426
Phonograph records and other flat articles, holder or case for, A. C. Hafely 931,600
Photographic appliance, G. F. Fraley 931,050
Photographic film pack, daylight loading, J. E. Thornton 931,525
Photographic machine, automatic, J. F. Raders 931,485
Piano, automatic playing, French & O'Brien 931,192
Piano pedal, auxiliary, J. Virgillito 931,662
Picture molding, L. Cholet 931,566
Pipe coupling, T. E. Williams 931,171
Pipe coupling, W. H. Hammon 931,296
Planter, potato, P. Bernhardt et al 931,178
Plow, E. B. James 931,125
Pneumatic elevator, A. Rosenthal 931,221
Pocket, J. Pensalek 931,473
Pole changer, automatic, Williams & Welch 931,242
Polishing machine, E. Cavicchi 931,383
Post hole digger, T. Hardy 931,061
Potato bug destroyer, A. Lindahl 931,440
Pressure regulating device, O. Onsrud 931,334
Prime movers, suspension means for, R. Siegfried 931,152
Printing and similar machines, sheet separating device for, O. Schneider 931,227

(Continued from page 167.)

erage speed, not affected except by decided slowing up or acceleration of the engine.

A tachometer has recently been perfected by Mr. Mellor Reece Hutchison, in which these defects are avoided by very simple and dependable means.

The accompanying illustration shows a merchant marine generating set of this electrical tachometer, installed in the shaft alley of a steamer.

The large split sprocket wheel *B*, of proper diameter to conform to the shaft *A*, is firmly clamped thereto. A Morse silent chain *C*, engaged by the sprocket wheel *B*, drives a similar sprocket wheel *D* mounted on a countershaft *E*, which forms part of the tachometer generating set. The rotation of this small sprocket is transmitted to the flywheel *F*, keyed to the countershaft *E*, through the intermediary of two opposite coiled spiral springs *G*, *H*. Inside the rim of the flywheel *F*, and on the end opposite to the spiral springs *G*, *H*, gear teeth are cut which engage two pinions. These pinions respectively actuate magnetos *XY*. It is seen that any momentary fluctuation in the rotation of sprocket *D*, occasioned by variations in the angular velocity of the main shaft *A*, are smoothed out by the springs *G*, *H*, imparting to the flywheel *F* and countershaft *E* a steady average speed. To protect the springs *G*, *H*, against rupture from sudden reversal of rotation of main shaft *A*, stop pin *K* is mounted on the flywheel, and engages radial arm *L*, mounted on the sprocket wheel *D*, thereby preventing more than one-half an independent revolution of the countershaft. This one-half revolution is sufficient to take care of practical conditions on marine equipments.

The magnetos *XY* are of the inductor type. The armatures and the pole pieces are stationary. 1 is a permanent magnet of finest steel, properly aged to insure absolute permanence. 2 2 are the pole pieces of soft iron attached thereto. 3 is a stationary shuttle armature, on which is winding 4. Rotating between the pole pieces and the armatures is the soft iron inductor 5. As the inductor is rotated, an alternating electromotive force is generated in the armature, two cycles per revolution.

The magneto is so designed that the voltage is directly proportional to the speed of rotation of the inductor, over a wide range. Therefore, the faster the propeller shaft turns, the higher the voltage directly proportional thereto.

It will be noted there are no commutators or brushes, the armature being stationary and the leading-out wires soldered to the main-line wires. Therefore, no error can creep in from increase of resistance of contacts.

The indicators are alternating-current voltmeters of the dynamometer type, i. e., having a moving coil and stationary coils.

In present practice, however, alternating-current voltmeters read but one way, with the zero on the left of the scale. A tachometer, specially for marine use, must show direction of rotation of main shaft as well as the speed. In the design of this, therefore, the zero is at the center, deflections of the pointer to the left indicating speed of rotation of the propeller shaft astern, and to the right ahead.

The pointer of the indicator is deadbeat at its reading, and is not influenced by the rolling or pitching of the ship. Provision is also made to protect the instrument against concussion or atmospheric disturbance from heavy gunfire.

In the naval type each indicator is entirely independent of all the rest, being connected to its own pair of magnetos; hence, should one indicator be shot away or otherwise damaged, it will not affect the reading of any of the other indicators.

In the merchant marine type, however, this is not deemed necessary, one pair

(Concluded on page 169.)

