SCIENTIFIC AMERICAN

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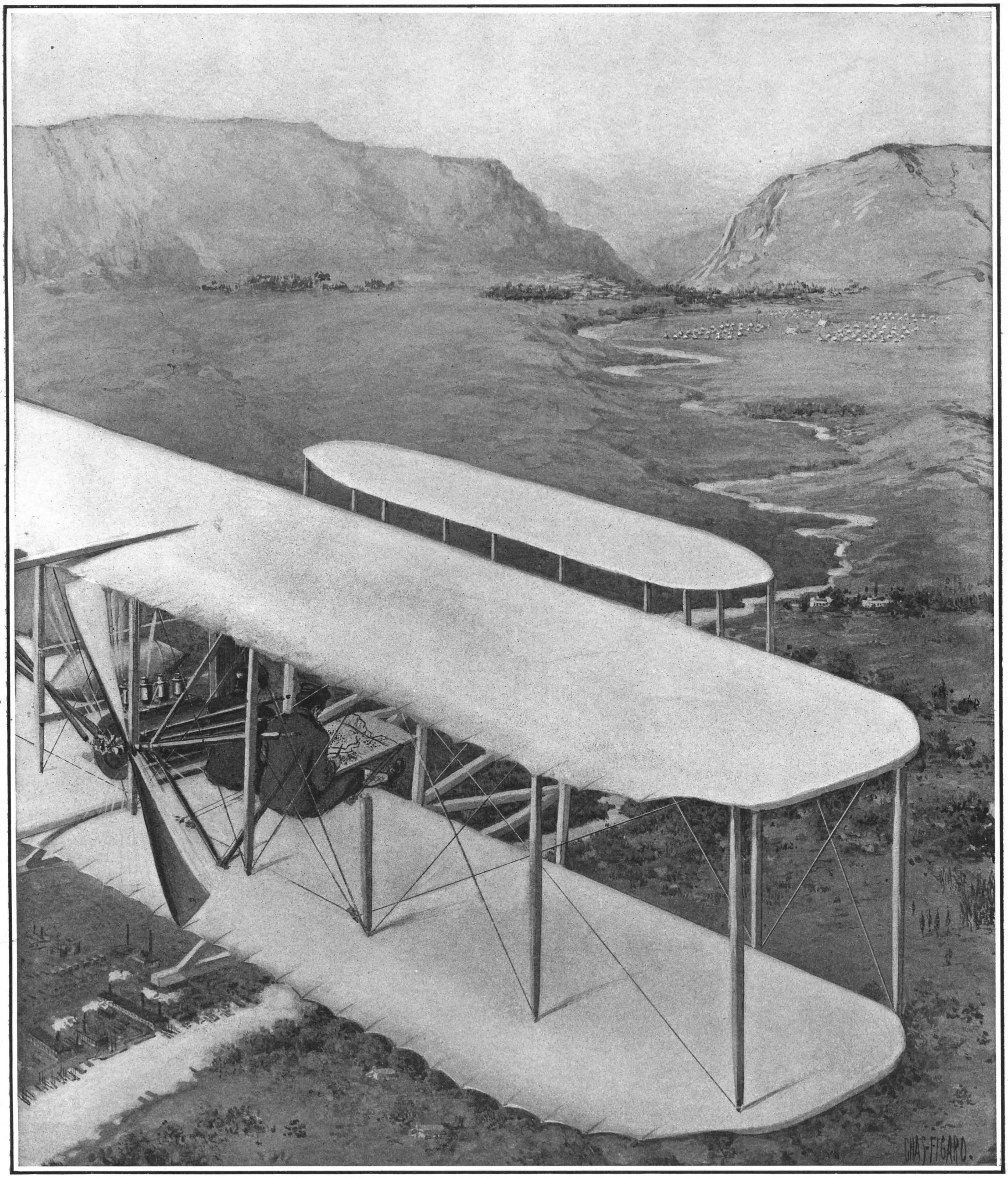

The aeroplane will find its principal field of usefulness as a scout. At an elevation of from 1,500 to 2,000 feet, it will be possible to make an accurate map of the country occupied by the enemy, and note the strength and disposition of his forces.

THE AEROPLANE MILITARY SCOUT.—[See page 450.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, DECEMBER 19, 1908.

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

PRESIDENT ROOSEVELT WOULD REORGANIZE THE NAVY DEPARTMENT.

In his annual message President Roosevelt says: "There is literally no excuse whatever for continuing the present Bureau organization of the navy. The Secretary must be supreme, and he should have as his official advisers a body of *line officers* who should themselves have the power to pass upon and co-ordinate all the work and all the proposals of the several Bureaus."

We have italicized the words "line officers" (sea-going officers), since it is to them exclusively that the President would intrust the all-important function of having the *last word* as to what kind of ships are to be built for our navy.

We do not hesitate to affirm that the designing of the modern battleship is the most perplexing and difficult problem in the whole field of constructive engineering, calling for a wider range of technical knowledge, a keener judgment, and a more just sense of proportion than is necessary in any of the practical arts of the day.

Under the present organization the work of designing a battleship is intrusted to several separate Bureaus, one of which is responsible for the steam machinery, another for the guns and armor, a third for the equipment, and the fourth, the Bureau of Construction, for the construction of the hull and the general design and arrangement of the ship as a whole. The final word as to the design at present rests in a Board on Construction, which is made up of the Chiefs of the four Bureaus above mentioned, and an additional officer from the sea-going branch of the service. The Chiefs of the Bureaus of Equipment, Ordnance, and Machinery are sea-going officers, so that in the composition of the Board there are already four sea-going officers to one of the Construction Corps; and now even he is to be eliminated.

Let us take a look at the duties of this gentleman, for whose continuance on the Board there is "literally no excuse whatever."

The size of a battleship, as determined by the total weight, or displacement, is set by Congress. This displacement might be called the capital with which the Bureaus have to work in getting out the ship. Each Bureau naturally desires to make that part of the ship for which it is responsible as effective as possible. The Ordnance Bureau wishes to clothe the ship with the heaviest armor and mount the largest possible number of heavy guns. The Steam Engineering Bureau would like to make her the fastest battleship afloat. The Bureau of Equipment would wish to make the ship a record-breaker in respect of the amount of coal and stores she can carry, and in the variety and convenience of the various details of her equipment. Each of these Departments will ask for a big slice out of that working capital of 16,000 or 20,000 tons which Congress has allowed.

Now, it is evident that the final design of the ship must be the work of the Bureau of Construction; for upon this Bureau falls the difficult task of harmonizing the various requisitions of the other Bureaus upon the total displacement of the ship, so that when completed she shall not exceed the limit of weight as imposed by Congress. This is by far the most difficult problem connected with the design. In fact, it is the very essence of the design, and it calls for the widest range of technical knowledge and skill. The hull must be made broad and full enough to give the requisite stability; yet fine enough in its lines to secure the desired speed. Thousands of tons of plating must be worked into the double bottom, and used up in the provision of that intricate system of sub-division which is a safeguard against the sinking of the ship by gun or torpedo. It occasionally happens that ships are run on the rocks, or into one another; the Naval Constructors must make provision to minimize the danger of sinking due to this. They must find out how high above the water they can carry the heavy guns and armor without endangering the stability of the ship. In their investigation, controlled always by the inexorable limit of predetermined displacement or weight, they will find that where the sea-going officers ask to have the guns mounted from 22 to 32 feet above the sea, they can be mounted only from 15 to 25 feet above the sea. Where a request is made for an armor belt reaching from 10 feet above to 7 feet below the water line, limitations of weight prevent them from making the armor belt higher than 4 feet above and lower than 5 feet below the water line unless they reduce its thickness; where a request has been made for engines corresponding to a speed of 20 knots and for a coal supply of 2500 tons, the constructor finds that the maximum possible weight that can be given to these elements necessitates reducing the speed to 19 knots and the coal supply to 2,000 tons; and, in addition to harmonizing these many conflicting demands, the Naval Constructor must see to it that the various concentrated weights of engines, magazines, heavy guns and enormously heavy turrets and barbettes, are so placed with respect to the hull, and, conversely, that the hull is so built with regard to these weights, that it shall not be unduly strained when the ship is being driven hard in heavy weather. Evidently, if there is any one man who is supremely necessary to the work of getting out a successful modern battleship, it is the Naval Constructor.

Yet this is the very man whom President Roosevelt would exclude from that body of "official advisers," who are to "have the power to pass upon and co-ordinate all the work and all the proposals of the several Bureaus."

The folly of this proposal will perhaps be more evident, if we apply Mr. Roosevelt's principle of selection to another highly specialized and very difficult branch of naval construction, that of yacht designing. Let us suppose that a determined assault was being made on the "America" cup; that a syndicate had been formed to bear the expense of building a challenger; and that the all-important question of the design of the yacht had come up for discussion. Let us suppose that the performance of the challenger in her preliminary trials had been so marvelous that the American syndicate approached Mr. Roosevelt under the conviction that he would be willing to advise them, in his private capacity, as to how best to proceed in the matter, particularly as to the composition of the Board of Design for getting out the plans of the defending yacht. Mr. Roosevelt, consistently with his naval policy, would doubtless suggest that a Board of Design be formed, composed, let us say, of Captains Charley Barr, Lem Miller, Rhodes and Hanson, with a Sandy Hook pilot thrown in to stiffen its salt water character; which Board should "have the power to pass upon and co-ordinate all the proposals of," let us say, Mr. Herreshoff, Mr. Gielow, and Mr. Crane, as to the size of the yacht, the ratio of her wetted surface to her sail area, the position of the center of her sail area with reference to the center of her buoyancy, and the various other troublesome, but unfortunately necessary minutiæ of design.

At the risk of laying ourselves open to a charge of temerity, or something worse, we venture to predict that the yachting syndicate, after expressing its sincere appreciation of the advice so tendered, would preceed to place a naval architect in full charge of the design; and we also dare to believe that when Congress takes up the work of reorganizing the Bureaus, it will place the Naval Constructors in charge of the design of our battleships, with the sea-going officers acting in a strictly suggestive and advisory capacity.

TRIBUTE TO A CIVILIAN INVENTOR

We have before us the Annual Report of Gen. Crozier, Chief of the Bureau of Ordnance of the Army, from which we learn that of the five 14-inch coast-defense guns provided for to date, four are to be built up of concentric cylinders assembled by shrinkage in accordance with the system heretofore in use, and the fifth is to be of the wire-wound type. We believe that the construction of these 14-inch guns is a mistake, and that before many years have passed it will be recognized as one of the greatest blunders ever committed in the development of modern artillery. This is not the first time that the Scientific American has expressed this conviction; for we criticised the design of these guns several years ago, when it was first made public. Progress in the construction of artillery during the intervening years, has all gone to prove the correctness of the position we then took. The 14-inch guns have a muzzle velocity of only a little over 2,000 feet per second; whereas the average velocity of the very latest designs of guns, in both the armies and the navies of the world, is over 3,000 feet per second. However, it is not of 14-inch guns that we wish to speak just now, but rather of the adoption of the wire-wound principle, which is to be used not merely in the construction of a 14-inch gun, but in that of a 6-inch rifle and a new 12-inch mortar. Now that the wire-wound principle has won its way to official recognition by the army, justice demands that mention should be made of the fact that the early and earnest advocacy, and the costly experimental work done by a private American citizen, has undoubtedly contributed more than any other single influence to the final official recognition of the wire-wound gun. We refer, of course, to the inventor of the Brown wire-wound gun, whose successive experimental pieces have formed, during the past dozen years, the subject of frequent illustration in the columns of the Scientific American.

It must be fully a decade and a half ago since Mr. Brown first demonstrated the possibilties of his system of wire-wound construction by producing and testing a rifle of 4-inch caliber, which, on test, withstood successfully a powder pressure and developed a muzzle velocity nearly 100 per cent greater than that of our army ordnance of that time. This was followed by a later experimental gun of 5 inches caliber, and by a 6-inch piece built under an appropriation from Congress, which aimed to secure a velocity of 3,800 feet per second, with correspondingly high chamber powder pressure. The 6-inch piece was built and brought to successful test, in spite of the not too friendly attitude of the officials of the Bureau of Ordnance. About the same time that Brown was building his 6-inch gun, the government constructed a 6-inch wire-wound piece upon the patented plans of the Chief of the Bureau of Ordnance, and these two guns were tested simultaneously at Sandy Hook Proving Ground. Both guns developed velocities and stood, without signs of failure, powder pressures far in excess of anything that had yet been achieved in any official tests of high-powered rifles, the Brown gun exceeding in these respects the results obtained by the Crozier wire-wound gun. An army board subsequently appointed to pass upon the merits of the Brown gun failed to recommend its adoption. We note, however, in the report of the Chief of Ordnance now before us that the design of a 6-inch wire-wrapped rifle, the interior ballistics of which are identical with those of the 6-inch rifle model of 1897, was completed during the past year, and that four 6-inch guns are to be constructed in accordance with this design. The principal difference between the Crozier and the Brown guns is that in the former the wire wrapping is wound upon an inner steel tube formed from a single piece of metal, whereas in the Brown gun, the inner tube is built up of a large number of convoluted sheets of very high compressive strength. There is no question that the intimate working of the metal which is possible when it is rolled into thin sheets of the kind used by Brown provides a tube of higher resisting quality than a tube made from a single forging, as used in the Crozier gun; and in building up this inner tube of separate elements of high compressive strength, Brown was merely extending the application of the principle which has led to the adoption of wire to give the necessary tangential or tensile strength to the gun. The built-up tube, however, has the disadvantage that it introduces additional complication into the manufacture of the gun; and it is certain that if a single solid tube can be produced which will present sufficient compressive strength to safely take the windings, the advantages lie with this form of construction. We presume that it was considerations of this character that led to the final rejection of the Brown system. The Crozier system, as adopted, is practically the same as that which has been used for many years in the British navy.

Very encouraging results have been obtained from experiments in the destruction of insects injurious to vegetation, by inoculating them with parasitic fungi. Many species of insects are subject to various fungous diseases. In a recent bulletin of the Portuguese Society of Natural Sciences, Pestana describes the method and the curious results of infecting the *Leconium hesperidum*, an insect pest of Portugal, with fungi of the genus *Sporotrichum*, which is parasitic on insects of numerous species. The development of the fungus commences in the interior of the insect, from the ventral surface of which the hypæ of the fungus then grow and form a layer between the insect and the plant. As the fungus continues to develop it forms a white sheet which often covers the insect completely and reduces it to an empty shell, which falls to the ground. The fungus draws all its nutriment from the insect and does not injure the plant. The fungus is first cultivated on potatoes, which are then converted into a paste, which is spattered on the plants, usually in spring. As all fungi need warmth and moisture for their development, the best time to apply the paste depends on local peculiarities of climate, as well as the habits of the insect which is the object of attack.

AERONAUTICS.

The Automobile Club of America has granted the Aeronautic Society the use of a room at its sumptuous club house in West 54th Street, for the weekly meetings of the Society. This will be found a much more convenient place of meeting than the club house at Morris Park. It is probable that the Automobile Club itself will take up the subject of aeronautics in the near future.

Columbia University students have recently organized an Aero Club, and at a lecture given recently by Mr. Wilbur R. Kimball, the members were given an insight into the state of aeronautics at the present time. Dr. Bell has presented the Club with the manuscript of Lieut. Selfridge's last paper on "The Progress in the Art of Aerial Navigation." Jay Gould, the son of George Gould, is an enthusiastic member, and he expects to experiment with a dirigible and with an aeroplane next spring. The club will also probably hold a competition of models made by its members.

Laurence J. Lesh the boy aviator, who broke his ankle while being towed in a glider by an automobile at the Aeronautic Society's exhibition at Morris Park, is slowly recovering. His ankle was improperly set the first time, and an operation had to be performed upon it afterward. Mr. Lesh is busying himself while recovering with inventing a new aeroplane. He expects to try a model shortly in the basement of the hospital.

Dr. George A. Spratt, who is one of the pioneers in aeroplane experimentation in this country, and who is at present said to be associated with Mr. Octave Chanute in carrying out some experiments, recently tested a glider at his farm at West Brandywine, Pa. The aeroplane was towed by an automobile, but after making a glide of about 150 feet, it was dashed to the ground and demolished. Fortunately, Dr. Spratt sustained no serious injuries.

The syndicate which has purchased the patent rights of the Wright aeroplane in France, has arranged for a 225-acre ground at Hyeres for a school of aviation. As soon as some of the fifty machines which are being built by the Société Navale de Chantiers de France are completed, instruction will be given to the purchasers at these new grounds. In this connection, it is interesting to note that M. Delagrange will teach anyone how to operate a Voisin aeroplane for $200.

Wilbur Wright, since the breaking of the driving chain of one of his propellers while in flight, has arranged another chain which connects together the two propellers, so that if either of the driving chains should break, both propellers will continue to revolve, and there will be no danger of accident from the gyroscopic action.

In a letter to Engineering, analyzing the relative performance of the Farman and the Wright brothers' aeroplanes, Sir Hiram Maxim, whose pioneer work in aeronautics of twenty years ago attracted wide attention, attributes the superiority of the Wright brothers' machine to the fact that they use two propellers, turning in opposite directions, and thereby get rid of troublesome gyroscopic action. French machines, as used by Farman and Delagrange, are equipped with a single propeller, which is run at a very high speed. When the machine is turned to the right or the left, the gyroscopic action tends to make the machine turn over about a transverse axis, and this accounts for the difficulties which the Frenchmen have had in making evolutions.

Russia has a dirigible, and negotiations are being carried on with the Wright brothers for the purchase of some of their aeroplanes. The price proposed is $100,000, with royalties on machines built in Russia. The government requires a three-hour flight, but Wilbur Wright thinks a one-hour flight a sufficient demonstration provided he can carry fuel enough to remain aloft three hours. The Russian War Department has recently granted $25,000 for the construction of a flying machine invented by H. Tatarinoff, who claims to have an apparatus that operates on neither the balloon nor the aeroplane principle. A small cigar-shaped model weighing about 30 pounds is said to have made successful tests recently.

During the past week there were several attempts by Messrs. Curtiss and McCurdy, of the Aerial Experiment Association, to make flights with the "Silver Dart," the new aeroplane described in our last issue. The first attempt was made on December 6, when three short flights were accomplished. On the 11th instant another attempt was made, with McCurdy acting as aviator and Mr. Curtis as passenger. The machine rose slightly, but tipped to one side until the end of one of the wings touched the ground and swung the aeroplane around sharply, breaking the wheels. The lack of control is thought to have been due to the new 50-horse-power motor, which is, if anything, too powerful, and which, with the single propeller, produces too much gyroscopic effect. The experiments on Lake Keuka with the "Loon" have been checked, owing to the freezing over of the lake.

ELECTRICITY.

A test of the Strang motor car is being made by the Chicago & Alton Railroad, to determine its efficiency for service on branch lines. The car is propelled by electricity generated by a dynamo coupled to a gasoline engine. Surplus electricity is stored in a battery, which is used as an auxiliary to drive the wheel motors when excessive loads are encountered.

The use of the telephone for train dispatching on electric roads is becoming very common. The various systems employed were discussed in a recent paper by Frank W. Fowle. The relative advantage of stationary and portable telephone sets was considered, with the arguments favoring the former. The objection to the latter being that at night it is difficult to make the connection with the wires by means of the so-called "fishpole," without coming in contact with line wires.

The largest induction motor in the world was started recently at Gary, Ind., where it is installed in a large rolling mill. The motor is rated to develop 6,000 horse-power. It is of the three-phase 25-cycle type, and two 2,000-kilowatt Curtis turbines generate the current necessary to operate it. The motor receives the current at 6,600 volts. By using a step-by-step controller starting at 1,350 volts, the motor was successfully started in the proper direction, coming to full speed in 45 seconds.

The enormous energy developed by a flat spot in a wheel has been estimated by Prof. Hancock of Purdue University. He finds that a flat spot 2½ inches long on a 33-inch wheel, carrying a load of 6,000 pounds at 30 miles per hour, will deliver a blow to the rail of more than a 1,000 foot pounds. The same flat wheel supporting a 55-ton interurban car running at 60 miles per hour, would deliver a blow with an energy of 9,500 foot pounds. Such a flat spot would be produced by wearing off less than 0.05 inch of metal.

A bill has been introduced in the German Reichstag which is to establish a tax on electricity and gas. The bill is causing much agitation among the German engineers, as it will undoubtedly hinder the development of electrical projects, if passed. The tax proposed is five per cent on the selling price of the current, with a maximum of 0.4 pfennig (one mill) per kilowatt hour. In addition to this, there will be a tax on illuminating apparatus as well. It is expected that this will net the government a revenue of about $12,000,000 per year.

The Health Department of Chicago is making experiments with one of the new "pay-as-you-enter" cars, with a view to installing a better ventilating system than is now to be had. This experimental car, as described in the Electric Railway Journal, is provided with a duplicate ventilating and heating apparatus. The apparatus is located under the longitudinal end seats. Two fans are used, one of which sucks the foul air from the upper part of the car and discharges it under the car floor, while the other takes in fresh air through a screened opening five feet above the platform, draws it through the coils of a heater, and distributes it close to the floor under the seats.

Some experiments have recently been made by M. Jagou, as reported before the French Academy of Sciences, on the use of a number of electrolytic detectors connected in series and in parallel. He finds that the detectors when connected in series are less sensitive than the most sensitive one of their number. When connected in parallel, however, the sensitiveness of the series depended upon the most sensitive of the individual detectors. He suggests that several electrolytic receivers might thus be connected in practice, so that if one of the detectors should lose some of its sensitiveness, it would not affect the series. The phenomenon is explained by the fact that the Hertzian waves act only on the most sensitive one of the detectors when the waves are weak; but when they are strong, the others are acted upon at the same time.

