SCIENTIFIC AMERICAN

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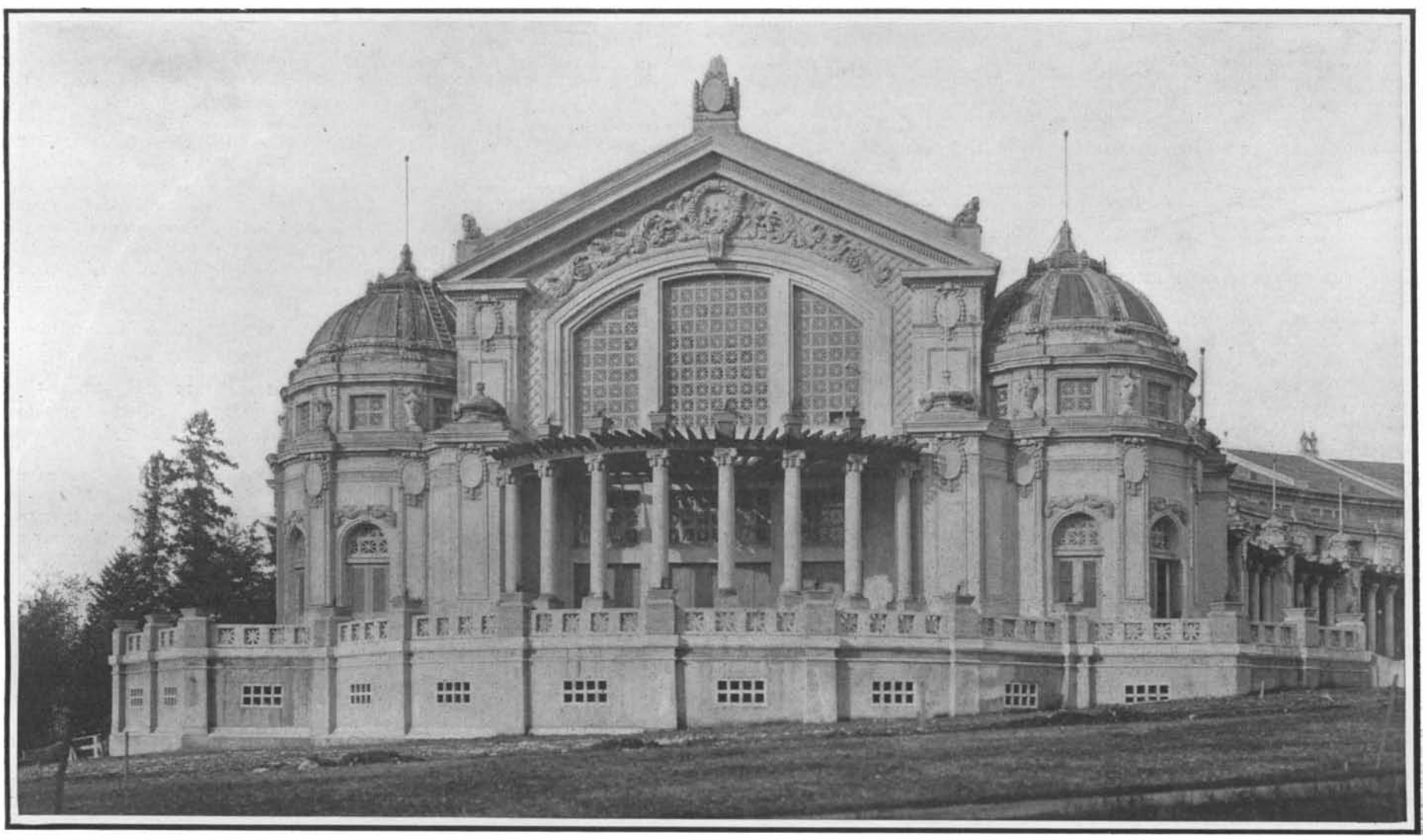

A feature of the fair will be the display of flowering vines on many pergolas.

Looking across the cascade toward the foreign exhibit palace on the right.

THE ALASKA-YUKON EXPOSITION.—[See page 296.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, APRIL 17th, 1909.

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

THE FULTON AIRSHIP FLIGHT CONTEST.

There is no contest of greater interest or importance for America than that for the $10,000 prize offered by the New York World, through the Aero Club of America, for an airship race from New York to Albany, over the course followed by Fulton in the first steamboat a hundred years ago. The contest derives its importance from several considerations, such as the great distance to be traversed; the fact that the route of the river must be followed—a most trying condition for aeroplanes; the value of the prize; and, lastly, the fact that the great prestige which will attach to the winning of the contest is likely to bring together several of the world's most noted aeronauts. We wish to draw special attention to this contest, among other reasons because we see in it an opportunity for America to win back some of that prestige which she undoubtedly lost when, by her indifference to the claims of the Wright brothers, she drove them to find more appreciative treatment at the hands of people of an alien tongue and race. For there is no denying that our attitude to the new art, or shall we say the lately-developed art, of flying has been altogether unworthy of a country, which claims to be particularly solicitous of the inventor, and ever ready to encourage the man who can present us with a novel and useful idea embodied in practical mechanical form.

It will be a thousand pities if, when the competing airships are sent over the course, it is found that American machines are conspicuous by their absence. In view of the importance of the contest, and the fact that it is held in connection with our great Hudson-Fulton celebration, there should be at least a dozen American entries. But the sport of aeronautics is a costly one, and to build and tune up an airship or aeroplane for such a trying contest as this will necessarily involve considerable expenditure of money. With one notable exception, private experimental work in this country has been done by men of more or less limited means. The SCIENTIFIC AMERICAN knows personally of several men whose unquestionable intelligence, wide reading, and keen enthusiasm render them admirably qualified for experimental work in this field. They are hampered, however, by want of the necessary funds.

Now, there is no country on earth where men of wealth are more ready to spend their money lavishly in the promotion of any sport in which they are interested; and we believe there is no field to-day in which, for the amount of outlay that would be necessary, so much sporting pleasure could be obtained and more world-wide sporting fame achieved, than in promoting the building of a sufficient number of machines to give the United States its proper representation in the forthcoming contest, and insure for this country a reasonable expectation of winning the prize.