Printing press, B. F. Upham 931,099
Printing press punch, adjustable, W. C. Dillingham 931,282
Propeller for boats, drop, F. E. Stribling.. 931,159
Propeller mechanism, collapsible, W. Morgan 931,456
Pump, centrifugal, F. Neumann 931,636
Pump, piston, H. P. Wedin.............. 931,535
Punching machine, W. B. Kilgore......... 931,431
Push button apparatus, R. D. Burk........ 931,380
Putting out machine, F. J. Perkins........ 931,340
Puzzle, H. W. Cadwell 931,677
Rail, continuous, C. E. Weaver 931,104
Rail joint, J. S. Hickson 931,117
Rail joint, T. K. Diehl 931,577
Rail joint, Frederick & Chapman.......... 931,589
Rail joint truss support, L. Mueller...... 931,459
Railway cattle guard, J. H. Wheeler...... 931,537
Railway construction, H. C. Grant........ 931,418
Railway frog, B. J. Morgan 931,073
Railway joint, D. B. Coupland 931,275
Railway overhead line construction, electric, T. Varney 931,354
Railway, pleasure, C. M. Perdew 931,705
Railway signal, B. E. Andress 931,666
Railway spike, C. L. Columbia............ 931,272
Railway switch, O. C. Jefcoat 931,428
Railway switch, automatic, G. E. Toullerton 931,660
Railway tie, J. F. Schneider 931,226
Receptacle, wooden, H. H. Horr.......... 931,694
Reflector, lantern, O. A. Prunner.......... 931,482
Rein or neck strap line terret, S. E. Harsh. 931,298
Reinforcing bar, A. E. Lindau 931,322
Releasing device, C. Hunt 931,122
Resinous matter, recovering, W. J. Hough. 931,608
Reticule, E. Lazarovich-Hrebelianovich..... 931,627
Reversing apparatus, G. Schulz 931,501
Rheostat, multiple switch, O. S. Schairer.. 931,148
Ring traveler holding and delivering means, J. C. Edwards 931,690
Rivet setting machine, A. R. Havener..... 931,062
Rock drill, W. E. Porter 931,479
Rock drill or boring tool, J. Hutchings.... 931,611
Rod. See Fishing rod.
Rolling mill tube trough, Worth & Harrison 931,543
Rolling pin, H. E. Fendring 931,691
Rotary engine, C. McQuown............... 931,077
Rotary machine, C. G. Conn............... 931,038
Routing machine guide device, W. H. Ahlers 931,552
Rubber, ebonite, or vulcanite, manufacturing goods of, O. C. Immisch.......... 931,310
Rubber like gum from its vegetable sources, extracting, F. H. Hunicke....931,120, 931,121
Sad iron, self heated, A. H. Davis 931,686
Safety switch, J. T. Krieger.............. 931,208
Sand blast blower, D. A. M. Doublet...... 931,579
Sash lifter, R. Corbin 931,388
Sash lock, J. L. Grether 931,194
Sausage machine, J. Wundrach 931,363
Saw feeding mechanism, H. B. Ross et al. 931,223
Saw frame, flexible, C. Kusch 931,435
Saw set and clamp, F. W. McLean........ 931,076
Scale, coin controlled beam, W. H. Jordan 931,429
Scarf holder, E. H. Rose 931,147
Seal, J. A. Beauerle 931,670
Seal, car, F. W. Brooks 931,379
Separator, A. J. Morlock 931,457
Sewing machine attachment, C. D. Armstrong 931,369
Sewing machine grinding attachment, G. I. Green 931,597
Sewing machine looper mechanism, F. E. Valois 931,352
Sewing machine, overseaming, A. Grieb.. 931,058
Sewing machine ruffler, W. R. Parsons.. 93 1641
Sewing machine shuttle and accessories, rotary, J. O. Huffman 931,610
Sewing machine work clamp operating device, T. M. McLaughlin and R. R. Hughes, Jr. 931,700
Shade roller bracket, adjustable, C. E. Sprague 931,514
Shaft construction, F. M. Remmek 931,488
Shaft hanger, H. La Casse............... 931,129
Shearing machine, C. M. Palmer......... 931,141
Shingle or tile, roofing, F. W. Meyer.... 931,329
Shock absorber, G. Bank 931,671
Shoe and fastener therefor, L. O. Lindberg. 931,441
Shoe, sporting, W. J. Riley 931,343
Sifter, ash, J. Farnworth 931,191
Sifter, ash, J. Markey 931,446
Sign, advertising, J. W. Ellis 931,188
Sign, luminous, P. L. Clark.............. 931,036
Signal, R. L. Cairncross 931,382
Signal device, H. J. Heeney 931,604
Signal system, supervisory, C. F. Patterson 931,704
Silk product and treatment of silk, J. Knup 931,433
Silo packer, G. R. Rogers 931,090
Siphon, S. F. Miller 931,453
Skate, roller, J. H. Hollar 931,064
Skirt trimmer, E. O. Blechschmidt 931,257
Sleeve closure, W. S. Barker 931,249
Smoothing iron, S. G. Buskard 931,381
Snap hook, T. Forstner 931,588
Snow plow, C. A. Bellrud 931,559
Solder for aluminium, Z. Tamassy 931,523
Sole edge burnishing machine, Z. Beaudry. 931,558
Sole, galvanic, Kennedy & Davis.......... 931,068
Spectacle frames, manufacturing, R. H. Simonds 931,508
Sprayer, D. O. Bowman 931,030
Spraying device air chamber, liquid, A. M. Phillips 931,215
Spring wheel, L. Flum 931,048
Spring wheel, W. H. Wildrick 931,241
Spur, folding, J. D. Hayes 931,063
Stalk cutter, J. A. McKay............... 931,635
Stamping machine, E. B. Wilhelm 931,170
Steel, method and apparatus for treating, W. E. Nickerson 931,332
Steels for industrial purposes, treatment of, E. Schneider 931,499
Stencil, T. C. Hough 931,309
Stirrup, G. W. Hooks 931,607
Stoker, underfeed fuel, G. Weiland 931,536
Stopper, K. Friedman 931,406
Stopper, B. J. Morrison 931,458
Stove, gas cooking, L. Kahn.............. 931,312
Stove, heating, A. K. Beckwith 931,374
Stovepipe holder, J. N. Queen............ 931,086
Strainer, R. H. Carlisle 931,564
Strainer or cooker, vegetable, W. Leetten.. 931,070
Street inlet and water closet flush, automatic, odorless, self-cleaning, J. Pratt. 931,481
Structural parts, means for preserving, A. Knapen 931,318
Sugar, producing milk, A. A. Dunham...... 931,584
Sunshade holder, E. H. Atkinson.......... 931,371
Surgical knife, E. Huttmann 931,612
Sweep rake, Brown & Keithly 931,675
Switch key, N. H. Holland 931,202
Swivel hook, W. R. Clarkson 931,270
Syringe, A. Bean 931,113
Tag fastener, Harris & Flood 931,420
Talking machine stylus replenishing mechanism, Beulna & Burson 931,676
Tanks from bursting by freezing, means to prevent, A. Ballard 931,112
Tap, Turner & Digman 931,526
Telegraph and selective system therefor, automatic, A. C. Gilmore 931,055
Telegraph and telephone pole, J. H. Hile. 931,425
Telegraph pole arm, L. Tyreman.......... 931,661
Telegraphy and telephony, receiver for wireless, S. Eisenstein 931,586
Telephone deck stand, J. A. Birsfield....... 931,179
Telephone exchange selector, automatic, F. H. Loveridge 931,072
Telephone exchange switchboard apparatus, J. L. McQuarrie 931,330
Telephone exchange system, measured service automatic, W. W. Leach 931,132
Telephone instrument mounting, H. E. Shreeve 931,231
Telephone key, J. L. McQuarrie 931,331
Telephone service rent collecting means, R. Yearneau 931,547
Telephone system, private branch intercommunicating, J. L. McQuarrie........... 931,138
Telephone system, private branch intercommunicating, N. H. Holland 931,307
Telephone transmitter, A. G. Kaufman.... 931,127
Telephone transmitting mouthpiece, R. E. Miller 931,452
Threshing machine, H. O. Sageng 931,347
Tie. See Cross tie.
Tie plate, A. L. Stanford................. 931,517
Time recorder, W. Beresford 931,254
Tire antiskidding device, T. I. Duffy....... 931,284