It has often been suggested that a dynamo be used as a telephone relay by placing the field winding in the primary circuit and the armature winding in the secondary circuit, so as to reproduce in the latter the fluctuating current of the former. The principal objection to this system seems to lie in the design of a suitable collecting device, which will not produce any disturbing effects. The Electrical Review and Western Electrician describes an invention which is adapted to overcome this difficulty. It consists in the use of a dynamo with the field winding and the armature winding stationary, while the only moving part is an inductor, which is magnetized by the field winding. This inductor has a natural frequency which is much higher than that of the telephone currents, so that each pulsation of the telephone current will correspond to a large number of alternations induced by the inductor. The variation of current in the primary circuit of the field winding does not change the frequency, but does change the amplitude of the armature currents.

SCIENCE NOTES.

The War Department has considered the advisability of immunizing soldiers against typhoid fever by vaccination. It has decided that inoculation as a preventive against typhoid has been so thoroughly demonstrated in foreign countries and its efficacy so well established that the vaccination method is to be adopted in the United States army.

A prize offered by a German society of manufacturing chemists for a method of removing arseniureted hydrogen from crude hydrogen gas has been awarded to O. Wentzki for the following process: The impure hydrogen is caused to flow through a cylinder filled with a mixture of two parts of dry chloride of lime and one part of moist sand or any similar inert material. The cylinder should be vertical and the gas should be admitted at the bottom, immediately above which it is advisable to place a piece of fine wire netting. The cylinder should have about one-third the capacity of the hydrogen generator.

Many farmers believe that dandelions increase the yield of milk and, consequently, that the presence of dandelions in pastures and meadows is rather desirable than otherwise. A Belgian investigator, J. P. Wagner, has shown the incorrectness of this opinion which, he says, is founded wholly on a false analogy, suggested by the milky juice of the dandelion. According to Wagner, the presence of dandelions in large numbers in pastures exerts a very deleterious effect on the quality of the butter and is one of the numerous causes of the difficulty of making butter of fine flavor and good keeping qualities in spring and early summer. The presence of large quantities of dandelions in hay has a similar effect. Hence Wagner advises farmers to weed their pastures, whenever it is practicable to do so.

One of the most interesting and picturesque trees in the world, as well as one of the most ancient, is the *Cupressus macrocarpa*, or Monterey cypress. Its native habitat is extremely restricted, for it is found in its wild state in only two spots in the whole wide world—on the edge of a grove of conifers stretching for a few miles between the Bay of Monterey and the Bay of Carmel (the latter of which bears a striking resemblance in outline and color to its prototype in the Holy Land) and in a similar spot near Pescadero, a little town lying on the coast between Monterey and San Francisco. The Monterey grove consists of only a dozen or two cypresses of large size and most striking appearance. Their trunks are massive and wrinkled with hoary age, while their boughs, gnarled and twisted, grow chiefly on one side, away from the stormy winds that have buffeted them for thousands of years. The noble trees are limited to the rocky, windbeaten shore, on which some of them have but a precarious hold. Hemmed between the slowly encroaching ocean on one hand and a pine forest on the other, their future is exposed to great hazard. It is, therefore, gratifying to observe that a fair number of thrifty young cypresses are holding their own against the pines for a short distance inland.

Teisserenc de Bort has been making a study, as interesting in its methods as in its results, of the constitution of the upper atmosphere, and especially of its richness in helium, argon, and the other gases. His investigations were confined to the permanent isothermal stratum which extends from the height of 26,000 feet to that of 46,000 feet above sea level, and the origin of which is yet unexplained. If the upper atmosphere differs essentially in composition from the air near the ground, the specific differences ought to show most clearly in this elevated isothermal stratum, which is not contaminated by the ascending and descending currents caused by cyclones and barometric depressions. The specimens of air were collected by a very ingenious method. A glass tube, which had been exhausted of air and sealed by fusing its pointed ends, was attached to a sounding balloon in such a manner as to avoid the possibility of absorbing hydrogen leaking from the gas bag. When the balloon attained a certain altitude the closing of an electric circuit by the barometer or by the clockwork of the meteorograph caused a little hammer to fall and break one end of the tube. Air entered and filled the tube, which was then sealed by the automatic action of an accumulator, the current of which heated to redness a platinum wire coiled round the broken end of the tube and fused the glass by the heat thus produced. The quantity of air that can be collected in this way is too small for quantitative chemical analysis and can only be analyzed qualitatively with the spectroscope. Two methods have been employed. In one, all the constituents of the air, except helium and neon, are absorbed by charcoal. In the other method, the argon is separated first. Argon and neon were detected in all specimens collected at elevations between 26,000 and 46,000 feet. The yellow line of helium appeared in the spectra of all the specimens except one which was collected at the greatest height attained, about 46,000 feet. The presence of krypton could not be determined with certainty.

BATTLE PRACTICE IN THE BRITISH NAVY.

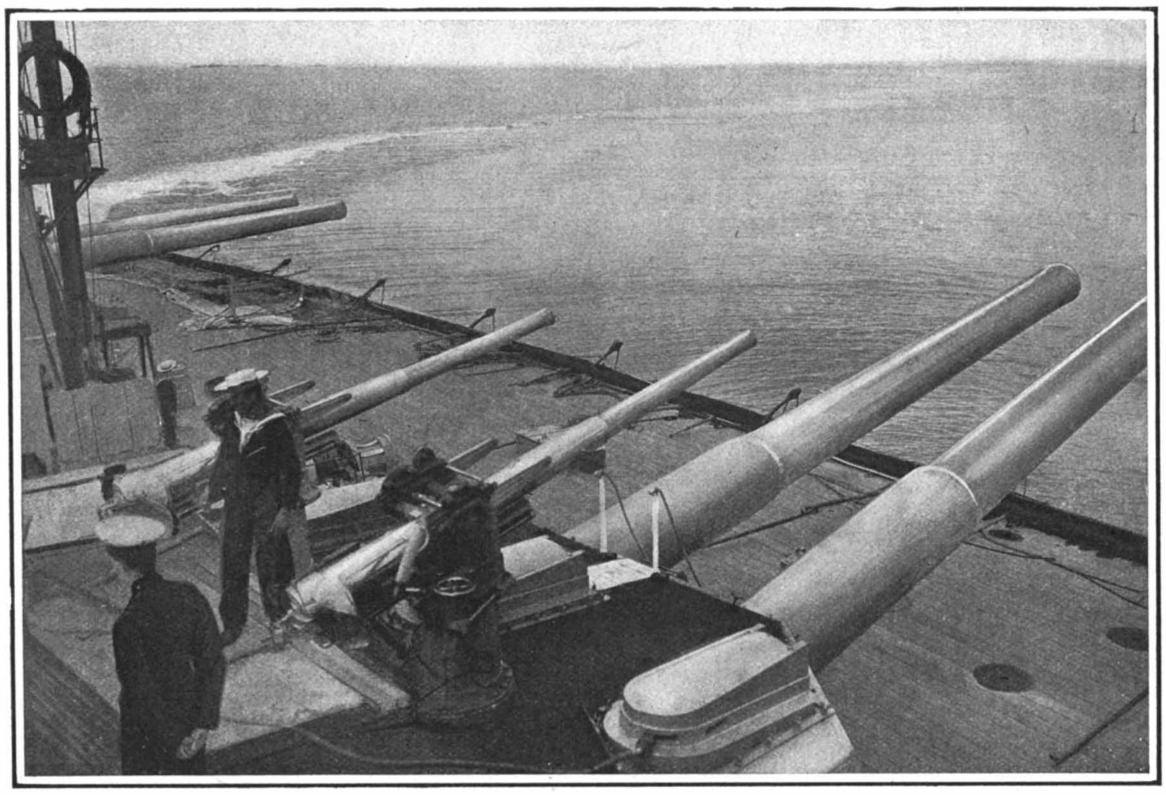
BY PERCIVAL HISLAM.

Many important changes in the conditions governing battle practice in the British navy come into operation this year, the aim of which is to reproduce more closely the conditions of a naval engagement. In the first place, the target, which has hitherto been moored to buoys in a fixed position, is this year to be towed at a speed of eight knots; secondly, instead of all hits being lumped together as formerly, careful note will be taken of the hits made by the various types of guns, and a larger allowance of marks will be made for bulls with heavy projectiles, the figure decreasing as the caliber of the gun diminishes. This is a much-needed reform, as it is obviously ridiculous to valuate a hit with a 6-inch shell weighing 100 pounds at the same figure as one with a 12-inch, weighing 850 pounds. Thirdly, both broadsides will be brought into play, instead of only one, as was previously the case.

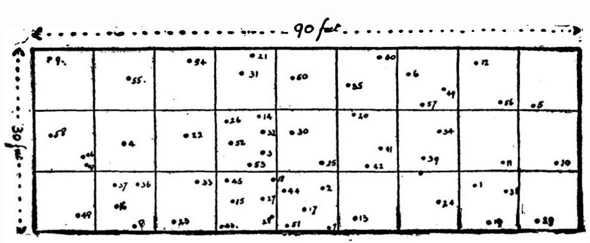
The introduction of these new conditions has necessitated the design of a new target, the old pattern being unsuited for towing. The first of the new pattern has recently been launched, and is illustrated in the accompanying photographs. In general appearance the structure resembles the hull of a ship with a huge oblong framework erected on it. This hull is constructed of steel, ballasted heavily with concrete, in order to give sufficient stability to enable the target to be towed. Its total length is 140 feet, and its depth, from keel to the level of the deck, 20 feet. Its beam amidships for the length of the target is 5 feet; but for a distance of 25 feet from either end a raised deck is built (that at the fore end having the lines of a small gunboat), and these ends are 9 feet wide.

In its completed state the target is submerged to a depth of 20 feet, leaving 31 feet exposed above the water. Over the gridiron framework, which is built throughout of 12 x 12-inch timbers, is stretched a canvas 90 feet long and 30 feet high, which forms the actual target, and which is of the same size as in previous years. The weight of the whole structure is 170 tons; the cost, $2,500; and the time required for building, six weeks. The targets are built and launched on their side, and afterward righted.

A few words as to the general conditions under which battle practice in the British navy is carried out may not be without interest. Just before the time for firing, the ship proceeds to a sheltered harbor in order to calibrate her guns, which means the adjustment of the sights to the wear of the barrel. This, especially in the heavier weapons, becomes considerably scored by the corrosion of the powder and the passage of projectiles along it—so much so, indeed, that after eighty or a hundred rounds have been fired from a 12-inch gun, it is necessary to reline the barrel. In calibrating, the guns are trained on a known range and fired, the fall of the shot being noted by officers stationed near the target, the gun sights themselves having an error of only 5 yards in 3,000. A number of rounds are fired, the mean of the errors taken, and the sights altered to correct the error of the gun barrel.

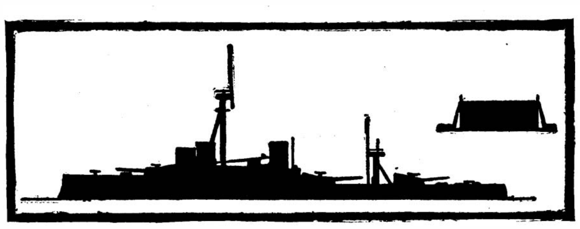


The "Dreadnought" cleared for action, showing the two after 12-inch twin turrets.



Hits recorded by the British cruiser "Essex."

Guns, fourteen 6-inch R. F. Range, 5,900 to 6,500 yards. Rounds, 108. Hits, 58.



Comparative sizes of H. M. S. "Dreadnought" and battle practice target.

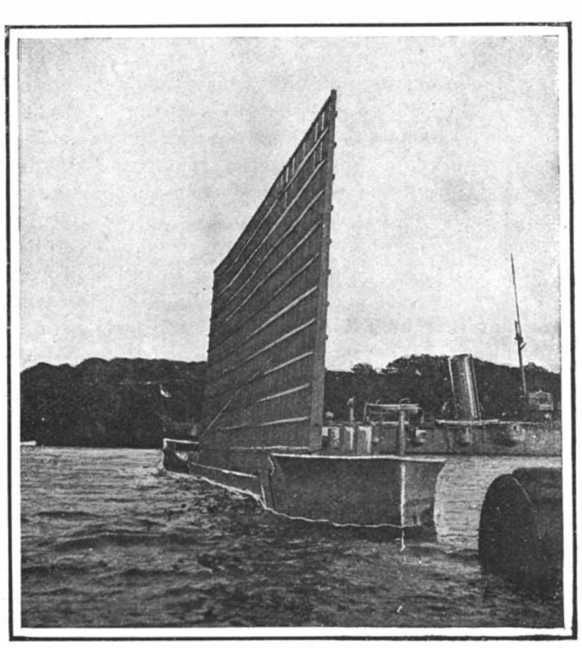
The ship then proceeds to the battle-practice range with the chief umpire on board. In the possession of the navigating officer is an envelope containing a sketch of the course to be followed. This course is laid down by the umpire, and no one in the ship is acquainted with it, so that the crew are in complete ignorance both as to the range at which the firing will open and the broadside which will first be brought into action. The range varies actually between five and seven thousand yards; and as the ship approaches it on a zigzag course, each broadside is brought into action alternately. The firing lasts for fifteen minutes.

After the firing is concluded the results are carefully noted by the umpire, who forwards them to the Admiralty. There they are worked out with the aid of a confidential formula—the actual number of rounds and hits being kept secret—and the results published as points. It is known, however, that the average of hits to rounds fired throughout the fleet runs to between 35 and 40 per cent, the best ships putting in about 65 per cent. A good target—that fired at last year by the armored cruiser "Essex"—is illustrated here.

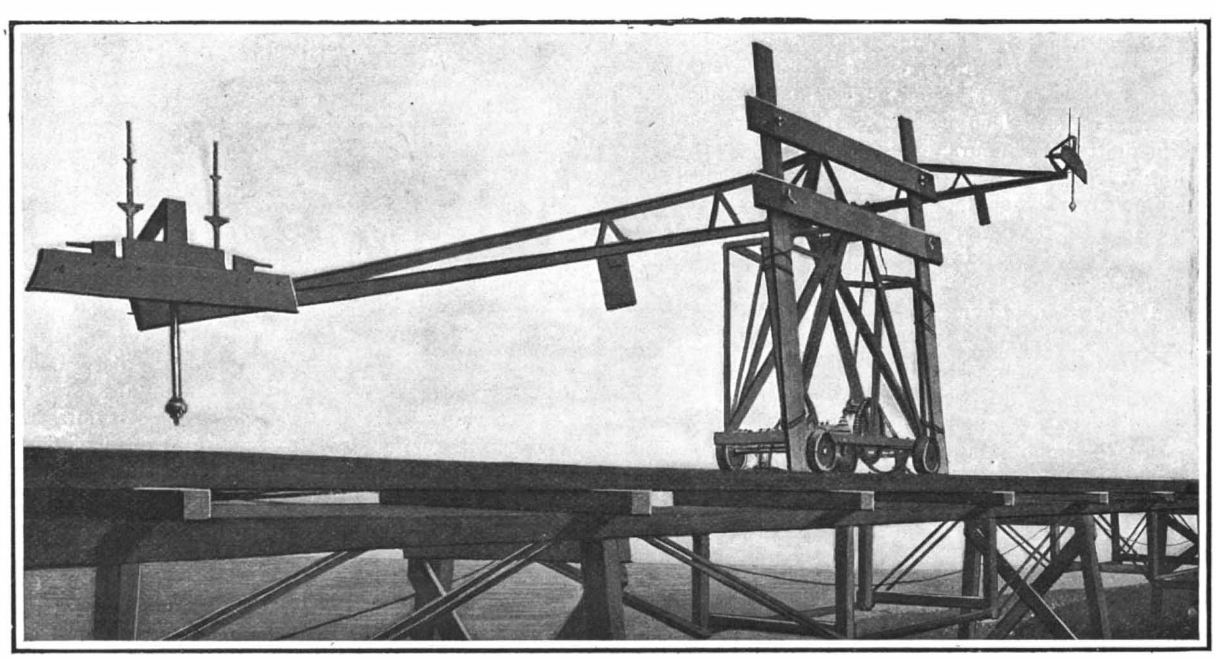
It is important that battle practice should not be confounded with the gunlayers' tests. The latter are carried out at ranges of 1,500 to 2,000 yards at a target 10 feet by 8, and the full details are published by the Admiralty. Eighty per cent of hits is now a common score in these tests, the best shooting so far having been made by a gunner of the cruiser "Argonaut" named Sparshott, who succeeded in getting off eleven rounds and scoring eleven hits in one minute with a 6-inch 100-pounder rapid-fire gun.

The question of fire control has been receiving a good deal of the British Admiralty's attention lately. In the gunnery trials against the old battleship "Hero" last November, the fire-control communications were shot away in the first half dozen rounds by a fragment of shell which went clean through the ship's mast, while later on a shell burst in the control top, setting fire to the dummy men which had been placed in it. Some time ago experiments were carried out with a new control system which could be installed behind armor near the waterline, but it was not successful, height being a *sine quâ non* of the control officer, who must note the fall of the shot with reference to the target. It is understood that experiments will shortly be made with a skeleton mast, similar to that which was built for the same purpose on the United States monitor "Florida."

In conclusion, it may be stated that the energy developed by a ship such as the "Dreadnought," with a broadside fire of eight 12-inch guns, in one broadside, is 400,000 foot-tons—sufficient to raise twenty ships of her size a foot in the air. Speaking at a dinner recently, Rear Admiral Sir Percy Scott, who is known as the "Father of modern gunnery," stated that the



The target afloat. Note the ship-like build of the bow.



Moving models for gunners under training at the Whale Island gunnery school.

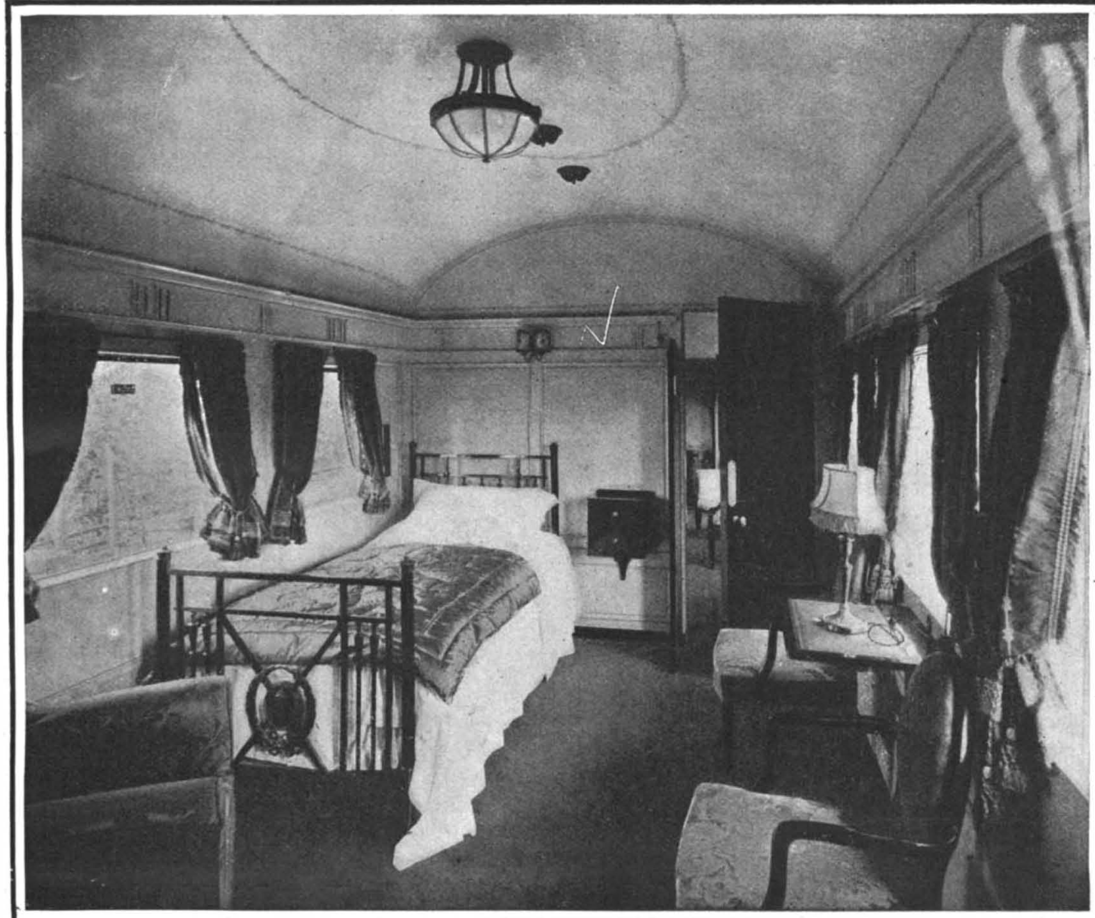
BATTLE PRACTICE IN THE BRITISH NAVY.

"Dreadnought" could fire her guns over a distance of 15 miles (26,400 yards), and that in firing over such a range, the trajectory of the shell would reach a height of 16,500 feet—more than 2,000 feet higher than Pike's Peak in the Rocky Mountains. Among the illustrations will be found one of the "Dreadnought" cleared for action aft, showing two pairs of 12-inch guns trained over the port broadside. There are also shown the model ships at which gunners under training are taught to fire, the models traveling on a railway, and rising and falling like a ship at sea.