The marvelous success of the Wright brothers in awakening the enthusiasm of the sport-loving public in Europe gives reason to believe that flying may become the most popular sport of the future, even to the extent of holding the public attention and interest to the same degree as the automobile has done during the past decade. Nor will the sport be so full of risk as is popularly supposed. Much thought is now being given to the question of automatic equilibrium; and it is probable that in a few months' time a machine will be flying in this country in which the equilibrium will be so perfectly maintained that sudden upsetting will be impossible. It will then remain for someone to give us a motor that is as nearly absolutely reliable as anything manufactured by human hands can be. When that is done, the airship and the aeroplane, and particularly the latter, will present, in the hands of a careful manipulator, no greater risks to life and limb than the perfected automobile.

The present time, then, is opportune for a rapid development of the sport of aeronautics in this country; and we repeat that the Fulton contest over the New York-Albany course offers an enticing opportunity for the wealthy sporting man of this country to supplement the able experimental work of the American inventor.

BRICK ROADS FOR THE AUTOMOBILE.

A correspondent in Cleveland, Ohio, commenting on our recent editorial, "The Highway and the Automobile," calls attention to the fact that there are a great many brick roads being laid in the territory adjacent to Cleveland, and asks our opinion as to their practical value. As far as the automobile is concerned, there is no question but that a properly-constructed brick road affords an excellent surface, in respect of the smoothness of running, the tractive adhesion of the tires, and the limited amount of tire wear and destruction. It is certainly superior to the concrete road as ordinarily laid. Those who have driven their machines at high speed over the Motor Parkway, Long Island, complain bitterly of both the roughness and the inequalities due to the hollows of the surface, the former producing a rapid wear of the tires, and the latter serving to set up, at anything but very moderate speed, excessive vibration. This was so marked at the last Vanderbilt Cup Race that several drivers were quoted as saying that there was a marked increase of speed in the car when they left the concrete surface for the ordinary macadam.

The smooth face of the brick is less destructive of tires than the file-like roughness of the ordinary concrete surface. Moreover, it is possible to lay the brick with a truer surface than is secured by the ordinary contractors' gang engaged in laying a concrete surface. To true up the surface of a continuous bed of concrete with the exactitude which is necessary to give a smoothly riding surface for high-speed or even moderate-speed automobile travel, is a job calling for no little nicety of workmanship.

Provided the brick be of high quality and the foundations of sufficient depth and thoroughly laid, the brick road forms an ideal automobile highway. The foundation should consist of large broken rock followed by smaller stone or a good quality of gravel, and a layer of concrete. Upon this should be a shallow bed of sand for surfacing purposes, upon which the brick should be laid and carefully surfaced, and grouted into place. The sand serves to give a slight cushioning effect between the concrete and the brick, and also permits of the necessary adjustment of level to bring the upper face of the bricks to the true surface. A State road of this character, built with a proper amount of crown for drainage, should be good for many years of service, and would require but little repairs, except in such sections as are subjected to heavy wagon and dray traffic carried on steel-tired wheels. Heavy concentrated wheel loads would tend to fracture the hard face of the bricks; and unless the bricks were at once replaced, the ceaseless hammering of traffic would quickly produce a low spot in the road. Even where traffic is heavy, however, we believe that, as in the case of a macadam road, immediate repairs, made at the first indication of a breakdown, would serve to give the road, as a whole, a long period of life. A good combination for a State highway would be to build it of macadam with a tarred surface in the suburbs and vicinity of towns and cities, and build it of brick through the country districts. Although the first cost would be heavy, the saving in repairs (that is, if the supervision were close and constant) and the enormous saving in the cost of haulage would, in the course of a very few years, constitute such roads a paying, and in many localities a richly-paying, investment.

STEAMSHIP VIBRATION.

When a modern steamship with a length of between 700 and 800 feet is running at a speed of 25 knots, the friction of the wetted surface of the hull against the water tends to overcome the inertia of the film of water lying immediately next the hull, and gradually imparts to it some of its own motion. The action is cumulative; the water at the forward end of the ship partaking but slightly of this motion; that against the amidship portion moving faster; and the film of water against the after part of the hull moving faster yet, and at a speed of several knots. The water immediately against the after hull moves almost as fast as the hull itself; the next layer somewhat slower, until, at a certain distance from the ship, the water remains inert and unaffected by the ship's motion.

In our issue of December 28th, 1907, speaking of the vibration in the after part of the "Lusitania," we stated that it was due to the successive tips of the wing propeller blades sweeping through this film of water swiftly moving forward, and meeting with a temporary resistance greater than that which they encountered throughout the rest of their circle of revolution. This theory was verified by personal observation on the ship, which showed that when the three-bladed propellers were making three revolutions to the second, the vibrations of the ship were at the rate of nine per second, or one to each passage of the blades past the side of the ship.

That the vibration was due to regularly-recurring shocks to the propeller, is suggested by the fact that during the past season both of the wing propellers were disabled by the loss of propeller blades, due to the breaking of the bolts by which the blades were fastened to the hub.

While the "Mauretania" was in drydock during the past winter, four-bladed propellers of less diameter were substituted on the wing shafts, with the result that the vibration was entirely eliminated, and the ship is now traveling with that perfect smoothness which the advent of the steam turbine in marine propulsion had led the ocean traveler to expect. Reducing the length of the blades has withdrawn the blade tips from the belt of forward-moving water adjacent to the hull, and thereby has eliminated the principal cause of vibration. Propellers of the original dimensions are being retained on the inner shafts, since these have never developed any serious vibration effects. The excellent results obtained by making this change on the "Mauretania" suggest that the vibration which is observed on other quadruple-propeller turbine-driven ships, such, for instance, as the "Yale" and the "Harvard," might be considerably reduced, if not eliminated, by decreasing the length and increasing the number of the blades. Experimental work on turbine vessels of this character might prove to be well worth the time and expense that it would involve.

WHY NOT THE ELECTRIC FIRE ENGINE?

The advent of the high-powered high-speed automobile leads Chief Binns of the New York Fire Department to suggest its possible use as a fire-fighting apparatus. The idea is not simply to substitute gasoline motors for horses, but to employ mechanically-propelled vehicles carrying electric pumps, which can be connected with an electric lighting circuit or any suitable source of current, thereby eliminating not only draft animals, but all the inconvenience of steaming up, carrying coal, and replenishing the coal supply at a big fire. Such a plan ought to be carried out, above all, in our rural districts. The fire company of a country village is rarely if ever of any service, either because it cannot reach a fire quickly enough, or because it is unable to cope with any but the smallest fires. Every country village has its electric lights in these days. A high-speed automobile carrying an electric pump could bowl along over ordinary roads at twenty-five miles an hour and reach a burning dwelling almost as quickly as a New York steamer could arrive at the scene of a fire. It would be the work of a minute only for the fire crew to connect the electric pump with the current and play a large stream of water on the blaze. The slipping in of a plug is about the only act required.