(*Concluded from page 168.*)

of magnetos supplying all the indicators, which are connected in multiple.

A very important fact in Mr. Hutchison's system is the use of an exceedingly small current value and low voltage; hence, in the event of the indicators being located in proximity to ammunition, should the circuit be opened by the breaking of a wire or otherwise, the resultant spark is barely perceptible and cool, therefore incapable of igniting anything. Should the line become short-circuited, no heating effect whatever is produced and no damage done to the magnetos, as they can run for an indefinite time on dead short circuit. No effect is produced on the compass by the current in the wires, and, taken all in all, the system seems to meet every requirement of accuracy and safety.

POWERFUL HOISTING AND CONVEYING MACHINE.

(*Continued from page 156.*)

in the machinery house at the pier end of the bridge, the power from which is transferred to the moving gear wheels by a line of shafting on top of the bridge, thence to lines of shafting down the pier and shear supports, and thence by a proper train of gears to the wheels.

The moving gear mechanism is attached to the operating mechanism by means of friction clutches, so arranged that the motion of the crane may be made in either direction at the will of the operator. Further provision is made for disconnecting the gearing, in order to skew the bridge within the limits given.

The main operating mechanism for the bridge is located in the machinery house, and consists of two drums. Each of these drums is mounted loose on its supporting shaft. Each drum is controlled by a Brown friction clutch and a band friction brake. The drums are connected one to the other through an equalizing gear mechanism, which is equipped also with a powerful foot brake, so that the two main operating drums may be made to rotate in opposite directions with the same speed. This feature of connecting the two drums is one of the all-important points in the Brown two-drum operating mechanism. The main operating machinery is further arranged to operate from the intermediate shaft the bridge crane moving gear mechanism, to which the supporting truck wheels are connected by shafting and gearing. This mechanism is controlled also by a powerful clutch and band friction foot brake.

In further connection with the two main operating drums is a small closing drum which, in conjunction with the two main drums, controls all of the motions of hoisting and lowering the load and traveling the trolley. The trolley, which in reality forms also a part of the main hoisting mechanism, is specially designed to operate in conjunction with the drum arrangement above described. In general, this trolley consists of a steel structural frame mounted on four turned cast-steel track wheels arranged to run on the trolley runway of the bridge crane. In the trolley there are mounted specially-designed drums, which run loose on their supporting shafts. The large section of each drum on the trolley is connected to the main hoisting drums in the machinery house in the following manner:

One length of wire rope will connect, from the under side, one of the main hoisting drums to the top side of one of the large sections of the trolley drums. The under side of this trolley drum is connected by wire ropes to the top side of the other main hoisting drum. The top side of this same hoisting drum is connected by suitable cable to the top side of the other trolley drum, and likewise this trolley drum from the under side is connected to the underside of the other main hoisting drum. By this arrangement of ropes, if one of the main

(*Continued on page 170.*)

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.

AGENTS WANTED.—$2.19 sample outfit free. 50 per cent. profit. Credit given. Premiums. Freight paid. Chance to win $500 in gold extra. Let the largest wholesale agency house in the United States start you in a profitable business without one cent of capital. Experience unnecessary. Write for free outfit at once. McLean Black & Co., Inc., 60 Beverly St., Boston, Mass.

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

FOR SALE.—Model Printing Press Co. Established over 40 years. Excellent opportunity for machinist. Mail order trade throughout the world. Will sell at a bargain. Model Printing Press Co., Chambersburg, Pa.

WILL MANUFACTURE OR SELL PATENT for a new carbide generator for house or town plant. Machines now out doing excellent service. Address O. Hasneder, Seaford, Long Island.