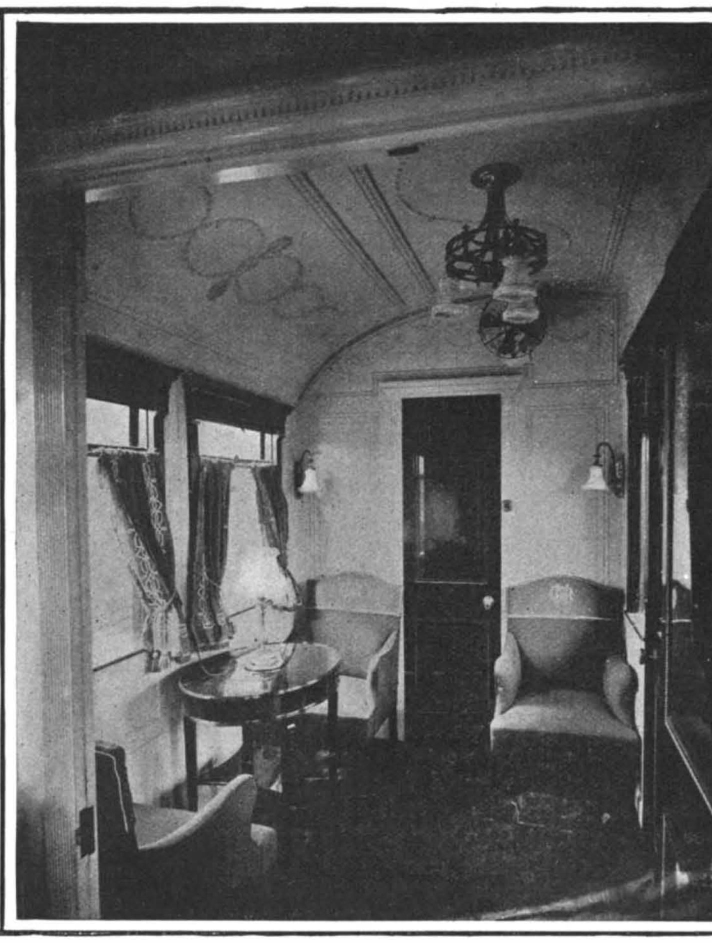
HOW ENGLISH ROYALTY TRAVELS.

BY F. C. COLEMAN.

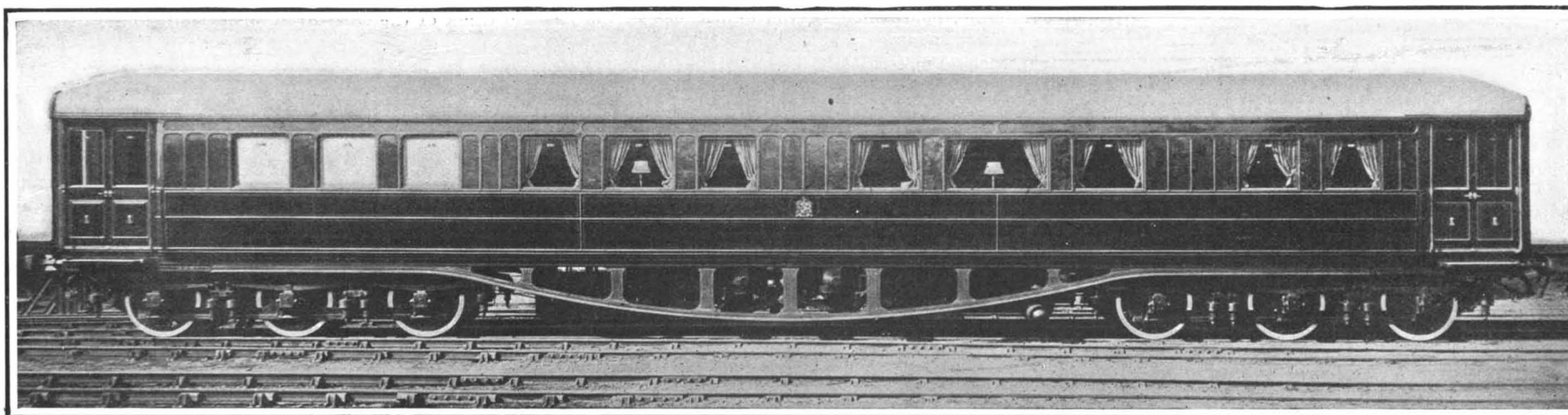
The three railway corporations (Great Northern, North-Eastern, and North British) controlling the East Coast route between London and Scotland, have just recently completed a new and luxuriously fitted royal train for the exclusive use of their Majesties King Edward VII. and Queen Alexandra and other members of the British royal family. Hitherto, when the royal family have traveled over portions of the East Coast route, the train built some years ago at the London and North-Western Company's works at Wolverton has been utilized; but now the East Coast companies are in possession of their own special train. Her Majesty's saloon has been constructed at the York Carriage Works of the North-Eastern Railway Company, while his Majesty's carriage and all the other vehicles forming the royal train have been constructed at the Great Northern Railway Company's works at Doncaster. The King's saloon, exterior and interior views of which are given herewith, is 67 feet in length over the body, 9 feet wide, and 12 feet 11 inches high from rail level to top of roof. It is constructed of teak, with a steel underframe, and is carried on two six-wheeled bogies. Entrance is obtained from double doors, opening inward at each end; the moldings round the panels and windows are of gilt brass, and the center of the bottom panels is ornamented with his Majesty's cipher. On each side of the doors are gilt grip handles, extending from the cornice to the floor. The outside panels are of specially selected figured teak, and the center panel bears his Majesty's coat of arms. The roof is elliptical, and the outside appearance of the coach conforms generally to the standard type of the Great Northern and East Coast joint stock. The windows are of beveled plate glass, and are balanced so that they can very easily be lowered or raised. Commencing at one end, the saloon is divided as follows: Entrance balcony; smoke room; day saloon; bedroom or dining room; dressing room; attendant's compartment. The balcony is paneled with richly figured teak and has a white paneled ceiling. The smoking room is 10 feet long and decorated in Jacobean style; the walls are of oak inlaid with boxwood and dark pollard oak. The furniture consists of two armchairs and a large settee, upholstered in reindeer plush hide. The fittings are of oxidized silver. The day saloon, which is 17½ feet long, is in Louis XVI. style, and the walls are of highly polished sycamore inlaid with trellis lines of pewter and light mahogany. The furniture, which is of light French mahogany inlaid with pewter and box, upholstered with silk brocade, consists of two armchairs, a large settee, and four smaller chairs. There is also a writing table, which is fitted with adjustable shaded electric lights. The use of pewter is a revival of an old French method, which has a very pretty effect in conjunction with mahogany. Both the day and smoking rooms are lighted by rows of tubular electric lamps, concealed behind the cornices on each side, giving a very soft and restful light. There are also corner brackets in the smoking room, and handsome gilt wall brackets in the day compartment, the lights in the latter being shaded with hand-painted silk screens. The bedroom, or dining room, is 14 feet long, and the walls are paneled and enameled white; the furniture being in mahogany inlaid with kingwood, and covered with fine old rose-colored silk damask with green silk embroidered cushions. When used for day journeys, the bed is taken out and the compartment is converted into a dining room. The dressing room, which is 8 feet long, is paneled and enameled white. Next to the dressing room is the lavatory, the floor of which is covered with inlaid cork parquet flooring, and the walls are of fine Italian Cipolino marble cross-banded with white statuary marble. The attendant's compartment is fitted up with electrically heated kettles, urns, etc., and a switchboard for controlling the lighting and heating of the carriage. In order to give uniformity of effect, the whole of these rooms, with the exception of the attendant's compartment, are carpeted alike with a fine plain Saxony pile old rose carpet, and all curtains and blinds are of soft green silk with white silk embroidery. In addition to electric radiators, the saloon is heated by means of warmed air, which is delivered into the various compartments through ducts from electric blowers situated in the attendant's compartment. Ventilation is also afforded in the same way, and the air from the roof ventilators is extracted by means of electric exhausters. The decoration and furnishing have been carried out by Messrs. Waring & Gillow, and Messrs. J. Stone & Co.'s system of lighting and ventilation has been fitted. In addition to the saloon for his Majesty the King, two special saloons have been constructed for his Majesty's suite and friends, which are vestibuled on to the royal saloon. These saloons are carried on four-wheeled bogies of special design with 10-foot wheel base. The vehicles are 58 feet 6 inches long, and are fitted with easy chairs and couches upholstered in green tapestry. The partitions are so arranged that each of the saloons can be made into four bedrooms. The walls are enameled white, and the doors are of richly-figured mahogany. All the electric fittings, electroliers, etc., are of tasteful design, and gilt, with white silk shades,



The King's bedroom on the royal car.



A corner of the special saloon for the royal suite and guests.



The royal car is 67 feet long, 9 feet wide, and 12 feet 11 inches high from rail level to roof. The strong steel underframe adds to the car's collision-resisting ability.

HOW ENGLISH ROYALTY TRAVELS.

THE AEROPLANE MILITARY SCOUT.

The astonishing advances which have been made during the past year in the development of the aeroplane and the dirigible balloon, have encouraged our War Department to ask Congress for an appropriation of $500,000, for the purpose of building dirigibles and aeroplanes and carrying on the general work of military aeronautics. We consider that the Department is fully justified in requesting this appropriation. The work done by the Wright brothers, both in this country and in France, to say nothing of the successful flights accomplished by Farman, Bleriot, and Delagrange, and the sensational journey by the monster dirigible of Count Zeppelin, is a fact of profound significance. These flights prove that the problem of mechanical flight is passing, if it has not already passed, out of the domain of theory and academics into that of the practical and useful. At the present writing it cannot be disputed that as compared with the dirigible the aeroplane holds the first place in popular, if it does not in official favor. The flight by Wilbur Wright of over an hour, the straightaway journey of Farman across country for seventeen miles, and the round-trip flight of Bleriot of eighteen miles across country, are feats which exceed the most optimistic expectations of the early months of the present year. Wright, with a 25-horse-power engine, has shown that he can maintain a speed of 35 miles an hour, and Farman and Bleriot, in their cross-country flights, averaged about 50 miles an hour.

It may as well be recognized at once that the aeroplane can never be seriously considered as a means of transportation on any extended scale. The present indications are that a single machine can never hope to carry more than two or three passengers. For the carriage of heavy freight it is altogether out of the question; although it is possible that it may have a field of usefulness in the post office and express service, for the transmission of important mail and light packages with the least possible delay.

Undoubtedly the greatest field of usefulness of the aeroplane will be in military operations; although even in this field its work will be of a limited character. Its small carrying capacity will prevent its being used on any extensive scale for the carrying and dropping of high explosives. The amount of explosive which it could take up would be so insignificant as to have no particular value for this purpose. The attack on fortifications, arsenals, dockyards, fortified camps, and cities by landing within them high-explosive shells, can only have any decisive effect upon the outcome of a war, if the high explosives can be thrown in enormous quantities. The dropping of a few isolated shells could work only a limited amount of damage, and unless they could be accurately aimed, they would represent so much time and money thrown away. Experience in bombardments has proved this fact conclusively. It was only after the capture of 203-Meter Hill outside Port Arthur, when the fire of the guns could be accurately directed, that the heavy mortar batteries were able to do any very effective work. Now to aim the one or two high-explosive shells which an aeroplane could carry so that they would unerringly hit some particular point below, would be a practical impossibility, for reasons which it is not necessary here to enter into.

The military aeroplane of the future will find its greatest field of usefulness in the important work of scouting. The military scout will carry two men; one to operate the machine, and the other to take photographs and make reconnaissance sketches of the country. The striking picture shown on the front page of this issue, is no mere dream of the enthusiast. It would be entirely possible for Wilbur Wright to take up with him an officer, rise to a height of 1,000 or 1,500 feet, sweep over 25 or 30 miles of an enemy's country, and secure a thoroughly accurate sketch of the lay of the land, the disposition and strength of the enemy, the various roads by which he might attack or be attacked, and all the other information which it would be the duty of the reconnoitering officer to secure. Because of the height at which the aeroplane would travel, and the uncertainty as to its speed and direction of flight, it would be an extremely difficult object to hit; and it would be possible for several shells of the small caliber which would be used in an attack to pass through the canvas of the aeroplane without impairing its stability.

Restoring Burnt Carbon-Steel Machine Tools.—When lathe or planer tools of carbon-steel have been overheated or burnt by being heated up to a temperature of say 2,100 deg. F., near the melting point, they may be restored, according to Mr. George T. Coles, in a recent article in the American Machinist, by reheating to 1,100 deg. F., or a very dark red, and then quenching in boiled linseed oil. This treatment is very simple and inexpensive, with no nostrums or chemicals to be used, and may be the means of saving a good tool, so that it can be used with satisfactory results.

The Vacuum Airship.

BY G. J. DERB.

Count Zeppelin's successful flights have proved that the rigid system of dirigible construction is the correct one, but the accident which terminated his flight of last summer illustrates the danger of using hydrogen and other inflammable gases. Although men willingly risk their lives for great objects, and although we have so mastered steam and electricity that we are no longer afraid of steam boilers, high voltage dynamos and transformers, it is nevertheless desirable to reduce the elements of danger to a minimum.

It is said that explosions by lightning will henceforth be prevented by the employment of earth connections, wire netting and other protective devices, but everybody who is familiar with the vagaries of inflammable gases knows how easily explosive mixtures with air are produced by slight defects in the gas bag and how often explosions are brought about by various causes. For example, sparks may be produced by impact, some metals spontaneously become very hot in explosive gaseous mixtures, particularly if the metals have been previously heated by the sun's rays, etc. Wireless telegraphy is another possible source of danger.

There are other objections to the use of hydrogen. It is still a comparatively costly gas and it cannot be obtained everywhere in large quantities. At present it is produced chiefly by electrolysis, as a by-product of the electrolytic manufacture of chlorine and alkalies. The cost of compression, containers and transportation, however, makes the gas, when delivered, very expensive, and the cost is still greater if the hydrogen is generated on the spot expressly for the purpose of filling the balloon. Although methods of producing hydrogen directly from water and coal, without electrolysis, are being developed, and although we are told that Zeppelin's balloon sheds and landing stations will soon be equipped with hydrogen generators, presumably electrolytic, the danger and inconvenience attending the employment of hydrogen will still remain.

In view of these facts the writer desires to call attention to a possible method of dispensing with hydrogen. The valuable property of hydrogen is its lightness. Now, a balloon filled with air may be made even lighter than the same balloon filled with hydrogen at atmospheric pressure if the air is sufficiently rarefied. Francisco Lana called attention to this principle, in connection with aeronautics, in 1670, but at that time it was impossible to construct a vacuum balloon light enough to rise in the air and yet strong enough to withstand the crushing pressure of the external atmosphere. Now, however, when we have at our disposal so light and strong a metal as aluminium, and perhaps other equally suitable materials, the vacuum airship seems at least worthy of discussion.

Retaining, approximately, the dimensions of Zeppelin's airship, suppose that 10 hollow globes of aluminium, each 20 meters (65.6 feet) in diameter and with walls 1 millimeter (1/25 inch) thick, are joined in a straight line, forming a vessel 200 meters (656 feet) long. The lifting power of the 10 globes, when completely evacuated, will be about 16 tons. Aluminium walls only one millimeter thick would be far too weak to resist, unaided, the external atmospheric pressure of about 15 pounds per square inch, the force of the wind, and the weight of the suspended parts, but half of the buoyancy, or eight tons, may be used to compensate the weight of an internal skeleton. Motors capable of furnishing 400 horse-power would weigh about 2 tons, leaving about 6 tons for the car, propellers and other mechanism, crew, supplies, etc. If the globes were evacuated only to a residual pressure of 53 millimeters (2.1 inches), in which condition they would have the same weight and buoyancy as if they were filled with hydrogen at ordinary atmospheric pressure, their aggregate lifting power would be about 13 tons, and they would not require so much stiffening, so that more than 3 tons would still be left for the car, passengers, etc. Besides, it may be possible to make both the skeleton and the shell of substances lighter than aluminium, such as paraffined wood and India rubber strengthened by imbedded wires. Air pumps that produce a partial vacuum as low as 53 millimeters are already in practical commercial use, and it should not be difficult to construct pumps of great capacity and rapid action, by which the balloons could be exhausted to the required degree very speedily.

Every balloon station would be provided with great pumps of this character, but the vacuum airship would possess a peculiar advantage in carrying with it a portable air pump by which the necessary degree of exhaustion could be maintained or restored in the event of leakage or slight accidents. In a hydrogen airship, on the contrary, losses of gas cannot be supplied during the flight, but can only be compensated by throwing out ballast carried for that purpose.

The vacuum airship could also be made to sink and rise by admitting and extracting air, and could be steered in a vertical plane by operating on the air chambers individually. Its flight would not be stopped by lack of gas and, on reaching its station, it would be quickly restored to its original efficiency.

Several problems must be solved before the vacuum airship, here suggested as a possibility, can become a reality. It is for the mechanical engineer to decide whether or not a sufficiently light and strong vacuum airship, stationary air pumps of the necessary capacity and rapidity of operation, and perhaps also portable air pumps of the required lightness and efficiency can be constructed with the materials now known to technical science.—Illustrirte Aeronautische Mitteilungen.

To Detect and Estimate Boric, Salicylic, and Benzoic Acids in Foodstuffs.

Boric Acid.—The substance, mixed with lime or magnesia, is incinerated, and the ashes are leached with warm water containing a little hydrochloric acid. A measured portion of the solution is neutralized until it fails to bleach phenol phthalein and, after the addition of a measured quantity of a 10 per cent solution of mannite, is titrated with an alcoholic solution of soda.

Salicylic Acid.—The best method is Freyer's, in which the salicylic acid is converted, by excess of bromine, into tribromophenyl bromide, which is estimated iodometrically.

Benzoic Acid.—The benzoic acid is extracted by means of a volatile solvent, a few drops of ammonia are added and the mixture is evaporated until nothing is left but an aqueous solution of ammonium benzoate. The addition of a dilute solution of lead acetate precipitates lead benzoate, which is washed, dried, and weighed.

The Supposed Inheritance of Acquired Characters.

Dr. Francis Darwin, in his presidential address before the British Association, spoke as follows:

"Fischer showed that when chrysalids of *Arctia caja* are subject to a low temperature a certain number of them produce dark-colored insects; and further that these moths mated together yield dark-colored offspring. This has been held to prove somatic inheritance, but Weismann points out that it is explicable by the low temperature having an identical effect on the color-determinants existing in the wing-rudiments of the pupa, and on the same determinants occurring in the germ-cells."

T. D. A. Cockerell suggests in Nature that still another explanation is possible to cover at least some such cases. In discussing various types of latency, Dr. Shull (American Naturalist, July) has recently defined as "latency due to fluctuation" those cases (of which many are known) in which the special characters of a race do not appear except under suitable conditions. Following this idea, it is possible to think of the dark *Arctia caja* appearing after exposure to cold as representing a variation which possessed an inherent tendency to darkness not exhibited under more ordinary conditions. Indeed, this must have been the case, since only "a certain number" were affected. Given such a variation, it is not unreasonable to suppose that when examples were mated together the tendency would be so emphasized as to appear under normal temperatures, thus producing an apparent case of the inheritance of acquired characters.

The Current Supplement.

The current Supplement, No. 1720, opens with an illustrated article on the steamship "George Washington," which is the latest type of passenger and freight-carrying vessel, embodying as it does every innovation known to the shipbuilding industry. Mr. James Denny writes on marine engineering, past, present, and future. Sidney H. Hollands contributes an article on "A New Departure in Aerial Propellers." W. W. Massie has prepared a diagram on electric wave lengths, whereby he eliminates the necessity of repeated calculations. The question whether explosion gas turbines or combustion gas turbines offer the greater practical possibilities is discussed. A. T. Cameron contributes an article on the number of radio-active elements and their properties. The Concrete Pier at Santa Monica, Cal., is described and illustrated. This is the first reinforced concrete pier to be built in the West, and probably the second in the world. Dr. Armand Billard shows the effect of agitated or moving water on animals. Prof. Meltzer's consideration of an animal as an engineering structure is concluded.

To Frost Window Panes.—The following process can be used for lights of glass already set in the sash. Dissolve 1 part of wax in 10 parts of oil of turpentine and add 1 part each of varnish and siccative. With this mixture the panes are coated on the outside, and before drying, dabbed with a pad of cotton wadding. If desired, small quantities of Paris blue, madder lake, etc., may be mixed with the wax solution.

CURIOUS FACTS ABOUT NUMBERS.

To the Editor of the SCIENTIFIC AMERICAN:

In an article which appeared in the SCIENTIFIC AMERICAN of October 31, p. 299, under the heading "Curious Facts About Numbers," it is stated by Mr. Frank Newcomb that "any number (or all numbers) can be expressed by the difference between two squares." The statement is not true. None of the numbers of the form $4n+2$ (that is, of the series 2, 6, 10, 14 . . .) can be expressed as the difference between two squares.

One of the most curious facts about numbers seems now to be the following: Any even number (or all even numbers) above 4 (that is, all the numbers 6, 8, 10, . . .) can be expressed as the sum of two prime numbers, as $8=3+5$, $12=5+7$, . . .

DR. G. VACCA.

Genoa, Italy, November 14, 1908.

GUN EROSION.