Even in those portions of New York city where the high-pressure fire service is not as yet installed, Chief Binns's idea could be carried out with excellent results. There is an abundance of electric power in every quarter of the city. Protected boxes containing electric connections could be installed near fire plugs. An electric pump could be connected with a box as easily as a telephone jack is plugged into a switchboard.

The singeing of the nap of the thread is one of the most unhealthy operations in the process of spinning. The method which has hitherto been in use was to pass the thread at a regulated speed between two spools twenty to thirty inches apart. On its way from one spool to the other the thread passed through two or three gas flames spaced about six inches apart. The rate of travel of the thread was sufficiently rapid to prevent the thread from burning, but the nap was converted into friable carbon and fell off as a grayish dust. On entering the working room in which this operation was conducted, one experienced a feeling of heat and of suffocation. The temperature toward the end of the day would rise to about 95 deg. F. The air was heavy, and charged with the odor of burnt thread. One felt an acrid sensation at the throat, and a stinging under the eyelids. There should have been ample ventilation. Unfortunately the necessity of keeping the flames steady forbade all air currents. Various improvements have gradually been introduced, such as burning gas under pressure, whereby a steadier flame is obtained, which allows ventilation to be provided for. A new electric process for singeing is now being introduced into spinning works. It is due to Mr. Gin, and consists in using the heat radiated from an incandescent electric conductor for burning the nap of the thread. The conductor consists of a long platinum tube, with a slit for admission of the thread. The temperature is readily regulated by means of a rheostat. The dust and the gaseous products of combustion are withdrawn by means of aspirators. The hygienic advantages of the new process are beyond dispute. On the other hand, the results are satisfactory from a financial point of view.

ENGINEERING.

It is stated that the greater part of the survey of the route of the Hudson Bay Railway has been completed, about 400 out of a total distance of 465 miles having been covered by the locating parties. The new road will provide a superior route for the shipment of the large and ever-increasing grain supply of the Canadian Northwest to European points.

The total number of boiler explosions in the United States, in 1908, as reported by the Hartford Steam Boiler Insurance and Inspection Company, was 470, as against 471 in 1907, 431 in 1906, and 450 in 1905. The record shows that since October 1st, 1867, there have been 10,051 boiler explosions recorded by this company, in which 15,634 people were injured and 10,884 killed.

A plan for a tunnel below the St. Lawrence River at Quebec was recently submitted to the Montreal Board of Trade. It is claimed by Mr. J. S. Armstrong, the engineer who made the proposal, that it would cost no more than the proposed Quebec bridge, and that it would have the advantage of presenting no obstruction to navigation. Provision would be made for four lines of railroad track and for vehicular traffic. The location would be at Quebec, and connection would be made directly to Levis at the opposite side of the river.

The British have so greatly improved the Whitehead torpedo that the latest type, which has a diameter of 21 inches, is credited with having maintained an average speed of 31 knots over a range of 7,000 yards. The drawback, limiting the usefulness of this really wonderful weapon, is that its increased diameter and length will necessitate the entire reconstruction of torpedo-launching gear on all existing ships to which it may be furnished. For the new "Dreadnoughts," however, it will be entirely available.

Among the advantages of the use of steel in passenger car construction are the following: It reduces the risk of accident; it is more available than wood; it is easier to work; it produces a simpler and more artistic appearance; it is easier to keep clean; and, when properly designed, a steel car weighs no more than one of wood. For the same capacity it costs no more than a wooden car; its life is longer; and finally the cost of damage suits arising from accidents is considerably less.

The great Pennsylvania Railroad Company is investigating, with characteristic thoroughness, the question of the most suitable form of overhead trolley construction for its tunnels and terminal station at New York. For this purpose it has in operation an experimental track, about five miles in length, which is divided into nine short sections, each of which is equipped with a different type of overhead line. By this policy the company will avoid the troublesome and costly delays, which were incidental to the early days of operation of the overhead line on the New Haven Railroad from Stamford to New York.

As the result of a proceeding brought by the Forest, Fish, and Game Commissioner, the Public Service Commission has ordered the railroads which operate in the forest preserve of the Adirondacks to burn oil in place of coal, through the months of the year from April 15th to November 1st. The complete installation of oil burning is to be effected by April 15th, 1910. At least four locomotives fitted with oil-burning apparatus are to be placed in service on these roads this summer, for the purpose of familiarizing the men with the new fuel.

The Bessemer & Lake Erie Railroad, which runs from Conneaut on Lake Erie to Bessemer near Pittsburg, is said by the Iron Age to have established a record for low cost of operation and net earnings. The average revenue trainload last year was 937 tons; and the average trainload from the lake to Bessemer, in the busy period of last year, was 1,406 tons. The road is 152 miles in length, and nearly 10,000,000 tons are being carried over it in a single year. During a year of normal traffic it has earned, on an average, $26,000 for each mile; the highest net earnings in a single year were about $3,000,000.

A new motor lifeboat has recently been placed in commission at the Sandy Hook life-saving station, for duty on the stretch of dangerous coast, 110 miles in length, reaching from Sandy Hook to Cape May. The lifeboat, which is 36 feet in length, carries a six-cylinder gasoline engine, that can drive it at a speed of 8 to 10 knots. The weight of the boat when fully equipped is 6½ tons. It is non-capsizable, non-sinkable, self-baling, and can carry seventy-five people. Capt. Charles McLellan, of the United States Revenue Cutter Service, who has charge of the designing and building of boats for the life-saving service, believes firmly in the value of the gasoline motor for lifeboat work; and he has equipped a light surfboat on the Cape May station with twin screws of a new design.

ELECTRICITY.

The first electric smelting plant in the world in which pig iron will be produced on a commercial scale is about to be installed in Norway. The plant will be fitted with an initial installation of two 2,500 horsepower reducing furnaces for iron ore and two 600 horse-power steel furnaces. Later it is expected to triple this equipment.

A new chemical fire extinguisher was recently tested in this city, to determine its availability for use in extinguishing "electric fires." The exact composition for the chemical has not been made public, but it is stated that it consists chiefly of carbon tetrachloride. To show that it is a non-conductor, a stream of the liquid was played on an arc between terminals of a 14,000-volt circuit without producing any effect upon the operator. The chemical was squirted over the commutator of a 5-horse-power direct-current motor without in the least injuring the armature or field.