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

MAIL ORDER GOODS WANTED.—Western firm wants quotations from manufacturers of quick-selling household specialties suitable for canvassers. Address Box 103, Victoria, B. C.

Inquiry No. 8921.—For the manufacturers of gilt paper.

PATENTS FOR SALE.

FOR SALE.—Patent No. 930,734. Metal shelf with folding brackets, as illustrated in Scientific American of August 28, 1909. Now being manufactured and marketed in New York and surrounding States with good results. Rights to distant States can be obtained by responsible manufacturers by applying to The Dahl Mfg. Co., 302 W. 14th Street, New York.

Inquiry No. 8922.—Wanted the address of Worthington Boiler Co.

FOR SALE—Patent No. 726,166. Purse or the like, chain purses, neck chains, fobs, belts, etc. For further information and particulars. Address P. O. Box 67, Attleboro, Mass.

Inquiry No. 8931.—For parties who manufacture the Western Stump borer for boring stumps.

FOR SALE—Patent No. 895,863, rowing appliance; works perfectly, every boatman needs a pair. Make us an offer. James & Deacon, Velasco, Texas.

Inquiry No. 8941.—For manufacturers of machinery for making fly screens.

FOR SALE.—Patent No. 915 305. Metal telephone pole. Most durable, strongest, lightest and cheapest pole in existence. Address E. J. Newhall, Waupaca, Wis.

SALESMEN WANTED.

SALESMAN WANTED to handle an exceptionally attractive real estate and timber proposition, which can be sold on annual, semi-annual or monthly installments. We furnish inquiries and strong literature. Capable, aggressive, energetic man can make a lucrative connection with largest and strongest house in its line in the country. Sacramento Valley Imp. Co., St. Louis, Mo.

Inquiry No. 8960.—For the address of the WindsorMfg. Co., manufacturers of waterproof collars and cuffs.

HELP WANTED.

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

Inquiry No. 8966.—Wanted the address of the Cohendet Motor Co.

SUCCESSFUL Gasoline Light Salesmen to handle the only instantaneous lighting system known to science. No alcohol, step ladders, torches, matches or time wasted. Pull the chain and they light instantly. For home and commercial lighting. Write for territory. Small capital required. Gloria Light Co., 1285 Wash't'n Blvd., Chicago.

Inquiry No. 8969.—Wanted machines that make accordion dress plaiting (steam).

YOUNG MAN, graduate of some school in mechanical engineering, for position in woodworking plant in small Tennessee town. Good opportunity for advancement. State experience, if any, and salary. Answer "Position," Box 773, New York.

Inquiry No. 8977.—For manufacturers of machinery for manufacturing denatured alcohol.

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. 8980.—For the address of manufacturers of mortars and pestles that are used by druggists.

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. 8984.—Wanted the address of the manufacturers of Cypress wash tubs.

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

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

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

Inquiry No. 8997.—Wanted the address of the manufacturers of bread or cake boxes.

Inquiry No. 9001.—For the address of progressive manufacturers of fruit jars.

Inquiry No. 9007.—Wanted, a tin churn for churning milk that has a wire spring at top and bottom of churn and operated by pressing the wire springs.

Inquiry No. 9009.—Wanted the address of the manufacturer of the "Leech" showcard holder, a device which is held to the outside of a show window by rubber cups.

Inquiry No. 9010.—Wanted to buy a "Rector Help-a-Phone."

Inquiry No. 9011.—For the manufacturers of a patent sewing needle that is made to slip over the thread; the eye is split so as to open and receive the thread.

Inquiry No. 9012.—Wanted to buy papier mache boxes in the shape of water melons, colored to resemble melons, etc.

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

Inquiry No. 9015.—Wanted the address of the manufacturers of a solid link chain made without welding, made in brass, several different sizes, made on an automatic machine.

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

Inquiry No. 9017.—Wanted, the address of manufacturers or dealers in card board plaster or wood pulp for plastering.

Inquiry No. 9018.—Wanted, the address of parties manufacturing gold-plated pens for use in cheap fountain pens.

Inquiry No. 9019.—Wanted, address of The Old Town Canoe Co.

Inquiry No. 9020.—Wanted the addresses of the manufacturers of metal novelties.

(*Continued from page 169.*)

hoisting drums is connected through its clutch mechanism to the driving shaft, and the other main hoisting drum is allowed to work through the equalizing gear mechanism loose on its supporting shaft, the motion of the drums will be in opposite directions and with the same speed, and when working under this condition the motion produced on the trolley drums will be *nil*, thus giving to the trolley a motion or translation along its supporting runway, and by the reversal of the motion of the main hoisting drums the trolley will be traveled in an opposite direction. Further, if the main hoisting drums are both rotated in the same direction, the drums on the trolley will be rotated in opposite directions with respect to one another, and by the proper reeving of the ropes from the small drums on the trolley, the suspended load may be raised and lowered by the reversal of the motions of the main hoisting mechanism. When equipped with grab bucket, the opening and closing of the same is accomplished by the ropes leading from one of the main trolley drums. The shell lines from the grab bucket are attached to the other of the main trolley drums, and for the same reasons as given above, the bucket may be raised and lowered. But to carry out the motion of opening and closing, the two main hoisting drums in the machinery house are held stationary, and the small auxiliary hoisting and closing drum is put in operation. This drum is connected to a sliding loop attachment located at a convenient point on the bridge structures, and in such a way that the ropes leading from the large section of the drum controlling the opening and closing lines of the bucket are reeved through this sliding loop mechanism, and, by the operation of this closing drum, the one set of lines leading to the trolley is lengthened while the other set is shortened. By this means the one drum, controlling the opening and closing of the bucket, may be rotated in either direction by the proper operating of the closing drum above referred to. From this description it will be seen that in reality the main hoisting mechanism consists of the two main hoisting drums and the auxiliary closing drum, all of which drums are under the complete control of the operator, and work in conjunction with one another to properly carry out the various motions of the trolley and its load.