To the Editor of the SCIENTIFIC AMERICAN:

In looking over the SCIENTIFIC AMERICAN of 1907, I saw a short article in the August 17 number in answer to Henry B. Griffe's suggestion that to prevent erosion, the charge should be ignited at the base of the projectile. He states that the needle gun did so ignite the charge, and that the recoil was so severe that it was speedily condemned. I think that history will inform him that the reason why it was discontinued was that the gases fouled the mechanism in passing the needle. I have been testing that plan of igniting at base of bullet in bottle-necked shells, and if there is any difference in recoil, it is in favor of igniting at the base of projectile, as it does not have to force any of the powder charge through the reduced hole in the shell. I tapped a small brass tube in the base of shell, and carried it forward to a point close to base of bullet, and with black powder it does not blow off the shell at the neck, as it does not have to force a large part of the powder unburned through the much smaller hole. I notice that there is considerable said about erosion in large ordnance, and difference of opinion as to the cause. It is said that the greater part of the erosion takes place in the first third of the length of bore. I would suggest that the damage to the rifling is done by *abrasion* instead of erosion. The mighty force it takes to suddenly rotate a 1,000-pound shell must cause a terrible rubbing on the edges of the rifling, by the gas check that causes the projectile to rotate, and the friction is much greater during the first third of distance in bore. I do not know whether a gain twist is used in large ordnance or not, but I think that if it is not used, it would be good policy to increase the twist in the rifling, so that as it leaves the muzzle it will have the requisite twist.

JAMES C. WATSON.

Penn Yan, N. Y., November 12, 1908.

The Political Economy of Good Roads.

Poor roads impose an unnecessary financial burden, not only upon those who most constantly use them, but upon the men and women who consume the products grown in the rural sections and brought to cities and towns by farmers.

No study can be more convincing than that of the economic waste placed upon the shoulders of the 85,000,000 people of this land from the almost criminally shameful condition of 2,000,000 miles of road. Every pound of farm products brought from rural sections to thickly-populated centers has placed upon it a fictitious value, because it costs the farmer more to transport it than it would cost him were the roads in passable condition. The price of the lamb chop that Brooklyn eats for breakfast is based, not upon the real value of the lamb, but upon the cost of bringing that lamb from the western fields to the Brooklyn breakfast table. The cost of the breakfast roll would be trifling did it not cost the farmer who grew the wheat from which the roll was made 1.8 cents a bushel more to draw that wheat from his farm nine miles to a railroad station than it cost to carry a bushel of wheat from New York to Liverpool, a distance of 3,100 miles. The cost of a soft-boiled egg, which is also closely related to the American breakfast, is established by the cost of transporting the product of the hen to the hotel, and not because the egg was at all intrinsically worth what was charged for it.

Everybody who thinks must concede the evident fact that if a farmer with two horses can draw but 600 pounds to market in five hours, he would save money if with one horse he could haul 1,200 pounds in two hours. Were the roads in good condition, he could do that and more. Any saving in hauling a ton of farm product would bring a benefit, not alone to the farmer, but to the consumer, and if the product hauled each year was large, it is not hard to figure that the saving would be large. Figures have been assembled to prove that owing to the frightful condition of almost all American roads, it costs 25 cents a ton a mile to haul. The superb roads of the old countries of Europe make possible the hauling of farm products at 12 cents a ton a mile. Therefore, every ton hauled costs the American farmer 13 cents more per mile than the farmers of the old country are forced to pay. The average length of haul of farm products in the United States is 9.4 miles; therefore, were our roads as good as those of France, the farmer's gain would be 9.4 times 13 cents, or approximately $1.23.

Let us see what that amounts to in a year in hauling but a portion of the products which traverse the country roads in wagons. The U. S. Department of Agriculture, through its Office of Public Roads, has collected the figures, and they may be accepted as approximately accurate. During the crop year of 1905-6, 85,487,000,000 pounds of farm products, consisting of barley, corn, cotton, flaxseed, hemp, hops, oats, beans, rice, tobacco, wheat, and wool, were hauled from the places where they originated to shipping points. This vast weight did not, by any means, include all of the crops produced, the most notable exceptions being truck products and orchard products, the tonnage of those two amounting high in the millions. Neither did it include any figures for forest or mine products, nor for those things which go in wagons from the cities back to the country districts. Were all those included, one may easily see what a vast annual saving would be made. As it is, however, of the figures quoted above, at a saving of 13 cents per ton mile, the cash benefit to the farmers would be $58,900,000.

Beyond that, however, the Interstate Commerce Commission has assembled other freight figures, a most conservative estimate and most liberal deductions from their figures tending to prove that 250,000,000,000 pounds are annually hauled. By the same method of figuring as that adopted above, the hauling of this would result in a saving of about $305,000,000 a year. It would appear that so vast a sum should not be annually thrown away, simply because those responsible for appropriations of money to construct roads cannot be brought to a realization of their tremendous importance. The time for an awakening is here, and the quicker the awakening occurs, the greater the benefit the farmer will enjoy.

This Year's Nobel Prizes for Scientific Awards.

The latest awards made by Nobel's representatives for scientific work seem to be fair. Metchnikoff and Erlich receive conjointly the prize for valuable contributions to medicine. Of the two, the former is better known. A disciple of Pasteur, he has devoted much time to bacteriological research. His studies of the possibility of postponing old age have recently attracted attention to his work. Erlich is at the head of an institution for experimental therapeutics in Berlin. His investigations have for their object the successful fighting of several diseases—tuberculosis, diphtheria and anæmia among them.

Rutherford, who won the chemistry prize, is well known to our readers as an ardent and painstaking student of the phenomena presented by radium. Lippmann, who received the prize in physics, is a student of both acoustics and optics.

The Tuberculosis Exposition at New York.

The action of the Committee on the Prevention of Tuberculosis of the Charity Organization Society of New York in bringing to the American Museum of Natural History the remarkably comprehensive exhibit which was installed in Washington during the recent International Tuberculosis Congress, finds its justification in the fact that to nearly half a million people will be driven home the truth that tuberculosis is a communicable, preventable, and curable disease before the Exposition doors will close. The Exposition consists of models, charts, and specimens furnished by nearly seventy exhibitors, comprising foreign governments, our own Federal government, many of our States and municipalities, and private sanatoria and manufacturers. There is a certain amount of unavoidable repetition in these exhibits—unavoidable because, after all, an educational campaign such as this can be conducted only along certain lines. We refer particularly to the duplication of mortality statistics, of charts showing the methods of preventing consumption, and of tents, camps, sanatoria, and cottages for consumptives. Perhaps this very repetition has served to make more forceful the need of cleanliness and fresh air, and to convince the individual of his duty and relation toward the disease.

The Exposition shows the need of attacking the disease in the two fields, intestinal and respiratory. Scores of charts and models illustrate the methods of preparing food, and above all milk, without danger of infection. In this connection the remarkable exhibit of New York city's Department of Health deserves particular commendation. The Department has installed a model cow stable and milk room and proved very convincingly that cattle and stalls can be kept clean and milk safeguarded from germs. Moreover, the Department has exhibited by photographs and charts its method of inspecting the farms that supply milk to New York city and of testing the milk thus supplied. One comes away with the reassuring conviction that New York's milk is safe. The tuberculosis work now being carried on by the Health Department of the city of New York may be summarized as follows: (1) Notification and registration of all cases of tuberculosis (inaugurated 1894 and extended 1897). (2) Free bacteriological examination of sputum, to aid notification and to facilitate the early and definite diagnosis (1894). (3) Educational measures of various kinds, circulars, lectures, exhibits, newspaper articles. (4) Visitation of consumptives in their homes (1894). Continuous supervision of cases in tenement houses by the corps of trained nurses (1903). (5) Free disinfection by the Department of Health, and issuance of orders for the renovation of rooms vacated by consumptives (1894). (6) Furnishing milk and eggs, and referring cases to the proper charitable organizations (1903). (7) Three classes of institutions are provided: *a*. Free clinics (dispensaries) for ambulant cases unable to go to sanatoria (1904). *b*. Free sanatorium for incipient and early cases (1906). *c*. Free hospitals for advanced cases. (8) Forcing certain classes of patients into a hospital and retaining them there (1901). (9) Enforcing regulations concerning spitting in public places. (10) Research studies concerning the mode of infection, the role of bovine tuberculosis, characteristics of the tubercle bacillus, etc.

Because the public is probably more keenly alive to the need of pure fluids for the digestive tract than of the air that enters the lungs, it is but natural that the majority of the exhibitors have endeavored to show the value, and indeed the vital importance of fresh air. It is impossible in our brief space even to enumerate the models of sanatoria, houses, camps, devices for sleeping out of doors in cities, window tents, and the like which crowd the hall. All of them instruct the factory owner and the tenement house landlord that it is necessary to control the aerial transmission of phthisis germs, which flourish only when they find congenial soil in a subject already enfeebled.

The Exposition has been planned with the view that public education is more necessary at the present time that mere public medicine. It grinds into the public mind the fact that tuberculosis is caused by the neglects of society and the individual. Technical terminology is avoided so far as possible. The many lecturers who explain the exhibits and comment on statistics for the benefit of the thousands who come to the Exposition couch their discourses in simple, popular language. Naturally such education cannot but appeal to the overstrained, uncultured, struggling, and submerged fraction of society which suffers more from tuberculosis than the upper classes. A leaf has been torn from the book of the advertising merchant, if we may judge by the warning placards that hang from the walls. The wording is in all cases simple and terse. "Don't give consumption to others, don't let others give it to you;" "Consumption is caused by germs discharged from the lungs of consumptives when spitting, coughing, or sneezing;" "Fresh air, good food, and rest are the best means of curing and preventing consumption," are fair examples. The contracted thoracic cavity and inert lung, the seedbeds of the disease, are everywhere pictured, and likwise their susceptibility to dust.

The Exposition is not an isolated, incidental attack on a modern scourge, but a social development which the Charity Organization Society co-operating with legislators has started as part of a systematic programme of prevention. If that development progresses along the lines of the Exposition, it is evident that the State will some day wage the fight alone—for prophylaxis, prevention, and cure.

How to Destroy Explosives Safely.

The best way to destroy ordinary black gunpowder is to throw it into a stream under conditions that prevent any harm coming to human beings or animals through the dissolving of the saltpeter. If no suitable stream is available, the gunpowder may be stirred with water in tubs, or the dry gunpowder may be poured out on the ground in a long thin line and ignited with a fuse at one end.

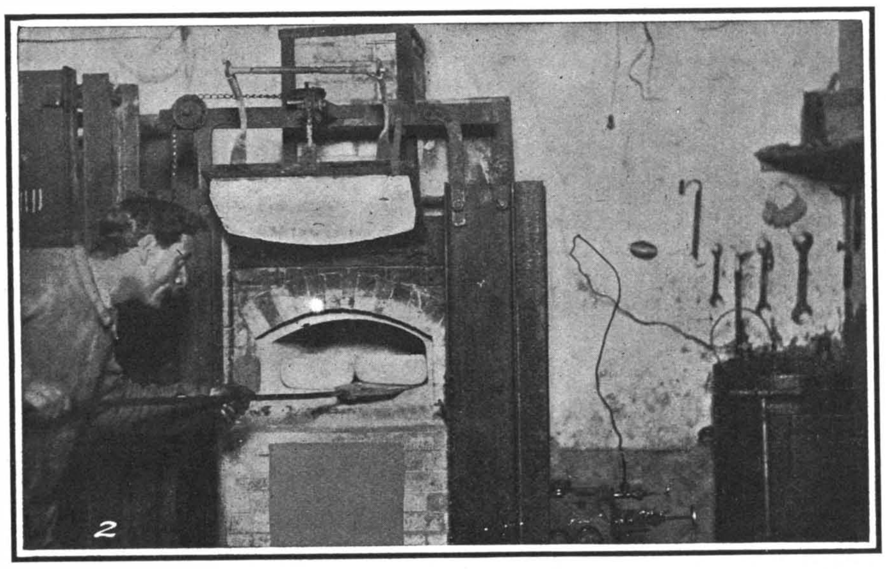
To destroy dynamite cartridges, the paper wrappings should be carefully removed, the bare cartridges laid in a row with their ends in contact, and the first cartridge ignited with a fuse without a cap. Even with these precautions a simultaneous explosion of the entire mass may occur, so that it is wise to retire to a safe distance. The row of cartridges should be laid parallel with the wind and ignited at the leeward end, so that the flame will be driven away from the mass. Frozen dynamite should be handled with especial care as its combustion is peculiarly liable to assume an explosive character. A small quantity of dynamite may be destroyed by throwing it, in very small bits, into an *open* fire, or the cartridges may be exploded, one by one, in the open air, with fuses and caps. Dynamite should never be thrown into water as the nitroglycerine which it contains remains undissolved and capable of doing mischief. Other explosives which contain nitroglycerine should be treated in the same way as dynamite.

Ammonium nitrate explosives may be thrown in small fragments into an *open* fire or, if they do not contain nitroglycerine, may be destroyed by means of water. Explosive caps should be exploded singly with pieces of fuse.

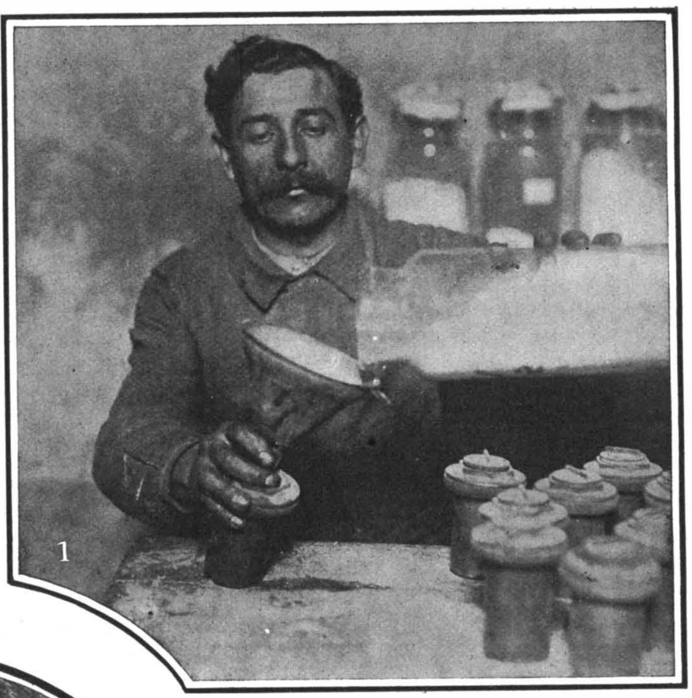
ARTIFICIAL SAPPHIRES.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

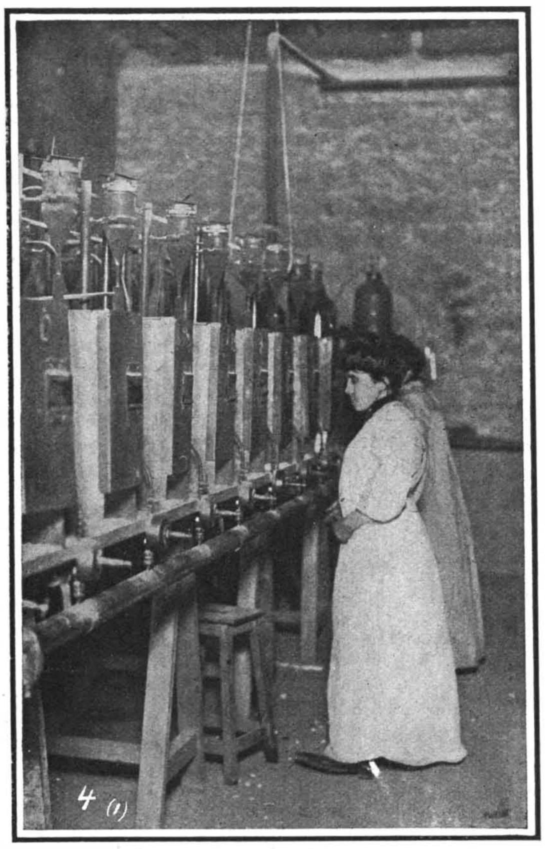
Up to the present it did not appear that the sapphire could be made by an artificial process, although there have been many efforts made to produce it. While the ruby is now made artificially by melting pure alumina and coloring it with oxide of chromium by the heat of the arc or the oxy-hydrogen blowpipe, the sapphire could not be produced by an analogous method. After some attempts, M. Paris, of the Pasteur Institute, has now succeeded in obtaining the sapphire in the laboratory of that establishment. His method consists in introducing foreign elements into the combination. Alumina and oxide of cobalt are theoretically all that is necessary to form the sapphire. The latter serves to produce the yellow color, and is in a small proportion to the whole amount. The experimenter had the idea of adding 2 per cent of lime and magnesia, and the whole mixture was melted at the usual high temperature. The effect of this combination is surprising. Before this, the melted alumina crystallized upon cooling and eliminated the coloring matter, but in the present case this crystallization does not take place. The mass becomes colored and remains permanently in this state. At the time of the highest heat the lime and magnesia are driven off and the alumina, colored by the oxide of cobalt, remains. This substance is therefore the artificial sapphire, and it is chemically identical with the stone found in nature. An expert cannot tell the difference, it is claimed, and a microscopic examination is needed in order to distinguish the two. Prof. Lecroix presented an account of the process at the last meeting of the Académie des Sciences, together with specimens of the new stone. We expect to give further details of the process here briefly outlined.



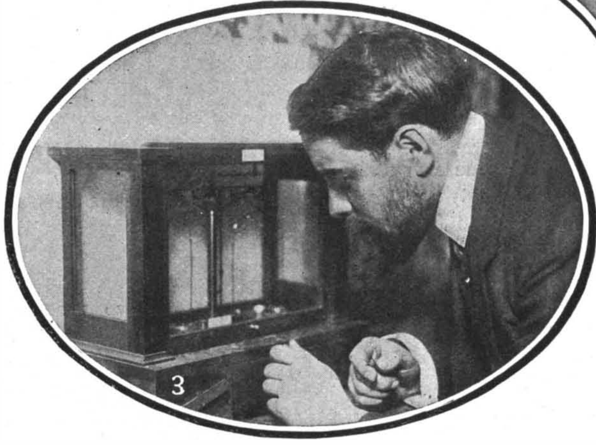
Thrusting the crucible into the furnace.



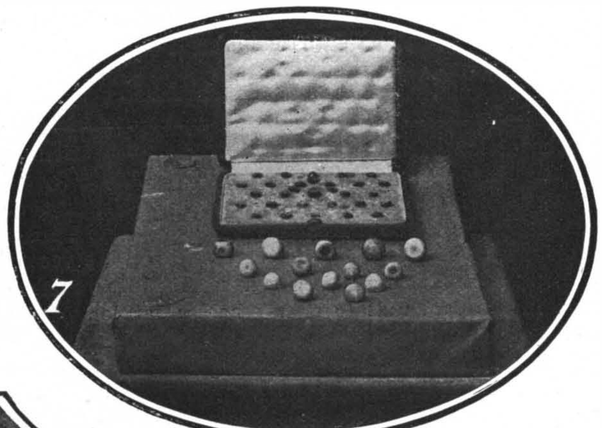
Pouring raw material into crucible.



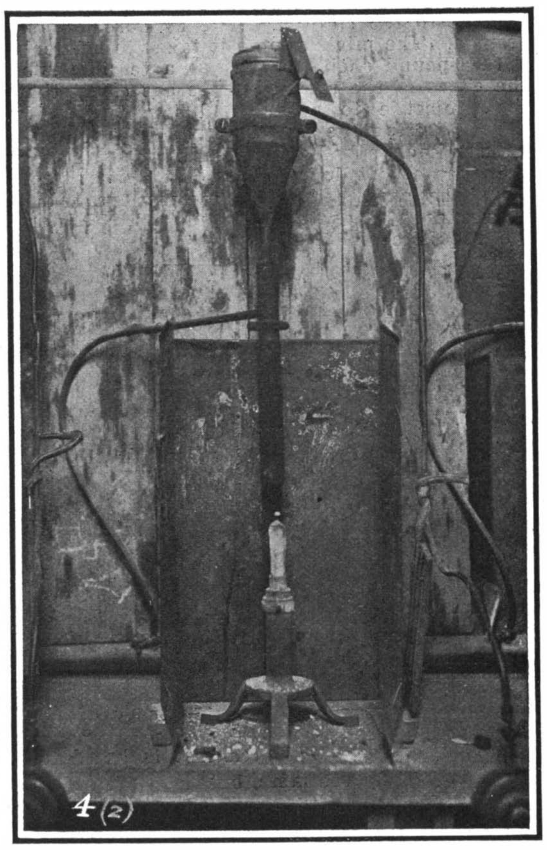
A row of blowpipes.



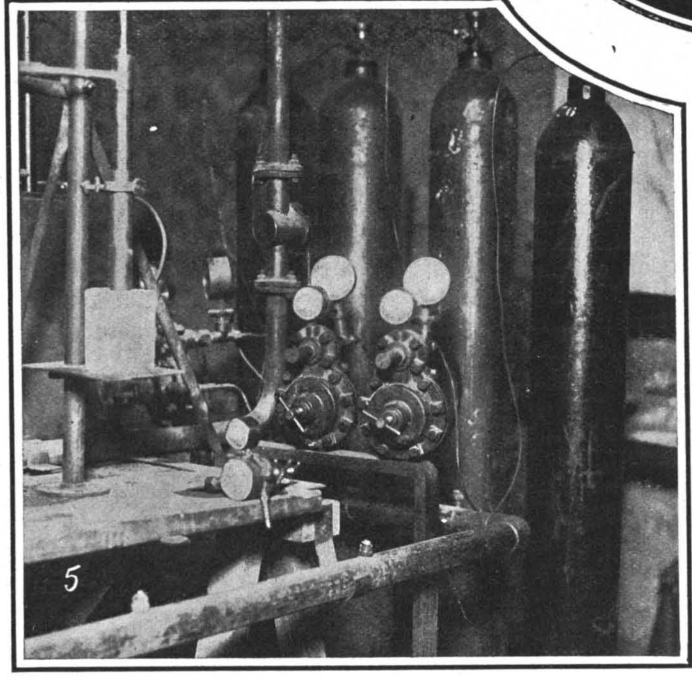
M. Paris weighing the raw material.