Metal filament lamps are now made so much less fragile that they are being recommended for use on railroad trains. The voltage of the train-lighting system is usually quite low, and this permits of using short filaments, and yet the candle-power of the lamp is so much higher that it gives 25 per cent more light with 30 per cent less consumption of current than the carbon-filament lamp. By using metal-filament lamps a lighting outfit that is now overloaded may have its load reduced, while it is possible to add electrically-lighted cars to a train in which the lighting outfit is already fully loaded.

It is estimated that three and a half million wooden poles used by electric companies in this country require renewal each year. These poles are perfectly sound except at the ground line; and as it costs more to renew a pole than to set a new pole, a scheme of reinforcing the poles with concrete has recently been devised. It consists in bridging the weakened part with reinforcing rods driven into the pole above and below the decayed portion. Concrete is then molded around the pole over the reinforcing rods. In this way the pole can be rendered even stronger than it was originally and at very little expense.

The longitude of a vessel at sea is found by noting the difference between the time at Greenwich or any other standard meridian and that of the meridian of the vessel, as determined by observations. In order to eliminate error due to inaccuracy of the chronometer, it has been proposed that time signals be transmitted at regular intervals from a land station, such as the Eiffel Tower. This would do away with the use of the chronometer, as the signals could be transmitted practically instantaneously to the vessels. In order to test the efficiency of such system, a set of signals were sent out from the Eiffel Tower, and were received at the Brest Observatory, where it was found that the maximum variations were not more than half a second.

In a paper recently read before the American Institute of Electrical Engineers, A. B. Reynders discussed the advantages of the condenser type of insulation for high-tension terminals. When a difference of potential is passed across a number of condensers connected in series, each condenser takes its share of the stress in inverse proportion to its capacity. This has led to the making of a terminal constructed of a metal tube wrapped with paper, and at regular intervals provided with a layer of tinfoil inserted during the rolling process. This done, the insulator is turned in the lathe so that it is tapered in steps. The result is a series of concentric condensers. In order to prevent a corona effect from the edges of the tinfoil, they are protected by metal rings electrically connected thereto. By this means it is possible to provide terminals which can be successfully used on transformers of 300,000 to 500,000 volts. A condenser type of insulator has also been made for outdoor use. But in this case, instead of the metal rings bell-shaped metal caps or petticoats are furnished.

An interesting demonstration was recently given in England of an electric generating plant operated by a windmill. The wind wheel was 16 feet in diameter, and was mounted on a tower 50 feet high. Three tails were provided, one at the side being fixed, and the other two adapted to be rotated on a horizontal axis, so that when they were turned into the vertical plane they would hold the wheel into the wind, and when turned in the horizontal plane, the fixed tail would throw the plane of the wheel in the plane of the wind. The two movable tails were arranged to swing out of the vertical position, automatically, when the velocity of the wind rose above a certain amount. A 2-kilowatt generator was driven by the wheel at speeds varying from 800 to 1,600 revolutions per minute. Six switches were provided to control the field circuit by throwing in a resistance when the current generated reached 5, 8, 11, 14, 17, and 20 amperes respectively. The current was used to charge a storage battery, which could be drawn upon as required for operating various electrical apparatus.

SCIENCE.

It is a prevalent opinion that if a human being is bereft of one sense, one or more of the other senses become more acute, and thus establish a compensation. The question is discussed with much shrewdness by M. Kunz, director of the Institution for the Blind at Illzach-Mülhausen. The results are somewhat surprising. As regards perception of the direction of sound, there is no difference between the seeing and the blind. The average distance at which sounds could be heard was essentially the same in both classes. The delicacy of the sense of smell was rather in favor of the seeing. It is generally supposed that the palp of the forefinger of the right hand, which is used by the blind in feeling the points in Braille's system of teaching the blind to read, must be very sensitive; but this was found not to be the case.

One of the most notable discoveries regarding the early history of Peru has recently been made by Hewitt Myring, an English antiquarian. He collected 2,000 specimens of pottery and weapons of the ancient Peruvians. Remains and relics of the early inhabitants of Peru, which are said by archæologists to date from 4000 to 7000 B. C., were found by Mr. Myring under an old Incas burying ground when he was exploring in the mountains about 200 miles inland from Lima. Each grave contained the remains of food and glazed clay jugs. The most valuable portion of this discovery of antiquities consists of the great urns, some of them six feet long and so heavy that it required three men to carry them. They were found buried beside mummies, and the majority of them had the features of the dead man or woman delicately carved either on the upper part of the urn or on a solid stand beneath.

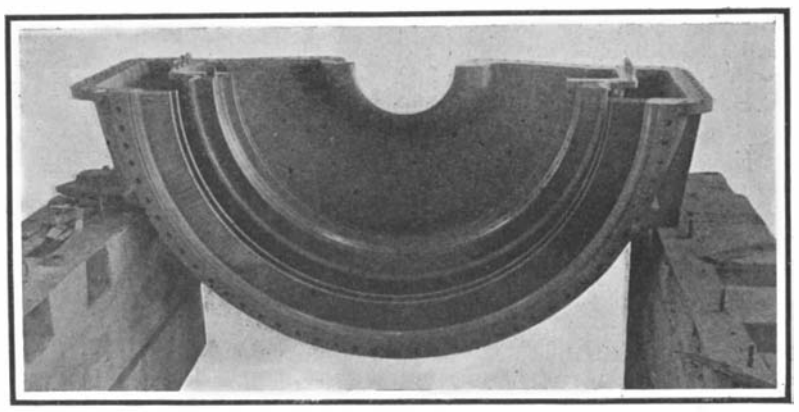
Messrs. Cowell and Crommelin, whose calculations of the movements of Halley's Comet are generally regarded as the most trustworthy, fixed April 8th as the most likely time of the perihelion passage, but later they revised their figures, and designate April 13th as the more correct date. In a recent number of the Astronomische Nachrichten, another computer, working for a prize, but whose name is not given, fixes the date on June 18th. This discrepancy is a little disquieting, both because it shows how widely apart the results found by two independent calculations based on similar data may be, and because it introduces much uncertainty for those who are searching for the comet. In 1835 the computers, who did not have as correct data as those now available, hit the day of perihelion passage within two days of the actual time, and none of the calculations was as much as one month in error.