In the operation, however, of the scoop bucket, with which the above bridge crane is equipped, only one main drum on the trolley is used, this being the drum operating the shell lines of the grab bucket. The lines leading from the small drum sections of this main drum are arranged to work in parallel and carry the shovel bucket. All of the clutches, brakes, etc., going to make up the main operating machinery are connected to the operator's cage by suitable rods and levers, so that the entire mechanism is under the complete control of one operator.

The 200 horse-power motor and electrical equipment is designed so that dur-

(*Concluded on page 171.*)

Practical and Instructive Scientific Books

AGRICULTURE.—The New Agriculture. By T. Byard Collins. 12mo.; 374 pages; 106 illustrations $2.00

A popular outline of the many changes which are revolutionizing the methods of farming, and the habits of farm life. It is one of the most practical treatises on the subject which has ever been issued.

ALCOHOL.—Industrial Alcohol. Its Manufacture and Uses. By John K. Brachvogel. 8vo.; 528 pages; 107 illustrations. $4.00

A practical treatise based on Dr. Max Maercker's "Introduction to Distillation," as revised by Drs. Delbruck and Lange, comprising raw material, mashing and yeast preparation, fermentation, distillation, rectification and purification of alcohol, alcoholometry, the value and significance of a tax-free alcohol, methods of denaturing, its utilization for light, heat, and power production, a statistical review, and the United States law.

AMATEUR MECHANICS.—Home Mechanics for Amateurs. By George M. Hopkins. 12mo.; 370 pages; 326 illustrations. $1.50

This is a thoroughly practical book by the most noted amateur experimenter in America. It appeals to the boy as well as the more mature amateur. Holidays and evenings can be profitably occupied by making useful articles for the home or in the building of small engines or motors or scientific instruments.

AMUSEMENTS.—The Scientific American Boy. By A. Russell Bond. 12mo.; 317 pages; 340 illustrations $2.00

This is a story of outdoor boy life, suggesting a large number of diversions which, aside from affording entertainment, will stimulate in boys the creative spirit. In each instance complete practical instructions are given for building the various articles.

COMPRESSED AIR.—Compressed Air. Its Production, Uses, and Application. By Gardner D. Hiscox. 8vo.; 665 pages; 540 illustrations $5.00

The most complete book on this subject. It treats on its physical and operative properties, and is written by an expert. Taken as a whole it might be called an encyclopedia of compressed air.

DIES.—Their Construction and Use for the Modern Working of Sheet Metals. By Joseph V. Woodworth. 8vo.; 384 pages; 505 illustrations. $3.00

A most useful book, and one which should be in the hands of all engaged in the press working of metals; treating on the designing, constructing, and use of tools, fixtures and devices, together with the manner in which they should be used in the power press, for the cheap and rapid production of sheet metal articles.

ELECTRICITY.—The Standard Handbook for Electrical Engineers. Written and compiled by a Staff of Specialists. Second edition, corrected. 12mo; 1285 pages; 1260 illustrations. Bound in flexible morocco $4.00

A new pocketbook consisting of twenty sections; each written by a specialist of engineering experience and containing the latest data and information regarding standard electrical practice.

ELECTRICITY.—Electrician's Handy Book. By T. O'Conor Sloane. 761 pages; 556 illustrations. Hansomely bound in red leather, pocket-book style $3.50

This work is intended for the practising electrician who has to make things go. Although the principles of electricity and magnetism are treated, the greater part of the book is devoted to practical handling of machinery, details of construction, and computations such as will be encountered in every-day practice.

GAS ENGINES.—Modern Gas Engines and Producer Gas Plants. By R. E. Mathot. 8vo.; 314 pages; 152 illustrations .. $2.50

A practical treatise setting forth the principles of gas engines and producer design, the selection and installation of an engine, conditions of perfect operation, producer gas engines and their possibilities, the care of gas engines and producer gas plants, with a chapter on volatile hydrocarbon, and oil engines.

GAS ENGINES.—Gas, Gasoline, and Oil Engines. Including Producer Gas Plants. By Gardner D. Hiscox. 8vo.; 442 pages; 351 illustrations $2.50

A complete book on the subject for gas engine owners, gas engineers, and intending purchasers of gas engines, treating fully on the construction, installation, operation, and maintenance of gas, gasoline, kerosene, and crude petroleum engines, with special information on producer and suction gases.

GAS ENGINES.—Gas Engine Construction. By H. V. A. Parsell and A. J. Weed. 8vo.; 304 pages; 145 illustrations .. $2.50

A practical treatise describing the theory and principles of the action of gas engines of various types, and the design and construction of a half-horse-power gas engine, with illustrations of the work in actual progress, together with the dimensioned working drawings giving clearly the sizes of the various details.

HEATING.—Practical Steam and Hot Water Heating and Ventilation. By Alfred G. King. 8vo.; 402 pages; 304 illustrations. $3.00

An original and exhaustive treatise, prepared for the use of all engaged in the business of steam, hot water heating, and ventilation. The standard and latest book published. Describes all of the principal systems of steam, hot water, vacuum, vapor, and vacuum-vapor heating, together with the new accelerated systems of hot water circulation, including chapters on up-to-date methods of ventilation.