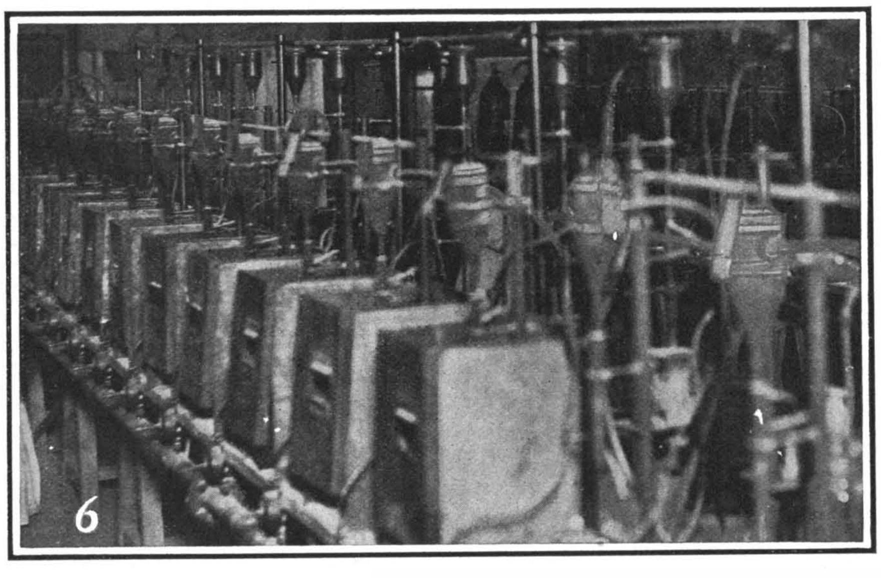
Artificial sapphires.



A single blowpipe.



Oxygen tubes feeding a row of blowpipes.



A general view of the blowpipe room.

ARTIFICIAL SAPPHIRES.

A short time ago it was announced that the Illinois Central Railroad had decided to electrify its Chicago terminal, this determination being influenced to a large extent by the public agitation against the smoke nuisance. It is now stated that the Chicago, Rock Island & Pacific, and the Chicago, Burlington & Quincy railroads are also seriously considering the advisability of electrifying their lines within the city limits.

NEW MECHANICAL TOYS.

BY JACQUES BOYER.

The eighth of the annual competitive exhibitions of toys and mechanical novelties, established by M. Lépine, was recently held in Paris. Many of the exhibits gave evidence of a keen desire to be fully abreast of the times so that the exhibition resembled an illustrated summary of current events and matters of public interest. Single, double, and triple aeroplanes, kites, and other aeronautical devices were shown in great numbers and variety. There were dirigible balloons of metal which merely revolved with fixed posts and others which were suspended by cords and described gradually diminishing circles, under the impulsion of tiny propellers. Some of these airships were really lighter than air, like real dirigibles.

Conspicuous among the aeroplanes were those shown by Mangin, the inventor of the "dragon fly," the "tortoise," and other mechanical toys which have become classic among Parisian children. The operation of these little aeroplanes (Fig. 1) is very simple. The mechanism, which can be started and stopped by moving a catch, is driven by the contraction of stretched rubber bands and is wound up by thirty turns of a crank at the bow. The aeroplane is attached, by means of a ring at the top, to a long cord, the other end of which is fastened to a hook in the ceiling or other elevated support. It is then set on the floor and the mechanism is started. The aeroplane, which is mounted on small wheels, first describes a spiral course on the floor, then rises and circles in the air.

Vallin showed self-propelling kites operated in a similar manner and so constructed that a broken stick is easily replaced. Vallin kites of three sizes were exhibited. The smallest is designed as a child's toy, the intermediate size for sport, and the largest for meteorological and photographic work. The largest kite has been successfully employed, at Havre, in carrying lines between vessels and the shore.

The Guillot automotor (Fig. 2) excited the liveliest interest and received a first prize. Its mysterious action has won for it the name of "perpetual motion." It consists of a disk of ground glass with a central hole, through which a rod passes, but without touching the glass. The rod is held perpendicular to the disk by twenty fine silk cords which are stretched tightly over the ends of the rod and the edge of the disk. The automotor is mounted in a frame with the rod, or axis, horizontal and resting on pivots or ball bearings, so that it can turn freely over a bowl into which the disk and some of the cords dip. When the bowl is filled with water the automotor begins to rotate and it continues turning indefinitely.

The principle of the automotor is illustrated by the diagrams (Fig. 3). The upper diagram represents the apparatus reduced to its simplest form, the disk being replaced by a straight bar *A* which passes loosely through a hole in the axle *B*, and at right angles to the axle, and is kept in position by the cords *D* above and the cords D_1 below. When the lower cords are immersed in water they contract and force the bar upward, so that the bar and cords assume the position indicated by the dotted lines. In this position, however, the center of gravity is above the axis and the equilibrium is consequently unstable. Hence the rod falls over and turns, with the cords and axle, until its longer end is below. Then the wet cords D_1, which have been raised to the top, dry and expand, and the cords *D*, which are now immersed, contract, again pushing the rod upward and causing a second half rotation of the apparatus. This series of operations is repeated indefinitely, but the successive and sudden half turns may be made in the same or in opposite directions, as accidental influences dictate. But when the rod is replaced by a number of spokes or a solid disk, and the cords are correspondingly multiplied, the action becomes more energetic and regular, and the differences in the times during which the various cords have been exposed to the action of the water and the air, respectively, produce a lateral as well as a vertical displacement, as indicated by the dotted line in the lower diagram, so that the apparatus continues to turn in the direction in which it has started.

The automotor exhibited made one revolution in four minutes. Great speed can be obtained by substituting for the water a more volatile liquid such as alcohol or ether. An automotor may be made with metallic wires, instead of silk cords, and arranged to dip into a very cold liquid in a warm room. In this case the lower wires contract because they are cooled by the liquid.

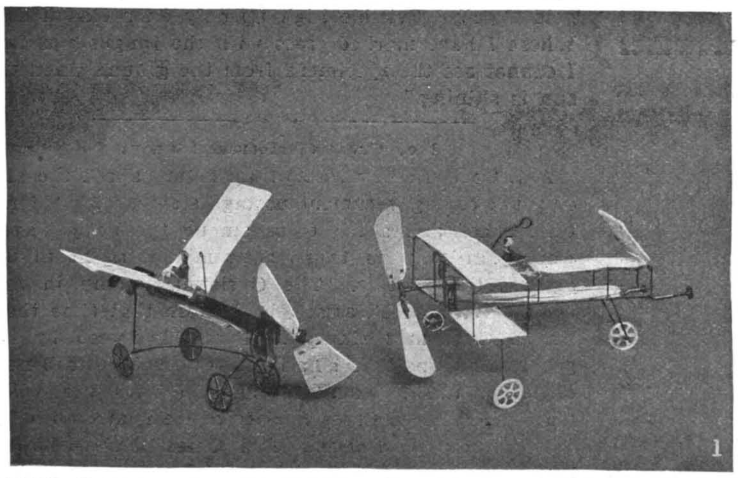
The accumulators which were employed to operate the little Lebrun electric motors (Fig. 4) have electrodes of pure lead, originally very soft, but hardened by hydraulic pressure and cut by machine into the form of a comb. They are enveloped in amianthus, which prevents disintegration and waste. The compression assures a long life of the electrodes, as the lead is attacked very slowly and the freedom from alloy and impurities gives a maximum capacity, 12 or 13 ampere hours per pound of lead.

The largest of the three Lebrun motors shown in the photograph (Fig. 4) operating a little bucket pump, is sufficiently powerful, in spite of its small dimensions, to run a sewing machine. It has eight poles, Niaudeb winding, and a horseshoe iron inductor, and is capable of great variation in speed.

Bressonet's mechanical soldier (Fig. 5) attracted especial attention because it was a caricature of the Socialist deputy Archimbaud, who was recently recalled to the army to complete his term of military service. When a coin is placed in a slot, music is heard and the soldier opens his kit and takes from it a carrot, an onion, and finally a toad.

Gasselin's swimming lesson (Fig. 6) is more interesting. The teacher is only an accessory, the interest attaches to the pupil, who travels on dry land, supported by wheels, but imitates very neatly the movements of a swimmer. Four iron wires, attached to the arms and legs, jointed together to form a parallelogram, and moved by one of the wheels, constitutes the entire mechanism.

The same inventor has introduced an innovation in his acrobats (Fig. 7), which are caused to turn about horizontal bars by the weight and impact of bicycle balls. The balls are stored in a box at the top of the apparatus, and roll, in a row, down an inclined channel until the first ball strikes a cam, which can be retracted by pressing a button. The first ball, having been released by this means, rolls down a series of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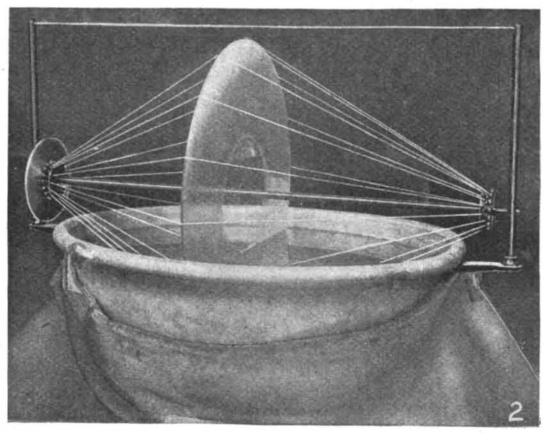
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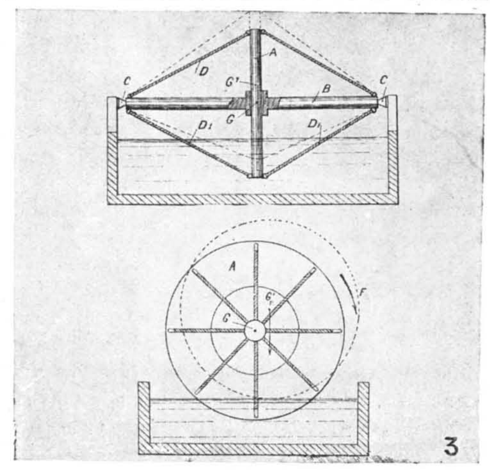
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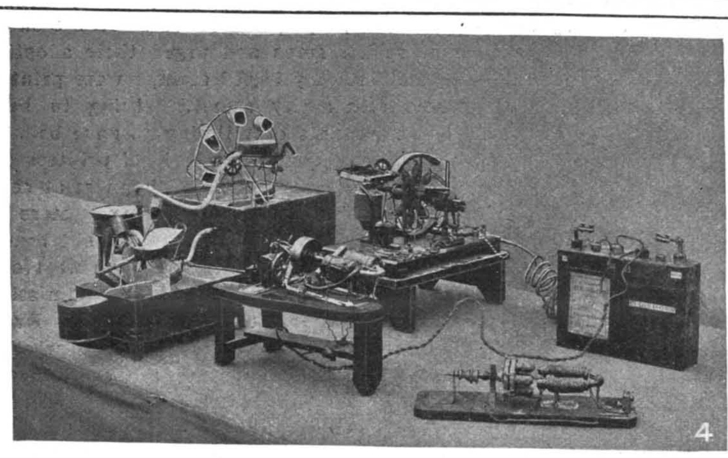
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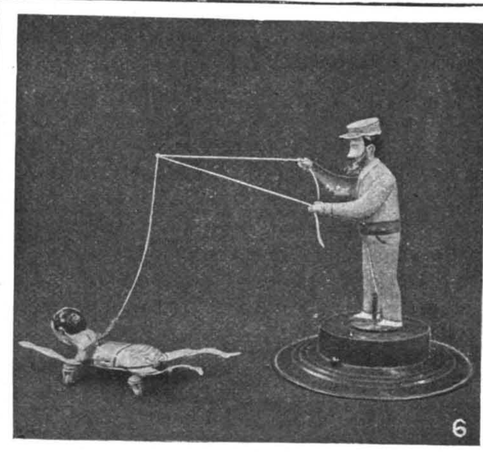
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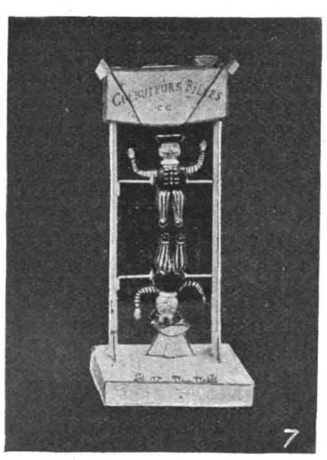
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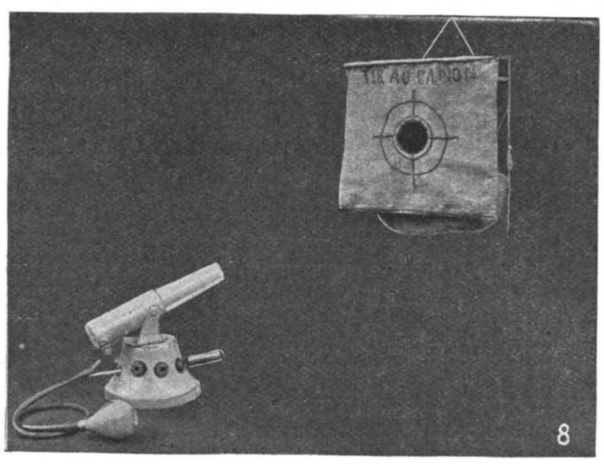
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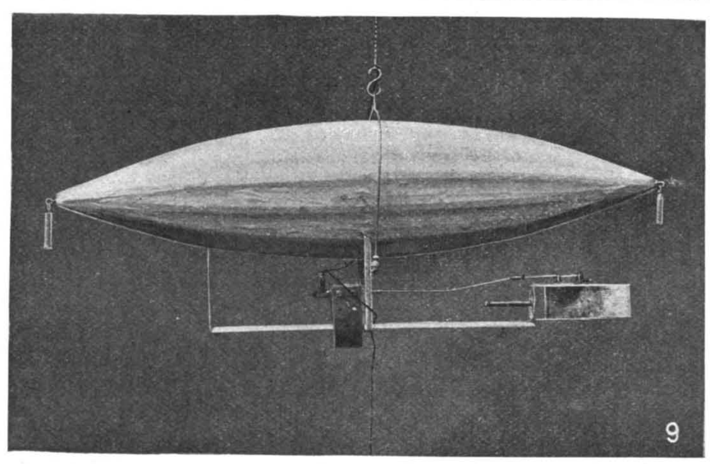
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1. Aeroplanes. 2. The automotor. 3. Diagrams of the automotor. 4. Accumulators and electric motors. 5. The soldier at dinner. 6. The swimming lesson. 7. The acrobats. 8. Artillery practice. 9. A dirigible balloon.

NEW MECHANICAL TOYS SHOWN AT THE EIGHTH LÉPINE COMPETITION IN PARIS.

inclined planes inside the box and falls into a cavity in the head of the upper acrobat, causing the figure to make a complete turn around the bar and, in passing, drop the ball onto the head of the figure below, which executes a similar movement, dropping the ball into a funnel at the base of the apparatus. The ball, in falling, strikes a lever which, operating through a rod concealed in one of the posts, again retracts the cam and releases a second ball. So the acrobats swing alternately round their bars until all the balls have reached the bottom.

The same inventor exhibited a pneumatic cannon and target (Fig. 8). The cannon is discharged by compressing a rubber bulb and, if it has been correctly aimed, the projectile passes through a hole in the target and is caught in a canvas bag behind. The projectile is tubular and the breech is perforated, so that the piece can be aimed by sighting along the axis.

Among other interesting novelties were Boisard's boat and airship, equipped with practicable rudders (Fig. 9), Mizault and Papin's auto-sphere, which recalls a famous device of antiquity, and Teantet's "flip-flap," a miniature copy of one of the notable attractions of the Franco-British Exposition, which has been fully described in the SCIENTIFIC AMERICAN of October 31, 1908.

In conclusion, let us glance at Blondinat's remarkable repeating gun, in which the usual mechanism of automatic toys is combined with a very ingenious device which enables the gun to advance, fire two shots, and return to its original station. The shots are represented by the explosion of two percussion caps which are fixed on hammers beneath the chassis of the gun. These hammers are released, successively, by the movement of a rod bearing a peg which enters a spiral groove on the front axle. This rod also causes the vehicle to turn while the shots are being fired, sufficiently to reverse its direction, and then allows it to pursue a straight course to the starting point.

The interest shown in these competitions by French manufacturers and inventors (to whom, by the way, the competition is restricted) increases from year to year. Inventors have learned that it is useless to exhibit an undeveloped idea. Every detail must be worked out in practical form if the invention is to find a manufacturer who will take it up. Hence the members of the "*Société des petits fabricants et inventeurs français*," under whose auspices this annual exhibition is held, have learned to combine their efforts and, as a result of this harmonious arrangement, they are every year becoming more formidable competitors of the German toymakers of Nuremberg.

In the current number of the SCIENTIFIC AMERICAN SUPPLEMENT will be found descriptions of other toys which were to be seen at the exhibition.

To Our Subscribers.

We are at the close of another year—the sixty-third of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT, a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

Detection of Gelatine.

Gelatine can be detected in solution by boiling the liquid with a mixture of equal parts of Nessler's reagent and a solution of tartaric acid. If gelatine is present a lead-colored precipitate is deposited, but no precipitate is produced by gum arabic, dextrine, cane sugar, extract of saponaria, or licorice. Hence this method may be used for the detection of gelatine in solutions of those substances. Nessler's reagent is an alkaline solution of potassium iodide and mercuric chloride, which assumes an orange color in the presence of even a trace of ammonia.

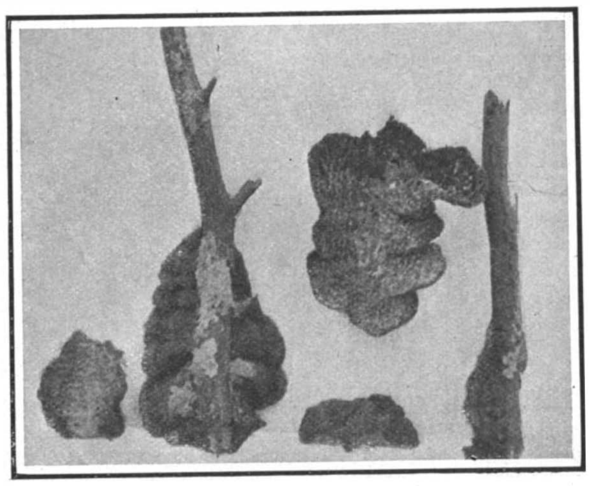
A $500 Prize for a Simple Explanation of the Fourth Dimension.

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

Competitors for the prize must comply with the conditions set forth in the current number of the SCIENTIFIC AMERICAN SUPPLEMENT.

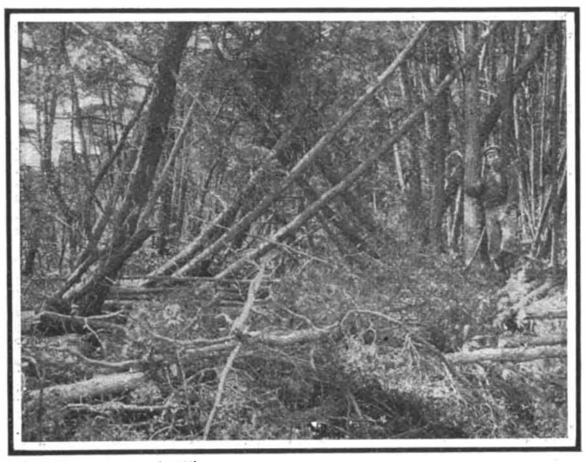
DESTRUCTIVE FUNGUS OF WHITE CEDAR.

The fungus which destroys commercial white cedar trees, *Chamæcyparis thyoides*, has at last been discovered by William Hosea Ballou of New York in the forests of Ocean County, New Jersey. For a half century, almost every fungist and botanist of America and Europe has overrun the Atlantic coastal plain,



Steecherinum Ballouii, the parasite of the white cedar of commerce.

looking for the deadly parasite of the swamp cedars, one of the most important woods used in vessel construction. Mr. Ballou, who gives much attention to expert field photography of the fungi, made repeated examinations of the swamps without result. Finally, he commenced a systematic search, tree by tree, his efforts being facilitated by the prevalent drought. Still failing in this effort, he commenced over again, this time examining the canopies of the trees. Almost at



White cedar killed by the new species of fungus.

once he was rewarded by seeing golden yellow fungi growing very near the tops of the trees on the branches, near and extending somewhat down, on the trunks of the living trees. An examination showed the specimens to be hydnums, a class of fungi named after the hedgehogs, on account of their spines, often resembling the quills of the porcupine. Specimens were therefore submitted to Dr. Howard J. Banker of De Pauw University, specialist of the *Hydnaceæ*. Dr. Banker declares the species new to science and has named it *Steecherinum Ballouii*. The generic name

Typical white cedar swamp.

DESTRUCTIVE FUNGUS OF WHITE CEDAR DISCOVERED BY W. H. BALLOU.

Steecherinum is tentative, as the fungus at present appears to be an entirely new genus.

Mr. Ballou says: "The new fungus has escaped attention heretofore because of its lofty tendencies, and the density of the canopies of evergreens crowded together makes it almost impossible to see what they conceal, nor is it comfortable to wade in a miry cedar swamp bog gazing upward, taking chances on deep holes concealed under the carpet of sphagnum mosses.