The present population of the earth, estimated at 1,467 millions, is distributed very unevenly. The average density of population of the entire land surface of the globe is about 31 inhabitants per square mile. This total land surface, which slightly exceeds 46 million square miles, is composed of 28 million square miles of fertile land, 14 million square miles of steppes, and 4 million square miles of deserts. Ravenstein estimates the maximum density of population that can be supported by the fertile regions at 207 persons per square mile, and thus (allowing 14 persons per square mile to the steppe regions) obtains 5,994 millions as the maximum population of the globe. The present rate of increase per decade is 8.7 per cent in Europe, 6 per cent in Asia, 10 per cent in Africa, 30 per cent in Australia and Oceania, 20 per cent in North America, and 15 per cent in South America. The mean rate of increase for the whole earth is 8 per cent per decade. At this rate of increase the earth would be completely filled with its maximum population of 5,994 millions in the year 2072, or in 163 years from the present time.

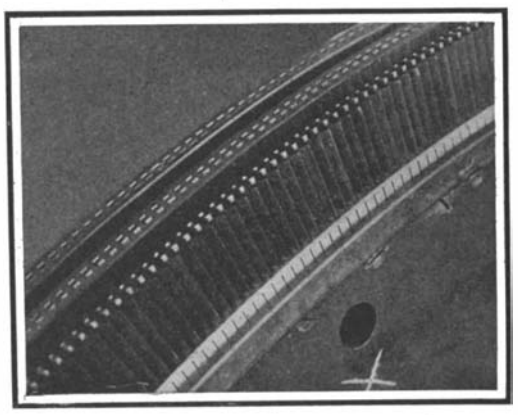
The mercury vapor lamp with a tube of quartz emits a large proportion of ultra-violet radiations, the bactericidal properties of which were established by Nogier and Thévenot in 1906. Courmont and Nogier have recently endeavored to utilize this property in the sterilization of drinking water. A Kromayer lamp, of 9 amperes and 135 volts, was suspended in an iron cask filled with water. All bacteria (including the coli bacillus and Eberth's bacillus) within 12 inches of the lamp were killed in two minutes. A long series of experiments proved conclusively that one minute suffices for complete sterilization in ordinary cases, and two minutes when the water is very greatly contaminated, either naturally or artificially. The water, however, must be clear, in order that the rays may pass through it. The elevation of temperature is only a fraction of a degree and the water, after treatment, is harmless to plants and animals. Hence it appears practicable to sterilize the water supply of a city (after clarification, if necessary) by distributing powerful quartz mercury vapor lamps in the reservoirs or the mains in such a manner that every particle of water shall remain two minutes within a few inches of a lamp.

THE TURBINES OF THE BATTLESHIP "NORTH DAKOTA."

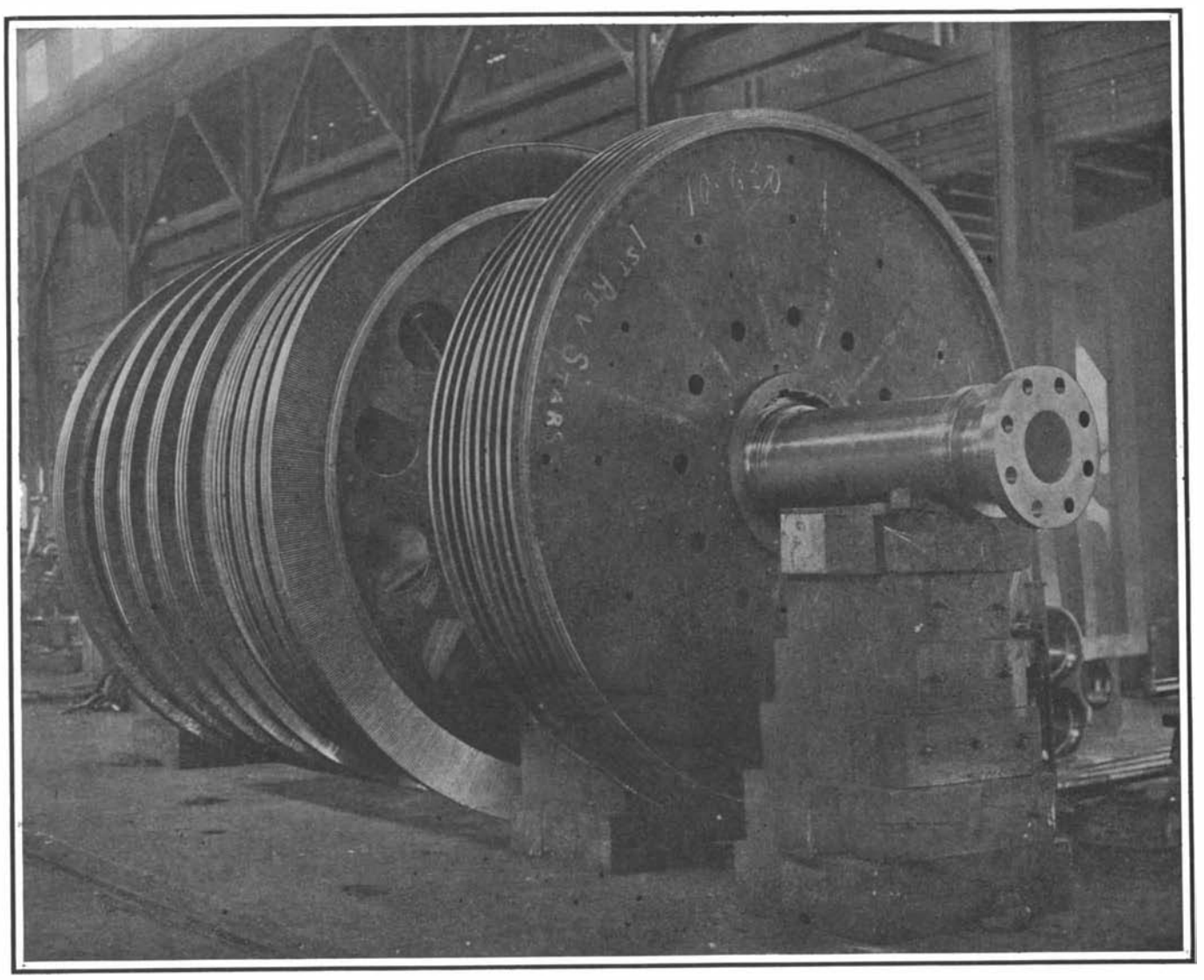
The battleship "North Dakota," which is now nearing completion at the yards of the Fore River Shipbuilding Company, possesses special interest, not merely because she is our first ship of the "Dreadnought" type, but also because she is the first battleship in our navy to be equipped with steam turbines. She will be driven by two of these, each of which will be of 12,500 horse-power. The steam will be expanded in nine stages, and will exhaust to a condenser operating under 28 inches of vacuum. We present three photographs, one showing a complete rotor, with the reversing turbine on the forward (in the illustration) end of the shaft, and the nine stages of the go-ahead turbine carried upon the same shaft. Steam is admitted at the far end of the shaft, and travels through the successive series until it reaches the wide space between the last of the go-ahead and the last of the reversing wheels, which space is easily recognized in the engraving by the wide gap between the wheels. Another engraving shows one-half of a section of the casing, with two half sections of the fixed blading of the last stage of go-ahead turbine, and the complete set of reversing blades in place. The third photograph shows a segment of one of the wheels, and indicates clearly the method of arranging the blades and fixing them in place.