HYDRAULICS.—Hydraulic Engineering. By Gardner D. Hiscox. 8vo.; 315 pages; 305 illustrations $4.00

A practical work treating on the properties, power, and resources of water for all purposes, including the measurement of streams, the flow of water in pipes or conduits; the horse-power of falling water; turbine and impact water wheels; wave motors; centrifugal, reciprocating, and air-lift pumps, etc.

INDUCTION COILS.—The Design and Construction of Induction Coils. By A. Frederick Collins. 8vo., 295 pages; 160 illustrations. $3.00

This work gives in minute details full practical directions for making eight different sizes of coils, varying from a small one giving a ½-inch spark to a large one giving 12-inch sparks. The dimensions of each and every part down to the smallest screw are given, and the descriptions are written in language easily comprehended.

LATHE.—Modern American Lathe Practice. By Oscar E. Perrigo. 8vo.; 424 pages; 314 illustrations $2.50

A new book describing and illustrating 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.

MAGIC.—Magic, Stage Illusions, and Scientific Diversions. Including Trick Photography. Compiled and edited by Albert A. Hopkins. 8vo.; 568 pages; 420 illustrations $2.50

This very interesting volume is acknowledged to be the standard work on magic. It appeals to the professional and amateur alike. The illusions are all explained in detail, showing exactly how the tricks are performed.

MECHANICAL MOVEMENTS.—Mechanical Movements, Powers, and Devices. By Gardner D. Hiscox. 8vo.; 403 pages; 1,800 illustrations $3.00

This is a collection of different mechanical motions and appliances, accompanied by appropriate text, making it a book of great value to the inventor, the draftsman, and to all readers with mechanical tastes.

MECHANICAL APPLIANCES.—Mechanical Appliances, Mechanical Movements, and Novelties of Construction. By Gardner D. Hiscox. 8vo.; 396 pages; 970 illustrations. $3.00

This book, while complete in itself, is in fact a continuation of the author's "Mechanical Movements, Powers, and Devices." The author presents to the reader information regarding nearly all conceivable devices for producing motion or accomplishing mechanical results.

SPECIAL OFFER: These two volumes sell for $3 each, but when they are ordered at one time from us, we send them prepaid to any address in the world, on receipt of $5.

PATENTS.—Practical Pointers for Patentees. By F. A. Cresee. 12mo.; 144 pages. $1.00

Containing valuable information and advice on the sale of patents and elucidation of the best methods employed by the most successful inventors in handling their inventions. It gives exactly that information and advice about handling patents that should be possessed by every inventor who would achieve success.

PHYSICS.—Experimental Science. Elementary, Practical, and Experimental Physics. By George M. Hopkins. In two volumes. 8vo.; 1,105 pages; 918 illustrations. Cloth, **$5.00.** Half morocco, ... $7.00

This book treats on the various topics of physics in a popular way and describes with rare clearness and in detail the apparatus used, and explains the experiments in full, so that teachers, students, and others interested in physics may readily make the apparatus without great expense and perform the experiments without difficulty.

PLUMBING.—Modern Plumbing Illustrated. By R. M. Starbuck. 392 pages; 10¼ x 7½; 55 full-page engravings. $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 method in all branches of sanitary installation are given.

PUNCHES.—Punches, Dies, and Tools for Manufacturing in Presses. By Joseph V. Woodworth. 8vo.; 483 pages; 702 illustrations. $4.00

This work is a companion volume to the author's other work entitled "Dies, Their Construction and Use." It might well be termed an encyclopedia on die making, punch making, die sinking, and sheet metal working.

RECEIPTS.—The Scientific American Cyclopedia of Receipts, Notes and Queries. Edited by Albert A. Hopkins. Containing 15,000 selected formulas. 8vo.; 734 pages. Cloth, **$5.00.** Sheep, **$6.00.** Half morocco, ... $6.50

Over 15,000 selected receipts are here collected, nearly every branch of the useful arts being represented. The alphabetical arrangement with abundant cross references makes it an easy work to consult. It has been used with equal success by chemists, technologists, and those unfamiliar with the arts, and is a book which is useful in the laboratory, factory, or home.

REFERENCE BOOK.—Scientific American Reference Book. Compiled by Albert A. Hopkins and A. Russell Bond. Containing 50,000 facts. 12mo.; 516 pages; illustrated. $1.50

This book deals with matters of interest to everybody. It contains 50,000 facts, and is much more complete and more exhaustive than anything of the kind which has ever been attempted. It is indispensable to every family and business man. It is a book for every-day reference—more useful than an encyclopedia, because you will find what you want in an instant in a more condensed form.

STEAM ENGINE.—Modern Steam Engineering in Theory and Practice. By Gardner D. Hiscox. 8vo.; 487 pages; 405 illustrations $3.00

This is a complete and practical work issued for stationary engineers and firemen, 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.

TELEPHONE.—Telephone Construction, Installation, Wiring, Operation, and Maintenance. By W. H. Radcliffe and H. C. Cushing, Jr. 16mo.; 171 pages; 125 illustrations $1.00

A practical book intended for electricians, wiremen, engineers, contractors, architects, and others interested in the installation of telephone exchanges in accordance with standard practice. Intricate mathematics are avoided, and all apparatus, circuits, and systems are thoroughly described. Selected wiring tables, which are very helpful, are also included.