"Dr. Banker will later issue a full scientific description of the new fungus, which has wiped out many square miles annually of the finest boat timbers, leaving large areas of dead trees. The fungus is a parasite which expires when it kills a tree, apparently drying up instantly and dropping off, so that no trace of its fruit is found on dead trees and scarcely a trace of its mycelium. It is semi-resupinate (lying on its back) and semi-pileate (having a cap). As seen in the illustration, the limb appears to grow across the top of it and a lichen on top of the limb. When drying, it forms into a series of cup shapes, resembling a bumblebee's honeycomb. One tree found had apparently just expired, together with the fungus. The fruit bodies in this case clung to the bark along the trunk of the tree, in form of single small cups, upside down. The least touch brought them all to the ground, rattling like peas in a pod. Unless one finds the living fruit bodies of the fungus on a living tree, he may never have a similar opportunity to find dead specimens on a dead tree. It is a fungus of mystery, the most beautiful as well as the most deadly I have ever come in contact with. Its spines are of a gorgeous golden yellow, visible high up only on a leaden day. Where I have marked trees with the fungus growing, I cannot see the specimens from the ground when the sun is shining."

Red Cross Christmas Stamp.

A little red and white penny stamp about the size of a two-cent government postage stamp, with "Merry Christmas" and a red cross among the holly leaves, would hardly seem to be a promising agent to use against tuberculosis. The Christmas stamp in America started in Delaware, but before that time there was a Christmas stamp in Denmark issued by the government and sold at all post offices for the benefit of a hospital for children afflicted with the white plague. The Red Cross Society of Delaware, with the approval of the National Red Cross, decided to try this Danish idea last Christmas. The plan was backed by many influential people, and Jacob A. Riis took up the subject of such stamps and urged their adoption in America. At first only 50,000 stamps were printed, and the whole community seemed willing to help. The dry goods merchants of Wilmington gave bolts of muslin to print street car banners; local printers did the work of printing the posters and banners at cost; the street cars displayed the advertising posters on their fenders day after day; the protected bill boards were placarded without expense; department stores and drug stores sold the stamps without commission, and even the school children took up their sale. Every penny for the stamps, after the expense of printing and distribution was paid, went to the anti-tuberculosis work in Delaware. Interest in the plan spread, and in a short time it was taken up by the North American in Philadelphia. The Pennsylvania Red Cross backed the plan and helped to sell the stamps. In the short space of eighteen days nearly 400,000 Christmas stamps were sold, and nearly $3,000 of clear profit resulted. The stamp had proved its possibilities in so short a space and in so conservative a section.

The National Red Cross has now taken up the Christmas stamp in a formal manner. A stamp has been designed by Howard Pyle and is printed in three colors by the Bureau of Engraving and Printing and is issued by the National Red Cross. The stamp will be offered for sale in every State this Christmas season. They can be procured in any quantity from the Red Cross headquarters in any State, or the central one in Washington, for cash only at one penny for each stamp. It will not carry mail, but any kind of Christmas mail will carry it, and they are most appropriate as stickers on Christmas presents. Every cent will go toward tuberculosis work in the State where the stamp is sold.

Experiments by the Forest Service, at its timber testing station at Yale University, show that green wood does not shrink at all in drying until the amount of moisture in it has been reduced to about one-third of the dry weight of the wood. From this point on to the absolutely dry condition, the shrinkage in the area of cross-section of the wood is directly proportional to the amount of moisture removed. The shrinkage of wood in a direction parallel to the grain is very small; so small in comparison with the shrinkage at right angles to the grain, that in computing the total shrinkage in volume, the longitudinal shrinkage may be neglected entirely. The volumetric shrinkage varies with different woods, being about 26 per cent of the dry volume for the species of eucalyptus known as blue gum, and only about 7 per cent for red cedar. For hickory, the shrinkage is about 20 per cent of the dry volume, and for long-leaf pine about 15 per cent. In the usual air-dry condition, from 12 to 15 per cent of moisture still remains in the wood, so that the shrinkage from the green condition to the air-dry condition is only a trifle over half that from the green to the absolutely dry state.

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

ANNOUNCEMENT.

The editor of Handy Man's Workshop has been flooded with inquiries about the home-made vacuum cleaner described in the issue of November 7. Many have expressed doubts as to the practicability of such a system, but we desire to assure our readers that the cleaner described is highly efficient. One of them has been installed near this city, and has been in constant use for some time, giving perfect satisfaction.

Owing to the widespread interest in this subject, we have asked the author to give us a second article answering the many questions of our readers. This article will appear in the next issue of Handy Man's Workshop.

LET THE CLOCK OPEN THE FURNACE DRAFTS.

BY H. L. WHITEMORE.

Most furnaces are nowadays arranged so that the drafts can be operated from the living rooms above, but still require the personal attention of some shivering member of the household, before dawn on cold winter mornings, if the house is to be comfortably warm by breakfast time. Undoubtedly much irritability and fatigue, if not actual sickness, can be traced to the strain of this early rising under the most unfavorable conditions.

It is a very simple matter, which anyone could undertake successfully, to so arrange an alarm clock that it will control all the drafts and dampers and open them at any desired time in the morning. If it is absolutely necessary to shake down the fire, remove ashes, and add fresh fuel, the problem is a much more difficult one, far beyond the strength or capacity of the dutiful alarm clock. Most furnaces, however, can, with a little experience, be so left the night before that on opening the drafts in the morning they will burn up rapidly and soon have the house at a comfortable temperature. Fresh fuel, unless absolutely necessary, actually delays the heating up of the house and is much better added later, when the demand for heat is not so urgent.

The apparatus comprises a base-board fitted with two screw eyes, through which the usual chains are passed. Hinged to the board with a pair of staples is a U-shaped lever, with one arm about 5 inches long and the other just long enough to catch the chains. The lever is located far enough above the screw eyes to allow for the proper opening and closing of the drafts. The screw eyes are not placed directly under the short arm of the lever, but on either side, so as to prevent the chains from kinking and catching on the hooks when they are released by the lever.

The alarm clock, which furnishes the brains for this apparatus, may be supported on a long hook or nail, and others bearing against the feet on each side will prevent it from swinging sidewise. Some people, who desire unbroken dreams, will turn the gong or bell upside down to put it out of the reach of the fiendishly energetic clapper, but that is an unimportant detail which may be left to personal taste and preference.

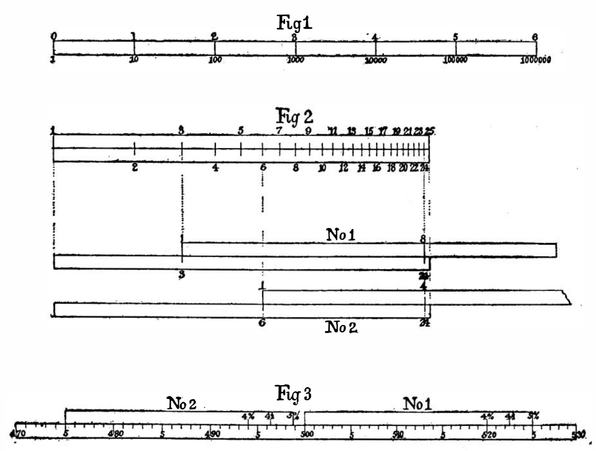
The clock, intended for a hard physical job like this, must have the alarm winding key so arranged that it unwinds when the alarm "goes off." There are a number of clocks on the market of different shapes and sizes which are made with this important feature.

To prevent chafing of the cord, unscrew this winding key and slip on, back of it, a thick cardboard washer. Then connect the key and wire lever with a piece of cord and the contrivance is ready for operation. After setting the clock, the cord should be wound onto the key in winding the alarm. Then the chains are hung in place on the lever. When the alarm "goes off" the lever turns on its pivot, releasing the chains and permitting the usual weight to drop and thereby open the drafts and damper. If the furnace is not arranged with a weight for operating the draft the chains may be connected directly to the key by a cord which will be wound up on the key as the alarm goes off.

HOW TO USE THE SLIDE RULE.

BY FREDERIC R. HONEY, TRINITY COLLEGE.

In comparatively recent times, the slide rule—whose value as an aid to rapid computations had been fully appreciated by the actuary, the engineer, and the architect—had not made its way into general use, owing partly to the cost of manufacture. At the present time, the instrument is constructed in a way so adapted to the needs of the business man, and at a cost which brings it within the reach of everyone, that it has become an indispensable possession of many who are engaged in commercial affairs.



SOME PRACTICAL USES OF THE SLIDE RULE.

A clear understanding of the fundamental principle of this valuable invention will make plain some of the many ways in which it may be practically applied. The illustrations here given are very much simplified, in order that a knowledge of the principle may be easily grasped. The parts composing the slide rule may be described as graphic representations of logarithms; i. e., the lengths of the measurements on the scale are proportional to the logarithms of the numbers which they represent.

Thus the scale, Fig. 1, which may be made of any convenient length, and may be assumed to represent the number one million, is divided into six equal parts from 0 to 1; from 1 to 2, etc. The number is indicated on the lower edge of the scale, and its logarithm on the upper edge: The logarithm of $1 = 0$, of $10 = 1$, of $100 = 2$, etc. This scale may be extended indefinitely, and if the logarithms of the intermediate numbers are marked upon it, the process of multiplication may be performed by addition; that of division by subtraction; a number may be raised to any power by multiplication; and any root may be extracted by division. Thus if it is required to multiply 100 by 1,000, add 2 to 3 (the logarithms of these numbers) $= 5$; and the product 100,000 is found under 5 (its logarithm). Two divisions on the scale are *added* to three divisions. If it is required to divide 10,000 by 1,000, three divisions on the scale are *subtracted* from four divisions, and the quotient is represented by one division or 10. The fourth power of 10 is found opposite 4; i. e., the number opposite 10 or 1 is *multiplied* by 4, which is the logarithm of 10,000. The cube root of 1,000,000 is found opposite 2; i. e., 6 (the logarithm of 1,000,000) is *divided* by 3; and the required root is 100. In the slide rule all of these operations are performed mechanically.

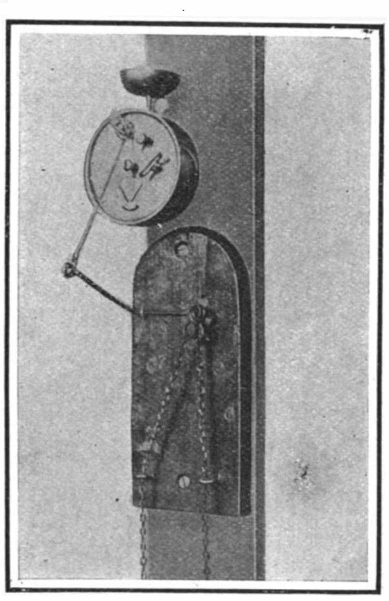
Fig. 2 represents two scales graduated alike, on which are shown the logarithms of numbers from 1 to 25. These scales may be made of any convenient length provided the representations of the logarithms are correctly proportioned. They may be obtained from any table of logarithms; and the unit may be assumed as large or as small as we please. In these scales the *number* is marked against the graduation instead of its logarithm.

A very simple example will illustrate the way in which the scales may be used for more complex computations. Find the value of the fraction $\frac{3 \times 8}{4} = 6.$ Move the upper scale into position No. 1, bringing one end opposite 3 on the lower scale; and the reading opposite 8 on the upper scale is 24 on the lower scale. This operation is performed by adding the length of log 8 to that of log 3; and the sum is log 24, the logarithm of the product. Now move the upper scale into position No. 2, so that the graduation 4 is opposite 24 on the lower scale; and the reading opposite the end of the upper scale is 6 on the lower scale. In the second operation log 4 is subtracted from log 24; and the difference is log 6, the logarithm of the quotient. The logarithms of 2, 3, 4, and 5 are respectively one-half of the logarithms of their squares 4, 9, 16, and 25; i. e., the square of a number is found by doubling its length on the scale; and conversely the square root of a number is one-half its length. The cube of a number is three times its length; and its cube root one-third; the fourth power is four times; and the fourth root one-fourth, etc. The scale may be extended indefinitely; and products, quotients, powers, and roots of any numbers may be measured upon it.

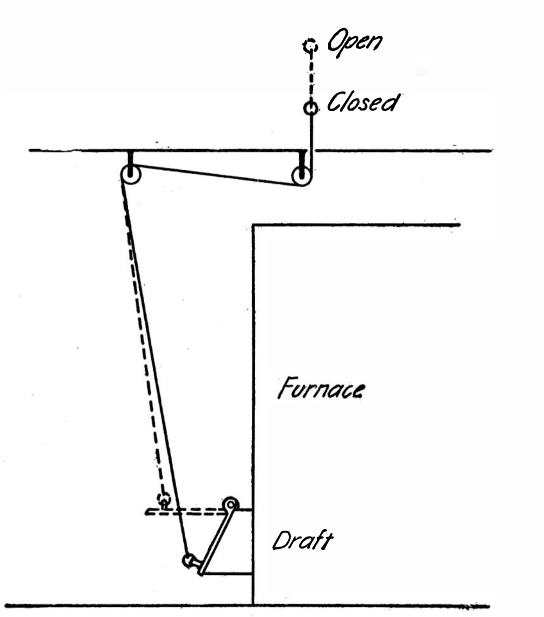
AN INTEREST AND DISCOUNT SLIDE RULE.

A useful application of the logarithmic measurements is found in a scale for the rapid determination of interest and discount. A portion of it is shown at Fig. 3. Let the numbers 470 to 530 on the lower scale represent these numbers of dollars. The lengths are proportioned to the logarithms of the corresponding numbers. The measurements are supposed to be made from a point beyond the limits of this page; but that part of it which is here shown, is determined without reference to this point. Its length is the difference between the logarithms of 530 and 470; and the positions of all the graduations on the scale are determined in the same manner. The scale may be made of any convenient length provided the proportions are correctly maintained; and the graduations may be carried out to any fraction of a dollar.

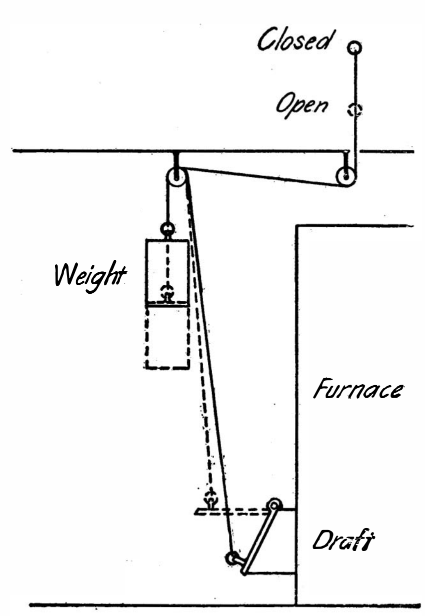
The upper or sliding scale is graduated for interest and discount. The lengths between the zero point—the logarithm of 1—and the points marked 4 per cent, 4½ per cent, and 5 per cent, represent the logarithms of 1.04, 1.045, and 1.05. This scale may be expanded indefinitely. For example: if the length for 7 per cent is required, the measurement is the logarithm of 1.07. While the scales may be made of any convenient length representing the logarithms of the numbers marked upon them, it should be noted that the same unit of measurement must be adopted in both scales. If it is required to find the amount, i. e., the sum of the principle and interest at a given rate per cent, the zero



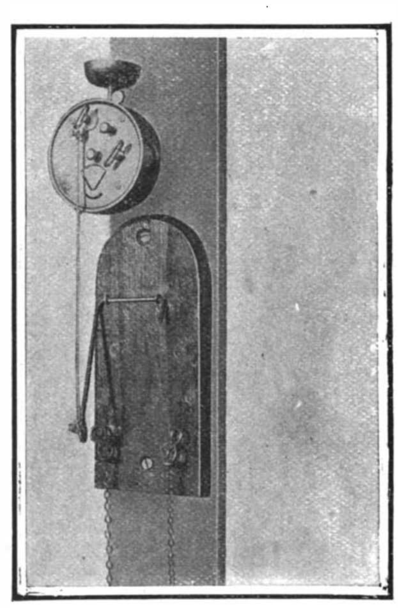
Drafts closed, alarm set.



Drafts directly connected to alarm key.



Arrangement with counterweight to open drafts.



Chains released, drafts open.

LET THE CLOCK OPEN THE FURNACE DRAFTS.

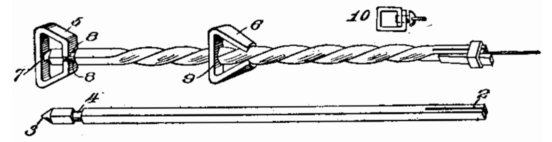
point of the sliding scale is placed opposite the reading for the principal and the amount is found on the lower scale opposite the rate per cent graduation on the sliding scale. The zero point of the sliding scale (No. 1) is opposite 500 (dollars) on the lower scale; and the readings opposite 4 per cent, 4½ per cent, and 5 per cent are respectively $520, $522.50, and $525. These amounts, which might have been obtained by multiplication, are determined by addition. For example: $\$500 \times 1.05 = \$525$. By the scale the logarithm of 500 is added to that of 1.05. The same position of the sliding scale illustrates the method of determining the present value of a sum of money due at some future date. The present value of $525 at 5 per cent; of $522.50 at 4½ per cent; and of $520 at 4 per cent is $500. Each of these values is obtained by placing the percentage graduation on the sliding scale opposite the amount on the lower scale; and the reading $500 is opposite the zero point on the sliding scale.

No. 2 shows how the interest on any other sum of money is determined. The principal is $475, and the rate per cent is 4. The zero point of the sliding scale is placed opposite 475, and the reading opposite 4 per cent is 494. This example also illustrates one in discount. If the graduation 4 per cent is placed opposite 494, the reading opposite the zero end of the upper scale is the present value, viz., $475. An interest and discount scale may be advantageously constructed in segments. The desirability of doing this will be evident from Fig. 2, in which the spaces between the graduations rapidly diminish. A different unit may be assumed in each segment, provided the same unit is adopted in the construction of both scales for that particular segment. The interest and discount slide should be graduated for every rate of interest at which money may be loaned. To make it available for general use, it should also be graduated at intervals of one-half of one per cent, to include computations in interest and discount for short intervals of time. For example we will suppose that it is required to find the present value of a sum of money due three months hence at 6 per cent per annum. The graduation on the sliding scale which would be used in determining the discount would be that for 1½ per cent, or one-fourth of the rate of interest. The measurements from the zero point should be the logarithms of 1.005, 1.01, 1.015, 1.02, 1.025, etc.

SIMPLE DRIVER FOR SMALL DRILLS.

BY L. G. HANDY.

In an emergency the writer made a drill driver as follows: A piece of 3/16-inch square brass wire about 10 inches long was slit at one end with a hack saw,



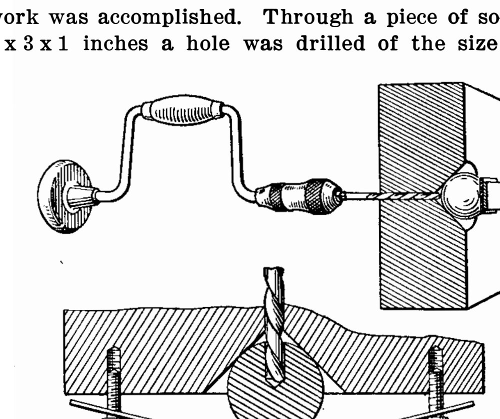
DRIVER FOR SMALL DRILLS.

as at 2. The opposite end was filed to a blunt point 3. About ½ inch from this end a round section 4 was filed. From a piece of sheet brass a swivel 5 and the slide 6 were formed. The swivel was made with a socket 7 to receive the point. Notches 8 were filed to fit the round section. The slide was formed with a square hole to fit loosely on the wire. The lugs of the slide were slightly concaved to permit displacement. By holding one end of the wire in a vise and gripping the other with a wrench, the wire was twisted. A ring and wedge, as illustrated, formed an effective grip for the drill. A more practical grip might be made, as shown at 10. The two ends of this ring should be soldered. A slot might be filed in opposite sides of the twisted wire to receive the ring and prevent it from dropping off. This driver has done good service for nearly two years.

DRILLING HOLES IN MARBLES.

BY J. O. BROUILLET.

Recently a man came to the writer and wanted a hole put through the center of some marbles. The accompanying sketch gives an idea of the way the work was accomplished. Through a piece of soft steel 2 x 3 x 1 inches a hole was drilled of the size of the



A METHOD OF DRILLING HOLES IN MARBLES.

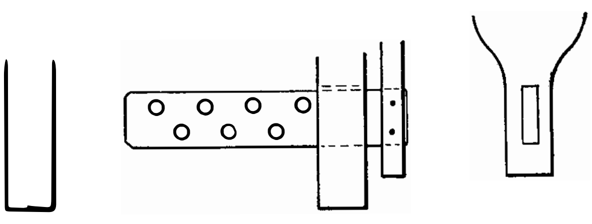
one wanted in the marbles. Then with a countersink a conical aperture was made in one side as illustrated. Two tapped holes, one above the other, below the aperture, admitted a pair of thumb screws that secured a flexible strip made from the spring of an eight-day clock. On the strip next to the marble which was seated in the conical aperture a piece of emery cloth was placed. The whole was then held in the vise and the marble was easily bored.

FURNISHING THE WORKSHOP.—I.

BY I. G. BAYLEY.

THE WORKBENCH.