One-half of a section of the casing with fixed blading in place.



Segment of wheel, showing method of fastening blades.



The rotor, showing the nine stages of the go-ahead turbine and the two stages of the go-astern turbine.

The Curtis turbine is what is known as the impulse type. To bring the speed of rotation down to a practicable limit, this type is divided into several separate pressure stages, and each stage contains three or four rows of revolving buckets. A single-wheel, impulse turbine attains its maximum economy when the speed of the buckets is about half that of the steam which impinges upon them. Since a jet of high-pressure steam, expanded in and delivered from a correctly-designed nozzle, will issue, if discharged into a vacuum, with a velocity of 4,000 feet per second, it is evident that for the buckets to attain maximum velocity they would have to move with a peripheral speed of 2,000 feet per second. With a view to reducing the speed to a practicable limit, several wheels, each contained in its own independent steam-tight chamber, are assembled upon the same shaft. The live steam is introduced upon the set of blades in the first chamber. Here it is expanded down, delivering up part of its energy. It then passes through a set of nozzles to the second chamber, where still more of its energy is given up, the process being repeated in each successive chamber upon each successive set of blades, until the steam is delivered to the condenser. In the nine stages of the "Dakota's" turbines there are four series of blades on the first wheel, and three on each of the others. The working speed at the blades is about 160 feet per second.

One of the marked advantages of the Curtis type of turbine is the nicety of control of the steam admission. In the go-ahead steam chest there are twenty independent valves, each opening one of the twenty nozzles for the first-stage wheel. For continuous running as many nozzles are opened as will supply the right amount of steam for the speed desired, and the go-ahead throttle valve is left open, thus giving a full pressure in the steam chest. The go-astern steam chest has the same number of nozzles, but only eight of these have valves. In maneuvering the ship, the nozzle valves in the steam chest are left open, and the speed is controlled by the throttle valve.

Another marked advantage of this system is that there is practically no leakage of steam between the ends of the blades and the adjoining surfaces. The steam which escapes past the ends of the blades, of course does no work upon them, and in pressure turbines of the Parsons type this leakage, especially in the high-pressure elements, is very serious, and shows a marked effect in reducing the economy. In the Curtis type the steam, moving at high velocity, passes directly across the surface of the blades, and has no tendency to pass around the ends of them. Consequently, not only does practically all the steam that passes through the turbine do useful work; but the clearances between the blades and the casing may be made large, and the danger of contact between the two, with its consequent disastrous stripping of the blades, is avoided. This clearance varies from ¼ of an inch to 2 inches.

Other advantages are that a smaller number of blades is necessary; that the construction of the blading may be made considerably stronger; separate cruising turbines are not necessary; the amount of power developed on the shaft is under close control, being determined by closing down the required number of nozzles; a lower pressure is used in the interior of the cylinder; and, perhaps most important of all, is the fact that the revolutions may be considerably lower, with the resulting advantage that two instead of four screws may be used and higher propulsive efficiency secured.

The accompanying illustration, showing a section of blading, illustrates the method of assembling and holding the blades in place. The blades are manufactured from a special bronze, which is formed to the desired section by being drawn through a die into long bars. These are cut into the desired lengths, and each length is notched or drilled at its ends for attachment to the base and the shroud. The inner ends are set in a channel-shaped piece of steel, known as the base, the ends of the blades being milled for this purpose. At the outer ends the blades are notched, and the notches fit into corresponding holes punched in a thin strip of steel known as the shroud, which passes entirely around the set of blades. When the blades have been assembled, the ends of the notches are riveted down over the shroud. In some cases the blades are built up into segments by casting on a composition base on the inner ends and a shroud on the outer ends, the blades being held during the casting in a sand core with their ends projecting. In this case the ends of the blades fuse into the cast parts, thus making a practically solid piece of the whole segment. The segments of blades, as thus formed, are held in the steel wheel rings by inserting the bases in rectangular grooves around the rings and calking the edges of the grooves.

TURBINES OF THE BATTLESHIP "NORTH DAKOTA."

Durability of Leather.

The following results of a series of experiments recently made by M. C. Lamb, have especial interest for the manufacturer of book leather, which is exposed to the destructive influences of the products of combustion of illuminating gas:

1. Leather properly tanned with alum and chromium is very durable, having a probable useful life of three or four centuries. 2. The use of tannin in conjunction with chrome alum greatly diminishes the durability of the leather. 3. The best vegetable tanning agents for book leather are those which contain pyrogallic acid, such as sumach, algarobilla, chestnut extract, and mirobolan. 4. Acid dyes applied to book leather should be prepared with volatile organic acids. 5. Basic dyes should not be "fixed." 6. Varnishing with shellac or albumen affords the best protection against destructive influences.

At the recent meeting of the New York Branch of the Associated Clubs of Domestic Science, Dr. Harvey W. Wiley, chief of the United States Bureau of Chemistry, urged that the nation can control only the interstate commerce phase of the pure food question and that the benefits of the agitation on this question will be enjoyed only after State legislatures are compelled to recognize the danger in impure and adulterated foods and to provide against their sale.

THE EYES OF ANIMALS.

BY PERCY COLLINS.

The late Sir William H. Flower, sometime director of the British Museum (Natural History), once expressed the opinion that it was impossible to overestimate the benefit that would eventually accrue to science from a thorough and systematized knowledge of eye-anatomy among the lower orders of animals. Such a knowledge, he added, would revolutionize the classification of the animal kingdom, and reinstate it upon a basis of unassailable fact. Year by year, this conviction has been gaining strength in the minds of certain advanced exponents of zoological science, on the continent of Europe and (more especially) in America. Moreover, in this connection it is pleasing to note that art and science have formed an alliance —the Old World supplying a skilled delineator in the person of Mr. Arthur W. Head, F. Z. S., of London, the New World the keen scientific element. In the United States, Mr. Head's studies and records have already aroused the greatest enthusiasm; and a movement, organized and headed by Dr. Casey A. Wood, president of the American Academy of Ophthalmology, is on foot with the object of securing capital which shall enable Mr. Head to make drawings of the eyes of all known birds—such drawings to be classified and published at the earliest possible date.