TOOLS.—American Tool Making and Interchangeable Manufacturing. By Joseph V. Woodworth. 8vo.; 535 pages; 601 illustrations. $4.00

A complete practical treatise containing a valuable collection of drawings and descriptions of devices, the results of the author's own experience.

TOOLS.—Modern Machine Shop Tools. By W. H. Vandervoort. 8vo.; 552 pages; 673 illustrations $4.00

A new and fully illustrated work describing in every detail the construction, operation, and manipulation of both hand and machine tools; being a work of practical instruction in all classes of machine shop practice.

WIRING.—Electric Wiring, Diagrams and Switchboards. By Newton Harrison. 12mo.; 272 pages; 105 illustrations. $1.50

This work is a thoroughly practical treatise on electric wiring in all its branches, beginning with the simple circuit and working up to the practical every-day problems, all being presented in a simple and intelligent manner. It is in every respect a handy, well written, instructive, comprehensive volume on wiring for the wireman, foreman, contractor, or electrician.

Any of the above books will be sent postpaid on receipt of price.

Our complete catalogue of scientific and technical books sent free on application

MUNN & COMPANY, - Publishers, - 361 Broadway, New York City

(*Concluded from page 170.*)

ing a run of twenty-four hours, when handling material at the speeds as specified in the contract, no part of the motor will rise in temperature more than 70 deg. C. above the surrounding air. All electrical equipment is designed for a direct current of 220 volts. The grab bucket has a cubical capacity of 100 cubic feet of limestone, and the scoop bucket of 132 cubic feet. Both buckets are especially designed for working in limestone. The grab bucket has an over-all width of about 7 feet 6 inches and an over-all length when open of 17 feet 6 inches. The capacity of the machine is 200 tons per hour. The hoisting speed is 250 to 275 feet per minute; the racking speed 900 feet per minute; and the whole bridge travels at the rate of 100 to 150 feet per minute.

MEASURING A RIVER'S FLOW.

(*Concluded from page 160.*)

the velocity recorded at a number of different depths in each strip. By the vertical integration method the meter is moved at a slow uniform speed from the surface of the stream to the bottom and back again.

For convenience of reference and comparison the results obtained are plotted in the form of a curve on a chart.

Another illustration shows the Great Falls of the Missouri River in Montana. A gaging station at the point from which the photograph is taken was established by the Geological Survey in July, 1902.

The river is favorable at this point for water-power development and shows the kind of stream, apart from navigable rivers, measured and reported upon by the Survey. In this way the Survey constantly brings to the attention of the investing and developing public many previously unnoticed but valuable water-power sites.

We are indebted to the director of the U. S. Geological Survey for the use of the accompanying illustrations.

THE AVIATION MEETING AT RHEIMS.

(*Concluded from page 159.*)

with their Bleriot monoplanes. Both Bleriot and Curtiss tried to lower their speed records for one circuit of the course, and the latter succeeded in making 2 seconds better time than before. His time of 8:09 1/5 corresponds to almost 45.7 miles an hour. Bleriot made the circuit in 8:08 2/5, which was 4 seconds slower than formerly.

At the end of 2 hours, 22 minutes, and 51 seconds, Farman had flown 140 kilometers (86.99 miles) and beaten Paulhan's record. It was getting dark rapidly and the spectators could only see the machine as it passed before the grand stand. Ten minutes and 19 seconds later he completed his fifteenth round, and less than five minutes later he had beaten Latham's record. One hundred and sixty kilometers (99.4 miles) were covered in 2:43:35 2/5, and 180 kilometers (111.88 miles) in 3 hours, 4 minutes, 55 2/5 seconds. As it was now 7:30, the nineteenth round afterward made by Farman was not counted in the official figures. He actually covered over 190 kilometers (118.06 miles) and remained in the air all told about 3¼ hours. As he finished in front of the grand stand a searchlight was thrown upon him. He was pulled from his machine and carried upon the shoulders of his friends, receiving a decided ovation. Thus, for the second time, he has won a $10,000 cash prize, the first instance being when he flew 1 kilometer in a closed circuit on January 13th, 1908. It is possible that he will try again to win this sum by making the 140-mile flight from New York to Albany. In the flight for the Grand Prix, he carried enough fuel to fly 3½ hours.

The other prizes awarded in the Grand Prix de la Champagne distance race were as follows:

Second, $5,000, won by Hubert Latham on his Antoinette monoplane. Distance, 154.5 kilometers (96 miles).

Third, $2,000, won by M. Paulhan with his Voisin biplane. Distance, 131 kilometers (81.4 miles).

Fourth, $1,000, won by Count de Lambert with his Wright biplane. Distance, 116 kilometers (72.1 miles).

Fifth, $1,000, won by Paul M. Tissandier. Distance, 111 kilometers (68.97 miles).

Sixth, $1,000, won by M. Roger Sommer with a Farman biplane. Distance, 60 kilometers (37.3 miles).

The distances covered by the other competitors were: 50 kilometers (31.1 miles) by M. Delagrange, with a Bleriot monoplane; 40 kilometers (24.9 miles) covered by M. Bleriot with one of his monoplanes; 30 kilometers (18.64 miles) covered by Mr. Curtiss with his biplane; and 21 kilometers (13.04 miles) covered by M. Lefebvre with his Wright machine.

This first aviation meeting has demonstrated beyond a doubt that the real flying machine is here. That aeroplane races will soon supersede the dangerous automobile races, there can be no question. We expect in our next issue to give full details of the successful machines at Rheims and their motors, as well as further particulars of the flights which were accomplished.