In the article on the Construction of a Workshop (Scientific American, November 21, 1908) we showed a workbench attached to the wall, thus saving time and



DETAILS OF THE HEEL OF THE VISE.

labor in making it; but a stationary workbench is not always desirable, especially if there is no permanent shop for it. The standard size of a joiner's bench is 12 feet in length and 2 feet 9 inches in height and width. This size is altogether unnecessary for home purposes, and in particular for a boy or young man. From 8 to 9 feet in length, and about 32 inches high is a convenient size. Mechanics sometimes test the height by sitting on the front edge of the bench sideways, with one foot dangling over the side, which should just touch the floor.

If the planking and supports are made of yellow pine, a sound solid bench will be the result. In any case, the top front plank should be of this material, the rest can be of white pine or hemlock. The vise

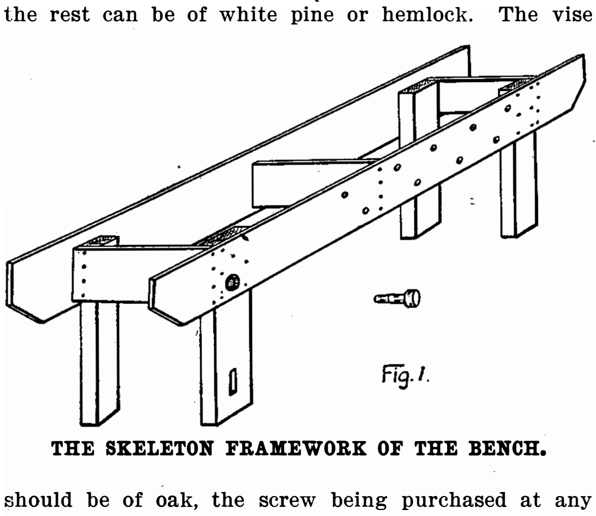


Fig. 1.

THE SKELETON FRAMEWORK OF THE BENCH.

should be of oak, the screw being purchased at any hardware store for about fifty cents.

Referring to Fig. 1, three of the supports are made of 3 by 4-inch timber, 30 inches high. The one at the vise is 3 inches by 6, of the same length. Care should be taken that the bearing surfaces are true, and the posts set up level. The slotted hole, or mortise, at the bottom of the vise post, should be cut before the post is set up, but the round hole for the screw can be made when the bench is complete. The mortise is made by boring two ⅞-inch holes 2 inches apart, vertically, and cutting out the wood between with a flat chisel. The ends, top, and bottom can be left round, or squared up with the chisel, as illustrated.

Cut three short lengths of 1 by 10-inch boards, 23

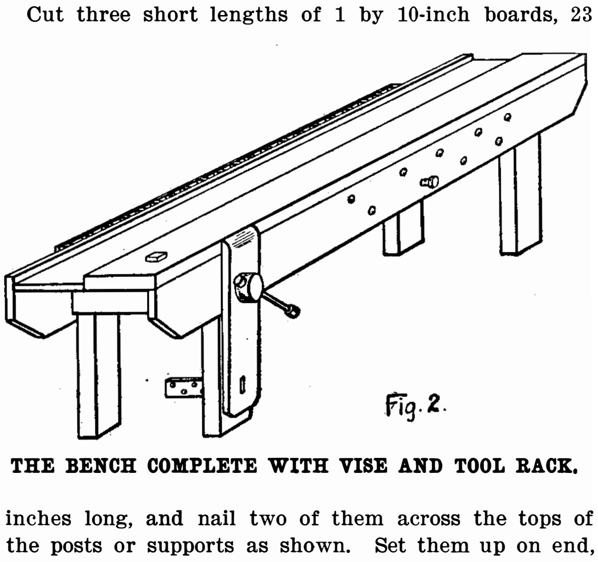


Fig. 2.

THE BENCH COMPLETE WITH VISE AND TOOL RACK.

inches long, and nail two of them across the tops of the posts or supports as shown. Set them up on end, and nail the front board, or apron, which is 9 feet in length, to the forward posts, spacing the latter 1 foot from each end. The top edges of the front board and the three cross pieces are brought up exactly level with each other, but the back board, which is 12 inches deep, is nailed to the posts, with the top edge 2 inches above. The top of the bench consists of two planks, 12 inches wide by 9 feet in length. The front plank is 2 inches in thickness, and should bear evenly along the top edge of the front board, or apron, which supports it. The board at the back is only 1 inch thick, and like the rest of the bench, can be made of cheaper and lighter timber. With the exception of the tool rack, the bench can be put together with 8-penny or 2½-inch wire nails. The 2-inch thick plank should be nailed down with 10-penny flooring nails, or nails having finished heads, which must be driven in below the surface with a nail set or punch.

The tool rack can be made from ½-inch stuff, about 2 inches wide, running the full length of the bench, or cut off within a foot or so of each end. Partitions can be made of the same wood, spaced from 1 to 3 inches apart, to suit various sized tools. A strip of wood nailed across the top edge of the back, and furnished with a number of different-sized bored holes, will answer the purpose just as well.

While there are many different kinds of vises on the market, it is safe to say the old style, as shown in cut, is very generally used, and it has the advantage of being easily rigged up and inexpensive. Procure a piece of oak, 1½ inches thick, 7½ inches wide, and about 30 inches in length, for the movable jaw of the vise. A hole for the screw is bored in the middle, 9 inches from the top, and a mortise for the guide is made in the lower end, after being marked off from the one in the 3 by 6-inch post of the bench. Corresponding holes for the vise screw are to be bored through the apron and the post, a trifle larger than the screw. The guide is made from hard wood, 18 inches in length, cut to easily fit the hole in the bench post, but having a driving fit in the vise jaw, to which it is secured by toe-nailing. Sometimes the jaw of the vise is tapered at the lower end, as shown in the detail view, when the guide can be secured by driving nails through the sides. The guide is furnished with holes evenly spaced, as shown, and a peg provided, similar to the one shown in Fig. 2, for the apron or front board of the bench.

The apron is provided with holes and a peg, to rest the free end of a long plank upon, when being worked in the vise. A suitable bench stop is put in the planing board of the workbench. Various designs are on the market, which can be easily attached, but a very good one can be made by using a 2 by 2-inch piece of oak, a foot in length. A hole is cut about 9 inches from the end of the bench, and the stop must have a driving fit, being raised or lowered by hitting it with a hammer. This is much better than the metal stops, since there is no possible chance of injuring the tools. The nut of the vise screw is secured to the inside face of the 3-inch by 6-inch post, to prevent its revolving when adjusting the vise.

When the vise is set up, the top can be planed true and level with the working face of the bench, slightly rounding off the corners. The 2-inch plank should be planed up true, and no work done upon it which will break up the surface. Any rough work should be done on a board placed on top of the bench.

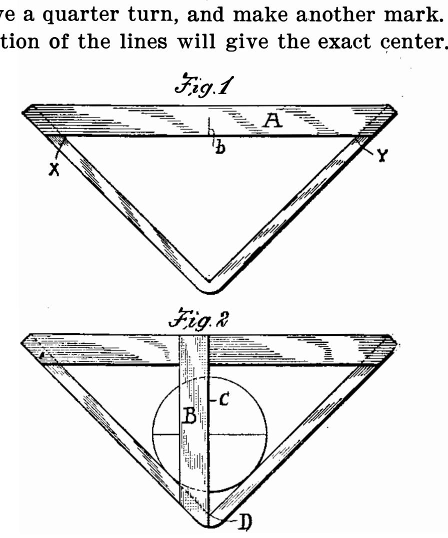
The workbench is now complete. It is a convenient size, and can be easily taken out through an ordinary door, and when it comes to moving, there will be no necessity to leave it behind, or knock it to pieces to get it out of the shop.

(*To be continued.*)

DEVICE FOR FINDING CENTERS OF ROUND WORK.

BY F. D. SWEET.

This little device if carefully made will enable one to accurately determine the centers of round bars, disks, and in fact any object of a circular form. A piece of 3/16-inch square brass rod about eight inches long is bent to form approximately a right angle, both legs being of equal length. A strip of brass, *A*, about ⅝ inch wide and 1/16 inch thick is soldered to the ends of the legs. Equidistant between points *X Y* make a mark *b*. Another brass strip *B* of same size as *A* is soldered in place as shown, being careful to have edge *C* exactly on the line *b* and over the angle *D*. Fig. 2 shows method of using the device. Simply place it on the end of the bar or shaft; make a mark with scratch awl; give a quarter turn, and make another mark. The intersection of the lines will give the exact center.



DEVICE FOR FINDING CENTERS OF ROUND WORK.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

METAL POST OR COLUMN.—S. H. TYSON, Zanesville, Ohio. The invention is an improvement in skeleton iron or steel posts or columns, particularly such as are intended and adapted for use as poles and supports for telegraph wires. The post is strong and rigid, and the concrete base forms a practically indestructible foundation.

Of Interest to Farmers.

PLANT-PROTECTOR.—F. C. ELLIOT, Tallahassee, Fla. The object of the invention is to provide a partial shade for growing plants, such as tobacco, pineapples, etc., the protector being so arranged that the plants are subjected to alternate bars of sunlight and shadow, the bars extending north and south, so that during the apparent motion of the sun from east to west the bars of sunshine and shadow will travel from west to east, thus subjecting each part of the plant to alternate bars of sunshine and shadow.

BEE-FENDER.—W. L. JOHNSON, Killbuck, Ohio. The improvement is in the fenders, which are constructed and adapted to be secured to the outer sides of hives, the same consisting of a small tin or other receptacle for saccharine matter and provided with openings in the side next the hive through which the bees may pass freely in order to obtain access to the feed in the receptacle.

Of General Interest.

LOOSE-LEAF BINDER.—F. H. CRUMP, Los Angeles, Cal. The object here is to provide means for binding loose leaves having perforations in their edges, instead of the usual slotted openings, and for holding the binders in proper spaced relation in respect to each other and for permitting the removal of either of the binders without disturbing the other, the leaves being inserted by moving longitudinally on the posts instead of perpendicularly thereto.

MANIFOLDING SALES - CHECK. — F. THOMAS, New York, N. Y. The invention has in view the provision of a sales check for hotel and restaurant use by which it will be impossible, without the same being detected, for the waiter to render the patron a bill for any other amount than that specified by the other slip or slips turned in to the checker or cashier, also to keep the check in a clean and sanitary condition.

LIFTING-JACK.—J. S. HEARN, Jett, Ky. The object of the invention is to provide details of construction for a device compact in arrangement and adapt the device for manual operation in different positions, enable the raising and lowering of a heavy load and afford a very powerful jack at a moderate cost.

SACK-FASTENER.—E. C. FAWCETT and A. MCKILLOP, Lake City, Colo. The fastener is especially adapted for bags containing granular or pulverulent materials, and the bag being filled, the strain on the sides of the bag will tend to move the sections of the fastener outward, and since they overlap, this outward movement will be toward each other, thus moving the hooks into closer engagement with the cross bars.

JOINT FOR SCREENS AND OTHER FRAMES.—F. W. VAN FLEET, Mount Blanchard, Ohio. The invention has reference to improvements in joints for screens and other frames and has for its object the provision of a joint which shall be simple, cheap and efficient and one which renders a frame rigid and permits of making frames of various sizes.

Hardware.

SUPPORT FOR TRUNK-LIDS OR THE LIKE.—J. A. I. CLAUDON, Mexico, Mexico. In this case the invention is an improved means for supporting the lid of trunks or the like, designed to maintain the lid, when open, in an upright position, thereby preventing it from falling forward or backward when the trunk is for any purpose open.

TOOL.—F. E. GORDON, Lincoln, Maine. The improvement provides an ordinary pair of pliers, comprising handles having jaws adapted to grasp the stud of the mount, with a third member composed of a handle having a jaw and supported upon one side of the pliers to move in a plane at approximately right angles to the plane of movement of the plier handles and jaws, the third member being reversely curved so that both its handle and jaw pass to the opposite side of the pliers from the point of its support.

Heating and Lighting.

STEAM-TRAP.—L. HAND, Amsterdam, N. Y. The invention relates more particularly to water-level regulators such as are adapted to be connected to boilers, tanks, or the like, for maintaining a constant water level in the same and preventing the level from exceeding a predetermined height.

Household Utilities.

COMBINED MOSQUITO-BAR AND TABLE ATTACHMENT FOR BEDSTEADS.—MARY E. C. COWDREY, Early County, Ga. The invention provides, by a simple economical construction, a mosquito bar for bedsteads, cots, and cribs, which may be easily and quickly attached and detached, and adjusted higher or lower and in other ways as required by conditions; further, that the main parts may be detached from each other and packed compactly for storage or transportation.

SHADE.—L. VERCOUTERE, Lebanon, Mo. One purpose of this inventor is to provide a portable shade adapted for use in connection with lamps or lights of all kinds, and to so construct the device that the curtains carried thereby are removable from their supports and can be quickly and conveniently partially or completely folded or partially or entirely spread out upon said supports.

Machines and Mechanical Devices.

PRINTING-PRESS ATTACHMENT. — C. MERZ, Fort Lee, N. J., and F. LEBART, New York, N. Y. In the present patent the invention has reference to platen or job printing presses, and its object is the provision of a new and improved attachment whereby the type is uniformly inked and double rolling is entirely prevented.

VIBRATOR.—F. R. MUENZENBERGER, New York, N. Y. The invention relates to improvements in hand-operated devices for giving vibratory massage, and relates more particularly to that type of device in which there are provided a vibratory arm having engagement with a cam, the cam being rotated by the aid of a series of gears, and the motion being rendered more uniform by a fly wheel or balance wheel rotatable with the cam.

MECHANICAL MOVEMENT.—J. H. FLOWERS, Enterprise, Ore. This invention relates to mechanical movements, and is particularly useful in connection with washing machines, churns, and devices of similar character in which an alternating rotary movement of certain parts is desired, or in which certain parts are to be reciprocally rotated in one direction and then another.

Prime Movers and Their Accessories.

VALVE.—F. L. ORR, Thurman, Iowa. The device is designed for use with starting means of gas or gasoline engines, of the internal combustion type, and the particular form of starting means employing air or gas, stored under pressure adapted in use for starting the engine in operation, by means similar in form to means disclosed in two Letters Patent formerly granted to Mr. Orr.

Railways and Their Accessories.

TIE-ROD FOR RAILROAD-RAILS.—H. HERDEN, Wellsboro, Pa. The purpose of the invention is to provide a tie rod having novel features, which adapt it for quick application or removal, as occasion may require, and that will, when employed in sufficient number, secure track rails upon cross ties, clamp the tie plates thereon, and prevent the track rails from shifting laterally.

Pertaining to Vehicles.

HUB, SPINDLE, AND AXLE-ARM.—W. E. BAXTER, Frankfort, Ky. The inventor provides a wheel and spindle in which inner and outer cups are held to turn with the spindles and fit over tubular portions of the hub, which tubular portions fit over but turn freely around the axle spindle, and do not contact therewith so that the load is borne by the cups bearing upon the tubular portion of the hub.

WAGON-BRAKE.—R. C. PRYOR, Wolfsville, Md. The purpose of the inventor is to provide a brake for vehicles which can be automatically applied by the backing of the team, and wherein the automatic brake mechanism can be rendered inactive at the will of the driver. The mechanism is positive in action.

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

Notes and Queries.

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

(11023) C. L. W. asks: The writer observed to-night, no doubt in common with others, what he had never before seen, though he has observed the moon closely at various times for many years. A bright elongation on the upper right-hand edge (that furthest away from the earth) the earth being in the direction that the arrow points. The elongation was probably a mountain, projecting high, and strongly illuminated by the sun, but it was so different from the irregularities usually observed in the edge away from the sun, was so large and so strongly illuminated, that the writer thought it would be at first a very large and bright star just on the edge of the moon. He first observed it at 9:45 P. M. and it had not changed its position at 11:00 P. M. The remaining portion of the upper edge of the moon showed no particular irregularity, this large protuberance standing out in bold relief. Is it possible that it is anything of scientific interest? It was no optical illusion. A. If the object you saw on the terminator of the moon was a lunar mountain, you will be able to see it at the next lunation in the same phase. The moon presents the same side to us at the same time each lunar month. A particularly clear night may have enabled you to see what had previously escaped your notice. No reports have reached us that any change has taken place upon the moon.

(11024) A. H. W. asks: Given a bottle, sealed airtight, the air within which is at 50 deg. above zero F., what fabric can I wrap the bottle in to insulate it against a surrounding heat of 120 deg.? Of course, I know that insulation cannot be complete, and insulation in this connection only means to retard the encroachment of heat. A. Loose wool, goose feathers, carded cotton wool, and hair felt are the best common materials (in that order) in which to wrap a hot or a cold body to prevent its radiating or absorbing heat from surrounding substance or air. Best of all is a partial vacuum, if it can be managed; if your sealed bottle were put inside a larger vessel also sealed, and the latter partially exhausted of air, there would be no appreciable change of the temperature in the inner bottle for many hours.

(11025) J. S. C. says: 1. Will you please give me specific directions for electroplating with copper leaves, flowers, insects, etc., similarly to the rosebud hat pins, so often seen now? A. Specific directions for preparing flowers, insects, etc., and plating them with copper, may be found in Watt's "Electro-Plating," which we send for $4.50. We must be excused from copying several pages from a book, when it can be had by buying the book. 2. If the objects are to be covered with graphite, how shall it be made to stick on? The powder form doesn't seem to. A. The objects are not covered with graphite, which is too coarse and cannot be made to adhere by any simple method. Silver is employed, and it is precipitated by phosphorus upon the leaves. 3. What voltage and amperage is necessary for good results? I can use six large bicromate cells or four Edison caustic soda cells or both. A. Silver plating requires about 1 volt; the amperes vary with the number of objects to be plated at once. Your Edison cells can be used for the purpose. 4. Can you recommend three or four good books dealing with the above and amateur electroplating in general? A. Watt's book will be quite enough, as it is authoritative on this subject. You will need no other book.

(11026) L. H. R. asks: 1. Does a static electric machine depend for its volume of electricity on the superficial size of plate or velocity and will a sufficient series of plates at a greater speed give off very much electricity at a high speed on one large disk, at 200 or 300 revolutions? Please answer an old reader in query column next issue, to satisfy a difference of opinion. A. The discharge of a static machine depends upon several conditions, size of plate, swiftness of rotation, dryness of plates, absence of dust, etc. The spark cannot much exceed the radius of the plates in length, since it will find the distance less between the combs if the balls are separated more than half the diameter of the plates, and will pass between the combs, taking the axle of the machine on its way across. This is the reason for using as large plates as convenient. Glass is the best substance for the plates. Since there is a limit to the safe speed for glass, hard rubber is now used a great deal. This can be run at any speed desired, and a very strong spark can be produced. It is better to use several smaller plates than one large one, because of compactness and neatness of appearance. A well-made machine with two 18-inch plates of hard rubber, driven by a quarter horse-power motor, gives a steady stream of sparks at 1,800 revolutions per minute. It may also be driven by hand, though no one can maintain that speed very long. 2. Are mica plates superior to glass? A. Mica differs very little from glass in its inductive capacity, and would serve equally well for the plates of a static machine, if pieces of sufficient size could be had at a moderate cost.

(11027) F. A. V. asks: Please inform me how a small dry battery for a pocket search-light may be recharged from a 110-volt direct-current circuit. The batteries become exhausted very quickly, and it is rather expensive to be continually buying new ones, while I have the 110-volt circuit to draw from, where the minimum amount of current charged for is not being consumed. A. A small pocket dry battery is not worth recharging. They are thrown away when exhausted. To reduce a 110-volt current to 4 or 5 volts for this purpose would be very wasteful. A pocket search-light is a luxury which those who carry must be willing to pay for. The battery is never durable, and soon gives out whether used or not. It is usually overrated. 2. What resistance in the way of 16-candle-power lamps should be used in a 110-volt direct-current circuit to enable it to be used for electro-plating? What should the voltage and amperage be? A. The voltage for electroplating varies with the metal to be deposited. It is from 0.5 volt to 7 volts. The amperes depend upon the area of surface to be plated. The data are to be found in such books as Langbein's, which we send for $4, and Watt's, which we send for $4.50. 3. I have an ammeter whose limit is 20 amperes. How many lamps in series or parallel should be connected in the 110-volt circuit to obtain a reading on the ammeter? What is the resistance of a 16-candle-power lamp? A. If your ammeter does not register till 20 amperes are flowing, you will require forty lamps to make it indicate any current. The resistance of an incandescent lamp when hot is about 220 ohms.

(11028) C. B. H. asks: Is it possible for the human eye to possess any of the features of a camera? I have noticed peculiarities about my own eyes being able to see objects a second time, after looking away from the object looked at, especially if in the shadow. The force of this lasts several seconds, being of greater strength with certain colors, etc. Will you have the kindness to answer this query, without reciting it in the columns of your paper? A. It is not a peculiar experience that you can still see an object before the eye after you have gazed intently at it for a brief time. Everybody can do the same. If you look at a colored object, say a bright blue, the object seen afterward will be a yellow. We call these objects seen after the object has disappeared, after-images, and the color presented by one of these is the complementary of the color presented by the object itself. Such an after-image will drift before the eye in a very curious fashion along a dimly-lighted wall, larger than the object if the wall be farther away from the eye than the object was, and smaller if the wall be nearer. This proves that the image is in the eye and is simply projected against the wall in the line of sight. You will find these matters discussed in books of physics under the name Accidental or After-Images. As you send no post-office address, but only your name, we can only reach you by publication of the information in our columns. We think too that the matter is of general interest, so as to justify its publication. Quacks often prey upon the fears of the nervous by means of these after-images.