The object of the present article is to place before the readers of the SCIENTIFIC AMERICAN a brief account, couched in popular terms, of Mr. Head's labors, and of his achievements to the time of writing. For, be it noted, Mr. Head is no upstart naturalist with a novel theory formulated to tickle the fancy of the moment. He commenced to study and delineate the eyes of mammals, birds, reptiles, and fishes as long ago as 1892; and he has thus been engaged in the work, without intermission, for a period of nearly seventeen years. He has already made finished drawings, by the erect method, of some 250 mammals and reptiles, and these include at least one example of the normal eye of every order, *Cetacea* (i. e., the whale kind) alone excepted. In addition to this, Mr. Head has actually completed drawings of a large number of birds' eyes, these forming the foundation of the vast collection which, it is hoped, will ultimately be completed and supply the key to bird-classification on truly scientific lines. Apart from his expenditure of unremitting labor upon his self-imposed task, Mr. Head's drawings have cost him nearly $15,000 in cash to obtain. But Mr. Head is now working as an artist in collaboration with Dr. Casey A. Wood, the well-known eye-scientist of Chicago. Eventually, his completed series of drawings are to be published in colors, in the form of an atlas; and although Mr. Head resides and works in London, the United States will present the results of his labors to the world of science.

Most persons who lack ophthalmic knowledge find it a difficult matter to understand the exact part of the eye which is represented in a drawing by Mr. Head. It should be explained, therefore, that the paintings represent what is known as the "fundus oculi"—not the exposed part of the eye, visible under normal circumstances, but the interior or back of the eye-ground. In other words, if we regard the eyeball as a hollow sphere, the center of the inner wall most distant from the observer is the part which the pictures present. To obtain a view of the fundus oculi a special optical instrument, known as the ophthalmoscope, is necessary; and when the reader thinks of the constant movement of an animal's eye, he will be able to form some idea of the time and patience evoked in Mr. Head's work. Moreover, observations must be made under special conditions, a strong shaft of light being directed into the eye of the subject, which is confined in an otherwise dark chamber. Mr. Head tells us that he has spent several weeks in accustoming a caged animal to his presence, and to the brilliant shaft of light, before he could take the first peep through his ophthalmoscope.

We may now briefly describe the figures (photographs from Mr. Head's original drawings) which illustrate this article, mentioning the special points of interest in each.

Fig. 1.—The fundus oculi of the chimpanzee is chocolate brown in color, very similar to that of a negro. The disk is red, showing a strong gray reflex round the macula lutea, i. e., the wavy patch to the right of the picture, which is the area of vision, where mirages are sharply defined. The veins are indicated by the thicker streaks converging upon the disk, while the thinner streaks represent the arteries. It should be noted that the veins are highly reticulated and ramified—a condition in accord with Mr. Head's theory that the presence of numerous blood-vessels in the eye is concomitant with a high type of life. After a hasty glance at this picture, many medical men would probably conclude that it was intended to represent a human eye under conditions of disease. Indeed, the eye of the chimpanzee comes nearest to the eye of man; and, as Mr. Head has pointed out, those unscientific persons who may wonder what sort of use his labors can serve will find a striking answer to their inquiry if they compare this painting of an ape's eye with the representation of a negro's eye; or, better still, if they ask a scientific friend to let them glance through an ophthalmoscope at the fundus of a living human eye. Those who admit the Darwinian theory of evolution will find the extraordinary similarity which exists between the eye-grounds of ape and man of profound interest and significance.

Fig. 2.—In this picture Mr. Head has faithfully portrayed the eye-ground of the African elephant. It is pale straw-yellow color, covered with irregular brownish rod-like markings, the whole producing a pretty tessellated effect. The disk is pale gray. Few blood vessels are evident—the elephant possessing, in the opinion of Mr. Head, the comparatively simple eye of a prehistoric survival. Moreover, great atrophy of the optic nerve is present, a condition which, while normal in the elephant, would mean well-nigh total blindness in a man.

Fig. 3.—In the African lion we have a far more highly developed eye, with many blood vessels. The eye-ground is emerald green in color, mottled all over with bright golden-yellow blotches with tiny brown dots in their centers. The optic disk is pale red, and forms a cup, into which the retinal vessels dip on all sides.

Fig. 4.—This shows us the eye-ground of the Mississippi alligator. It is bright yellow, verging to orange toward the outer region, where are scattered a number of black, wavy markings such as are present in the diseased condition of the human eye described as retinitis pigmentosa. The whole eye-ground is stippled over with irregular patches of gray, while the disk is white, with a mass of black pigment in the center and round its edge. A number of opaque nerve fibers radiate from all sides.

Fig. 5.—This illustrates the eye of a reptile, viz., the tigrine frog. The fundus oculi is warm gray in

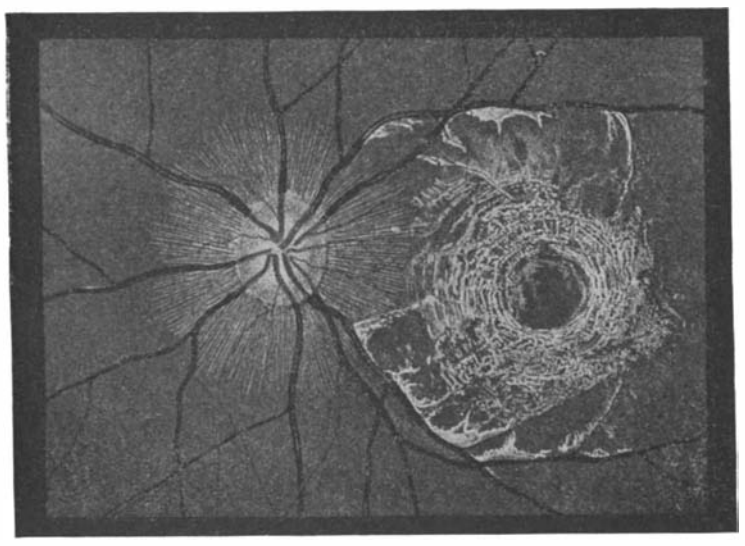


FIG. 1.—The fundus oculi of chimpanzee, very similar to that of the negro. The wavy patch to right is the area of vision.