Tire cover and fastening therefor, G. W. Brown	931,674
Tire inner tube, pneumatic, H. K. Raymond	931,648
Tire plug, pneumatic, J. Glanz	931,056
Tire upsetter, J. H. Macdonald	931,325
Tires for wheels, manufacturing elastic, T. L. Carbone	931,563
Tires, making casings for pneumatic vehicle, J. O. King	931,207
Tobacco cutter, rotary, W. A. Hagemeyer	931,295
Toe calk machine, D. G. Wyman	931,364
Tongs, A. G. Kjellerstedt	931,317
Toothpick machine cutter, H. A. Dorr	931,044
Top, T. N. Reed	931,487
Toy, S. H. Rogers	931,221
Toy air gun, S. T. Allen	931,553
Toy motor, electric, H. C. Grant	931,417
Toy, moving picture, E. W. Davis	931,184
Toy, musical, O. Einicke	931,286
Toy musical instrument, S. R. Divine	931,578
Track, carrier, W. & J. F. Mitchell	931,455
Track laying machine, J. H. White	931,166
Track rail support, J. W. Kemmerle	931,206
Track sanding device, E. A. Longmire	931,444
Train lighting system, D. C. Jackson	931,613
Tray adjustable support, aseptic, C. F. Booth	931,378
Tripod, tilting top, J. C. Fyfe	931,692
Trolley and support therefor, S. S. Goldman	931,292
Trolley clamp, E. E. Rose	931,345
Trolley clamp, T. Varney	931,355, 931,357
Trolley clamp, H. P. Davis	931,390, 931,391
Trolley conductor clamp, C. Aalborg	931,368
Trolley conductor hanger, H. P. Davis	931,593
Trolley hanger, T. Varney	931,353, 931,356, 931,358
Trolley hanger, H. P. Davis	931,392
Trolley hanger, G. B. Dusinberre	931,397, 931,398, 931,400
Trolley hanger and clamp, C. Aalborg	931,366
Trolley harp, T. A. Gannoe	931,592
Trolley wire hanger, Heimbecker & Orum	931,301
Trough and glass support for glazed structures, combined, J. A. Olsson	931,638
Truck, H. C. Grant	931,413, 931,414
T-slot bar, G. H. Vining	931,164
Tube and bar mill conveyer, North & Harrison	931,545
Tube drawing device, W. T. Adams	931,551
Tube making machine, G. A. Lutz	931,134
Tube mill tube trough, J. S. Worth	931,544
Turbine, elastic fluid, B. Ljungstrom	931,323
Typewriter, G. W. Downing	931,689
Typewriting machine, W. F. Helmond	931,303
Typewriting machine, J. J. Cooper	931,680
Typewriting machine, J. C. Doane	931,688
Umbrella, folding, P. L. Page	931,079
Umbrella lock, R. E. Adams	931,550
Undergarment, R. M. Sidev	931,151
Upholstering attachment, H. G. Westmore	931,106
Upholstering machine, I. Karpen	931,313
Urinal ventilator, A. J. Cheney	931,268
Valve, F. C. Smith	931,155
Valve, L. Schutte	931,228
Valve, C. Wainwright	931,532
Valve, flush, E. Nanfeldt	931,465
Valve for gas main joggle, L. Shaw	931,506
Valve, gas regulating, C. C. Armstrong	931,668
Valve gear, air, E. A. Rix	931,650
Valve, lavatory supply, W. A. Speakman	931,512
Valve, triple, W. V. Turner	931,238
Valve, triple, J. W. Cloud	931,271
Vapor electric apparatus system, F. Conrad	931,114
Vapor generator, R. W. Zierlein	931,664
Vapor rectifiers, system of distribution for, F. Conrad	931,115
Vault, burial, W. E. Haworth	931,299
Vehicle, D. H. James	931,614
Vehicle automatic brake, F. D. Kaser	931,430
Vehicle brake, automatic, G. R. Kelly	931,621
Vehicle foot board, J. Hage	931,601
Vehicle shock absorber, F. N. Rosenstengel	931,653
Vehicle wheel, B. C. Oblinger	931,214
Vehicle wheel, C. L. Shaw	931,505
Vehicle wheel, T. B. Jeffery	931,615
Veil clasp, B. Honsowetz	931,308
Ventilator. See Draft ventilator.	
Ventilator, F. G. Andrews	931,667
Violin chin rest, G. Beisheim	931,251
Wagon brake, W. L. Roper	931,491
Washing compound and making same, clothes, J. H. Schlueter	931,498
Well drilling apparatus, H. B. Walker	931,101
Whalebone stretching and straightening machine, O. Holzhauer	931,204
Wheelbarrow, R. T. Todd	931,096
Wheelwright's tool, F. M. Sturgis	931,160
Whip, H. Flesch	931,047
Whip socket, J. H. Larson	931,437
Windmill regulator, M. S. Newcomer	931,140
Window or shutter operating mechanism, E. Van Noorden	931,239
Window screen, D. M. Henry	931,421
Wire bender, J. S. Pratt	931,480
Wires and cables, hanger and clamp for, C. Aalborg	931,367
Wrapping machine, A. M. Price	931,646
Wrench, F. Smith	931,510
Wrench, J. J. Parsons	931,640
Writing machine, E. B. Hess	931,305
X-ray apparatus, E. W. Caldwell	931,034

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.