(11029) C. L. K. asks: Will you please advise me through your query column how to get the various broken parts of the mercury column in a thermometer together after they have been separated in shipping? A. To reunite the parts of a broken mercury column in a thermometer, first try jarring it by taking it in the hand and striking the arm suddenly downward as if to give a blow with a hammer, being careful that there is nothing in the way of the arm which the thermometer can hit. If this does not accomplish the object, tie a sufficiently strong cord to the thermometer, and whirl it rapidly around the head. In this way centrifugal force and momentum may bring the mercury together. As a last resort cool the bulb in a freezing mixture, and contract the mercury till it is all in the bulb at the bottom of the tube. When the instrument warms again, the thread of mercury will be continuous. The break in the column of mercury is caused by minute air bubbles in the mercury and on the glass. These are pushed down by the mercury as it contracts into the bulb, and so the column becomes continuous when the mercury expands from the bulb again. If there is a small cistern at the top of the tube, the mercury can be heated till the broken portions are driven up into this cistern, thus accomplishing the same object as if the bulb is cooled.

(11030) C. D. R. asks: Can you give me a receipt for transparent etching ground, for retouching? Silicate of soda is transparent, but leaves a ragged edge in the lines. Is there anything I could add to it for the purpose that would not destroy its transparency? A. Retouching varnish, sandarac 1 ounce, castor oil 80 grains, alcohol 6 ounces.

(11031) F. C. asks: How can I cover a pulley with paper or leather? Pulley is of cast iron 9 inches by 8 inches with an extra smooth face. A. Scratch the face of the pulley with a rough file thoroughly, so that there are no bright or smooth places. Then swab the surface with a solution of nitric acid 1 part, water 4 parts, for 15 minutes; then wash with boiling hot water. Having prepared a pot of the best tough glue that you can get, stir into the glue a half ounce of a strong solution of tannic acid, oak bark or gall nuts, as convenient to obtain, to a quart of thick glue; stir quickly while hot and apply to the paper or pulley as convenient, and draw the paper as tightly as possible to the pulley, overlapping as many folds as may be required. By a little management and moistening of the paper, it will bind very hard on pulley when dry, and will not come off or get loose until it is worn out. Use strong hardware wrapping paper.

(11032) L. A. S. asks: 1. What per cent of electricity, going out through the trolley wire, gets back to the dynamo through the rails or ground? A. All the current returns to the dynamo in one way or another. 2. Would it be possible under existing conditions of insulation, to send the current out through the rails and back to the dynamo through the trolley wire, and if so, would the electrical efficiency be the same? A. The trolley wire is made plus, not as you seem to think, because the current might not go out properly if sent out by the rails, but to protect metals, water and gas pipes, etc., from corrosion as much as possible. It makes no difference to the electrical efficiency which wire is attached to the trolley, the plus or the minus. If, however, the current flows from the trolley wire to the ground on its way back to the station, it will not act by electrolysis so much upon the metal which it traverses, as if it flowed in the opposite direction. Iron and lead are positive, and tend to attach themselves to the negative pole of the circuit. If then the rails, and water and gas pipes are in the direction of the flow of the circuit, they are not reduced by electrolysis as they should be if the current were flowing the other way, from the rail to the trolley wire.

NEW BOOKS, ETC.

Venetia and Northern Italy. Being the Story of Venice, Lombardy, and Emilia. By Cecil Headlam. Illustrated by Gordon Home. London: J. M. Dent & Co., 1908. New York: The Macmillan Company. 8vo.; pp. 347. Price, $2.50 net.

The object of this book is to recall familiar scenes to those who have visited them, to suggest them to others, and to be of use upon the spot; to deal in outline with the history, architecture, and art of towns of northern Italy which lie within the triangular space bounded on the north by the Alps, on the west by the Apennines, and on the east by the Adriatic Sea. It embraces the Lombard Lakes and the Lombard Plain; the chief towns that lie in the valley of the Po and its tributaries and along the great Aemilian Way, which the railway follows from Como and Milan to Bologna, Rimini and the sea. Following the railroad northward through Ravenna, Ferrara, and Padua to Venice, and omitting the northeastern portion of the Veneto, it treats of the towns that lie at the foot of the Alps, from Vicenza, Verona, and Brescia to Bergamo. In each Italian town there is a distinct personality, an individual charm, the outcome of the history and development so curiously individual and distinct. The author has endeavored in this book to show the history of each town of which it treats, as it is illustrated by its art and architecture, and he has endeavored to show how the various styles of art and the various buildings enumerated are the direct and natural outcome of history and tradition, of despotism or independence, of invasion or commerce, of political, social, and geographical environment, of the dominating, fascinating personalities who have guided the destinies of these towns. The illustrations are peculiarly charming, and it is little wonder that the author says in the preface that the good wine of Mr. Home's illustrations needs no bush. This attractively printed and bound volume belongs to the "Old World Travel" series.

The World's Gold. Its Geology, Extraction, and Political Economy. By L. DeLaunay. Translated by Orlando Cyprian Williams. New York: G. P. Putnam's Sons, 1908. 12mo.; 242 pp.

The present work was written by a Frenchman, translated by an Englishman, and Mr. Charles A. Conant of New York furnishes an introduction. The subject is treated in a very interesting manner, and those who deal in any degree with the subject will be benefited by a perusal of its pages. It is filled with most valuable information, some of which cannot be found elsewhere.

Chapters on Paper Making. By Clayton Beadle. New York: D. Van Nostrand Company, 1908. 16mo.; 182 pp. Price, $2.

The present volume treats of the theory and practice of beating, and gives the best English practice. It is an extremely technical book which will be of the greatest value to all paper-makers. There is practically no literature in existence available either here or abroad on the lines of this work, and it is to be hoped that more will be forthcoming—books by the same author on other subjects relating to paper making.

The Book of the Pearl. By Dr. George Frederick Kunz and Charles Hugh Stevenson. New York: The Century Company, 1908. Royal 4to.; pp. 550. Price, $12.50.

The preparation of this book has been a joint labor during the spare moments of the two authors, whose time has been occupied with subjects to which pearls are not wholly foreign—one, Dr. Kunz, as a gem expert, and Charles Hugh Stevenson (LL.M., D.C.L.), who has been connected with the U. S. Fish Commission since 1891. For many years the authors have collected data on the subject of pearls and have accumulated all the available literature in either printed form or in manuscript. Dr. Kunz has been fortunate in being able to handle personally the crown jewels of Russia. The English and Saxon crown jewels were also seen under favorable conditions. In "The Book of the Pearl," no possible point of interest relating to pearls is left untouched. It illustrates the use of pearls as objects of art and ornamentation, past and present, showing the gradual development and changes in prevailing fashions; it notes their decorative value as shown in portraiture and in imaginative designs by the greatest artists; it brings together the many theories and facts concerning their origin, growth, and structure; it sets forth their values, artistically and commercially, and shows how these are determined; it describes the proper treatment and care necessary to enhance and preserve their luster and beauty; it recounts the history and methods of the various fisheries throughout the world, and directs attention to the importance of conserving the resources, and the possibilities of cultivating the pearl oyster. One hundred full-page plates go to the making of this exquisite book—three photogravures, seventeen pages in full color, and eighty in tint and black—all showing some rare and rich or unusual phase of pearl life or romance. These include portraits of famous women wearing superb pearl ornaments, wonderful crown jewels, notable jewels, and unusual uses of pearls.

Magnetos for Automobiles. How Made and How Used. By S. H. Bottone. New York: D. Van Nostrand Company, 1908. London: Crosby, Lockwood & Son. 16mo.; 88 pp. Price, $1.

The author has endeavored as far as is permissible within the limits of a small work to give a brief outline of the history, construction, and furnishing of the magneto as generally used by motorists in the hope that an amateur provided with a machine of this type may not be at a loss should slight repairs or adjustments be required when the services of an electrical expert are not obtainable, and given the requisite tools, skill, and patience, may be able in an emergency to make the repair himself. That the magneto system has found much public favor is not surprising when the many advantages of that system in avoiding the trouble and expense entailed by constantly recharging the accumulator cells, the attendant danger of spilled acid and burnt-out coils are considered. The illustrations might have been larger and a great deal better.

The Story of Gold. By Edward Sherwood Meade. New York: D. Appleton & Co., 1908. 16mo.; 206 pp. Price, 75 cents, postage extra.

This book is an attempt to present the development of the modern gold mining industry with special reference to the connection between its development and the habit and vogue of business prosperity. The connection between the gold supply and prosperity is now thoroughly understood. Without a supply of gold increasing at a rate corresponding to the volume of business transactions, the prices must decline and the scale of business operations must be curtailed. On the other hand, in a gold mine furnishing adequate supply of reserved money which serves as a foundation for the immense edifices of credit and token money, the prices tend upward and prosperity endures and increases. From the author's account of the history of gold production material is drawn which serves as a basis for a forecast of the future of gold production. For a small-sized volume it is well illustrated.

Sewers and Drains. By Anson Marston, C.E. Chicago: American School of Correspondence, 1909. 8vo.; 156 pp. Price, $1.

In recent years such marvelous advances have been made in the engineering and scientific fields, and so rapid has been the evolution of manufacturing and constructive processes and methods that a distinct need has been created for a series of practical working guides of convenient size and low cost embodying the accumulated results of experiments, and the most approved modern practice along a great variety of lines. To fill this acknowledged need is the special purpose of the series of handbooks of which this is the latest. It is especially adapted for the purposes of self-instruction and home study. The method adopted in the preparation of this volume is that which the American School of Correspondence has developed and employed so successfully for many years. It is not an experiment but has had the severest of all tests, that of practical use which has demonstrated it to be the best method yet devised for the education of the busy working man. The book is excellently illustrated with well-chosen engravings and diagrams.

The Law and Commercial Usage of Patents, Designs, and Trade Marks. By Kenneth R. Swan, B.A. New York: D. Van Nostrand Company, 1908. 12mo.; 386 pp. Price, $2.

This is a volume in the "Westminster" series, the object of which is to bring before the keen eye of the non-technical reader an accurate knowledge of manufacturing processes and the practical application of modern science to industries. Each volume is written by an expert to the end that practical readers and all who are engaged in the numerous allied branches of engineering and technical trades may have reliable works of reference. The work is, of course, from the standpoint of English law; for the book, though also published in this country, has its origin in England. The author is a barrister-at-law of the Inner Temple.

Confessions of a Railroad Signalman. By J. O. Fagan. Boston and New York: Houghton, Mifflin Company, 1908. 12mo.; 181 pp. Price $1 net.

The author is certainly familiar with the "tower," and he writes in a fascinating vein that holds his readers spellbound until the end of the book. The contents are "A Railroad Man to Railroad Men"; "The Man"; "The Management"; "Loyalty"; "The Square Deal"; "The Human Equation"; "Discipline." Perhaps a better idea of the contents may be gained from some of the titles of the illustrations: "A Typical Smash-up"; "A Head-on Collision"; "Yard Wreckage"; "A Typical Derailment"; "A Rear-end Collision"; "What Comes from a Misplaced Switch"; "Down an Embankment in Winter," and the "Aftermath." This is not a very cheerful list of titles, and after a persual of the book one wonders at the comparatively few accidents compared with the endless possibilities for trouble.

Far East Revisited. By A. Gorton Angier. With a preface by Sir Robert Hart. London: Witherby & Co., 1908. 8vo.; 364 pp. Price, $4.20 net.

The author is the editor of the "London and China Telegraph" and "London and China Express." Books of this kind have a singular appropriateness at this moment in a record-making epoch. The East is up and awake, and foundations are being laid for fuller share in the work of the world and for more intimate relations for all that concerns international intercourse and the influence one nation can exert on all others. Change is in order and developments will daily be more and more important, and whatever tends to clearness of ideas as to what is, or helps to guide thought toward what is to be will not fail to find its place in the general scheme of things. In "Far East Revisited" the author has done the public a service in thus reproducing the outcome of personal travel and observations made on the spot. He has repeatedly seen the localities and peoples which he describes and has accordingly been able to illuminate both past and present, so that the comparison thus made gives additional value to the work. The book is divided into four parts: Malaya, China, Korea, and Japan. There are a number of excellent plates.

American Annual of Photography. 1909. Volume XXIII. Edited by John A. Tennant. New York: Tennant & Ward, 1908. 8vo.; 328 pp. Price, paper, 75 cents; cloth, $1.25.

The American Annual of Photography is always a most welcome guest, filled as it is with pretty pictures and articles on improved methods. The present volume is of exceptional interest and shows the constant upward trend of the photographer. It is freely illustrated.

Magazine Writing and the New Literature. By Henry Mills Alden, LL.D. New York: Harper & Bros., 1908. 12mo.; 321 pp. Price, $2.

The author has been editor of Harper's Magazine for forty years. From an outlook of nearly half a century of close association with literature Mr. Alden has been singularly able to discern the forces that have been at work during that period, and to bring them forward with a rare personal touch. That part of the book which relates to magazine writing is really an account of the important influence of periodicals upon general literature and of the relationship to the magazine of every significant writer. The underlying theme of the book is the ever-developing relation of modern literature to life itself. The "new" literature is the result of recent tendencies in thought and feeling which have created new forms of expression.

Shadow World. By Hamlin Garland. New York: Harper & Bros., 1908. 12mo.; 295 pp. Price, $1.35.

Do the dead speak to the living? Is there a way to find out whether they do? The "Shadow World" of Mr. Garland is one of the most exciting replies ever offered to such speculations as these—and we do speculate about it. He does not try to convince—he only states what he himself has seen and heard. And it reads like fiction—the little group of a half-dozen men and women whom the author brings together, some half afraid, some openly scoffing, all finally persuaded to form themselves into a little circle, and suddenly finding that one of their own number, a woman, possesses, unknown to herself, the powers of a medium. Several experiments almost transcend belief, and yet—they are testified to by a man's experience.

Machine Shop Calculations. By Frederick H. Colvin, A.S.M.E., F.I. New York: Hill Publishing Company, 1908. Pocket size. 174 pp. Price, $1 postpaid.

Figures are simple tools and a help in securing accuracy, in saving time, and making a man more valuable to himself and others. Too many good mechanics get along with only enough mathematical knowledge to count up their wages, but the men who get to the top are not those who depend on others to tell them what gears to use, or the depth of the 9-pitch thread. The author has attempted to show in the present work how simple methods can be applied to everyday shop work. Only such rules and calculations are given as have been proved useful in the shop. For example, anyone would be at a loss to readily find the proper method of using the micrometer gage.

The Home Builder. By Lyman Abbott. Boston and New York: Houghton, Mifflin Company, 1908. 16mo.; 129 pp. Price, 75 cents.

The versatile editor of "The Outlook" has contributed a most interesting little book of which the contents are as follows: "Her Monument," "The Daughter," "The Bride," "The Wife," "The Mother," "The Housekeeper," "The Philanthropist," "The Saint," "The Grandmother," and "Alone." It is daintily printed and bound.

Handbuch ueber Triebwagen für Eisenbahnen. Von C. Guillery. Munich und Berlin: Druck und Verlag von R. Oldenburg, 1908. 8vo.; 202 pp.

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The Automobile Number of the Scientific American

Will issue on January 16, 1909

THIS YEAR WE HAVE DONE SOMETHING ENTIRELY NEW

WE called on 1200 manufacturers of automobiles and accessories for suggestions. The result was eye-opening. For days and days suggestions came in, most of them illuminating, helpful, and instructive. We read over every one of those letters and made up our minds to use each in some way. We classified them carefully and turned them over to a corps of expert writers on automobiles, with instructions to EMBODY THESE IDEAS IN THE BEST SERIES OF PRACTICAL ARTICLES AND SHORT MEATY NOTES that ever appeared in any one issue of a magazine.

Among the articles will be one on the commercial truck and delivery wagon. It tells just what the commercial self-propelled vehicle is capable of doing, compared with the horse-drawn vehicle of the same type.

The average automobilist is not an engineer. When his machine stops, he is all but helpless. Many of the 1200 thought it would be an act of mercy to help him out. Mr. Roger Whitman, technical director of the New York School of Automobile Engineers, has prepared a "TROUBLE CHART," which a man can carry in his hat, if need be, and consult if he finds himself in mechanical straits. A glance at that chart will tell any intelligent man, woman, or child how to locate a defect and what to do if a car refuses to run.

Magneto Ignition, because it is comparatively new, is a subject on which the automobile user needs enlightenment. Just what magneto ignition is, how it compares with coil ignition, and the comparative advantages of high and low tension, are ably explained in a lucid article.

The Two-cycle Engine is another innovation which ought to be dealt with in the opinion of the trade. Mr. E. W. Roberts, a well-known authority on the subject, has prepared an article which sets forth simply and accurately what the two-cycle engine is, and what it will do to simplify and improve the automobile.

Tires are found to demand more in the way of repair and renewals than any other part of the car. A tire expert has prepared an article, which the tire manufacturer ought to welcome, simply because it informs the chauffeur what he ought to do and what he ought not to do, and places the blame for much tire trouble where it properly belongs—on the man who drives the car. We think we have succeeded in explaining some of the mysteries of tire construction, and that we have laid a heavy finger on the cause of the trouble.

"Lubricants and Lubrication" is made the subject of some straight talk by Mr. Hanauer, whose chief business in life at present is to lecture on oil and oil devices at the New York School of Automobile Engineers. The driver of a car is set right on the subject of lubricants, and informed what lubricant to use for the various parts of his car. Mr. Hanauer explains all this clearly. What is more, he gives a few simple tests which will indicate whether the oils are what they purport to be.

Repairs are charged for at piratical prices. Automobile manufacturers rail at the garage keeper, because he is not fair to their cars. He puts them in a bad light. No manufacturer cares to learn how many dollars his car cost in repairs, particularly if most of the repairs are easily made. So we intend to publish an article **"Making Your Own Repairs,"** which will pluck out a painful thorn and make the owner of a car at least partly independent of the exorbitant garage man.

There will be a page full of novelties—short, illustrated articles about clever automobile inventions that save time and labor. Many of them will give the reader a little thrill of mechanical pleasure to learn that such simple—we might almost say obvious—devices are conceived and manufactured. Every one of them is a mechanical short cut.

The number will contain about 40 pages and will have a striking colored cover. The price will remain the same—10 cents.

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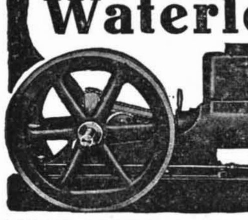

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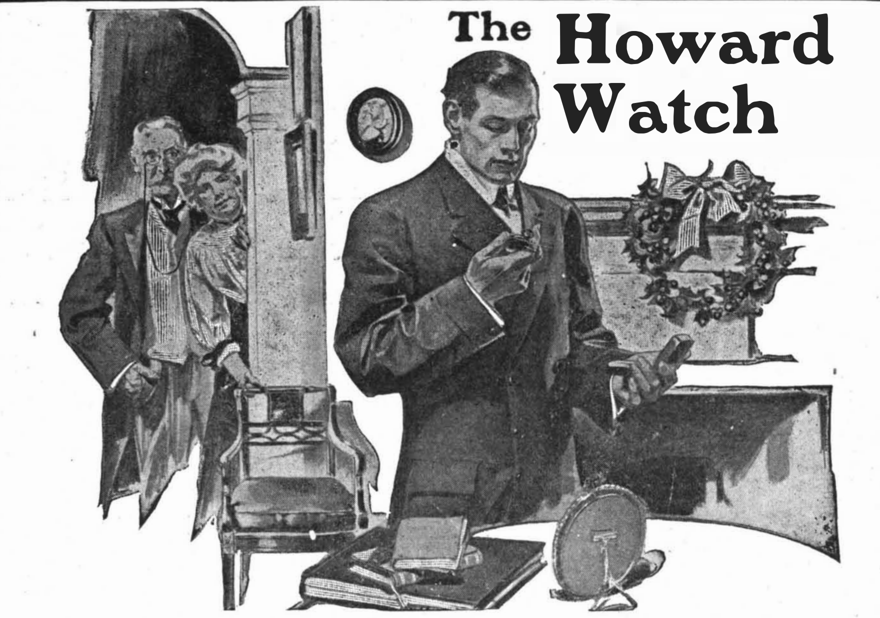

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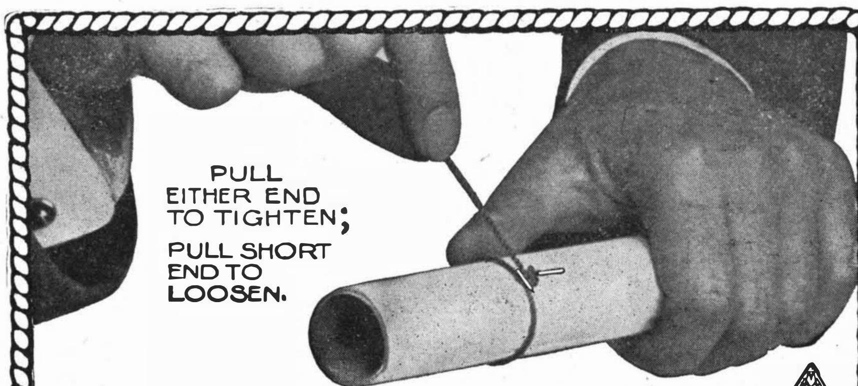

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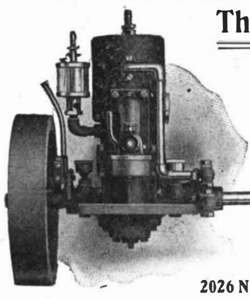

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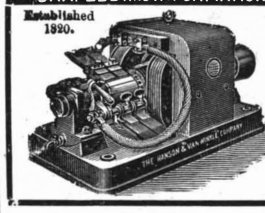

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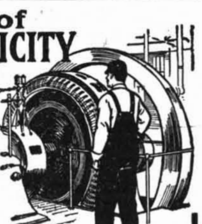

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