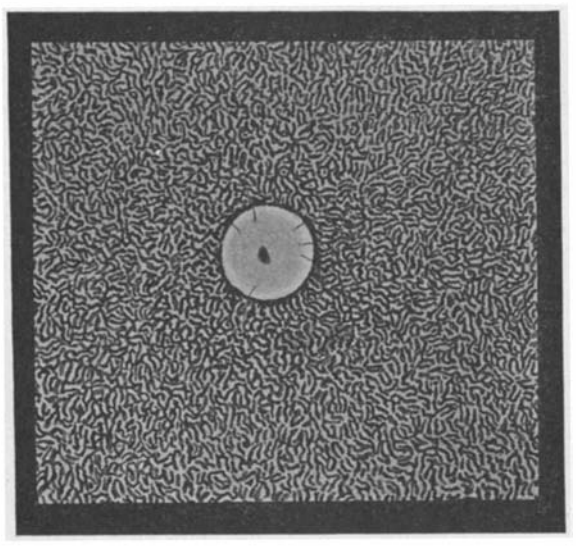


FIG. 2.—The eye-ground of the African elephant. The comparatively simple eye of prehistoric survival.

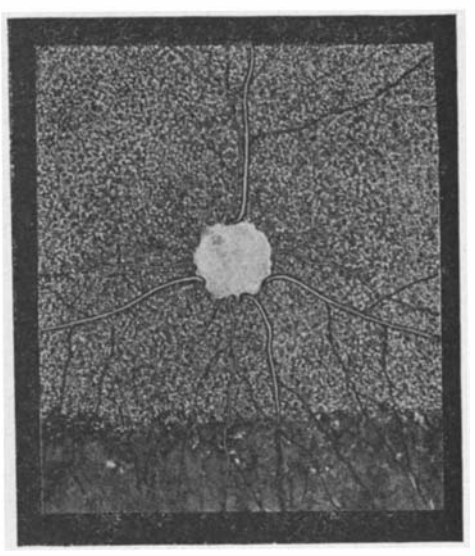


FIG. 3.—Showing the more highly developed eye of the African lion, with many blood vessels.

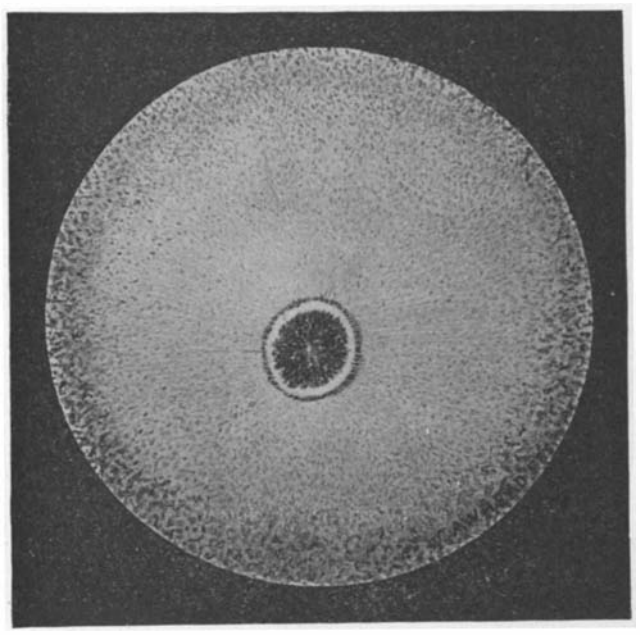


FIG. 4.—Right eye of the Mississippi alligator. Direct image. Opaque nerve fibers radiate from all sides.

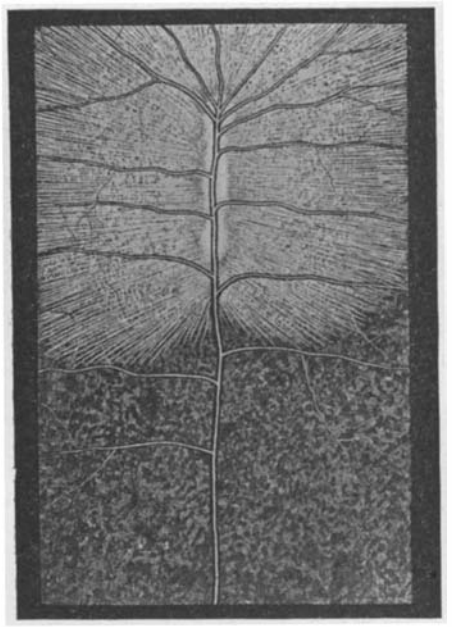


FIG. 5.—The eye of the tigrine frog. Ramifying blood vessels are evident.

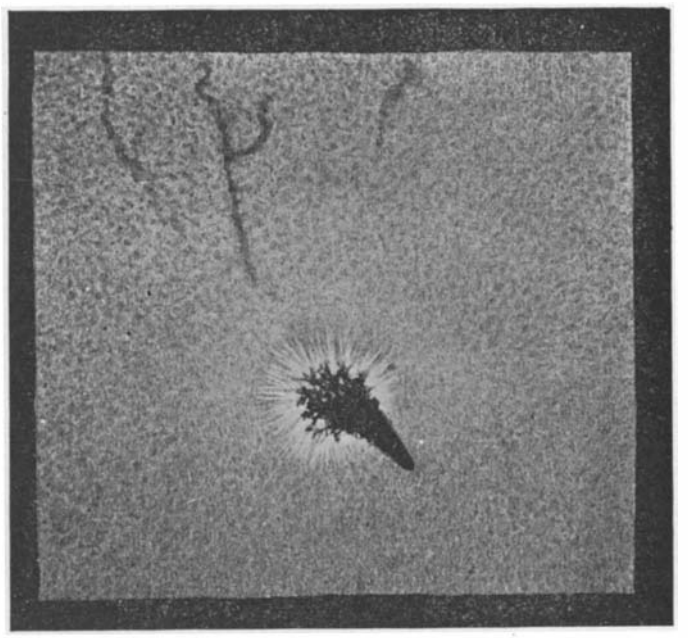


FIG. 6.—The eye-ground of the strange bird kiwi. White disk covered with rods of the pecten, a fold not developed in mammals.

color, blotched all over with bright orange-red patches. The oblong disk is white, surrounded on both its long sides with a mass of coarse, opaque nerve fibers. Ramifying blood vessels are evident.

Fig. 6.—In this picture we have the eye-ground of that strange Australian bird known as Mantell's apteryx, or the kiwi. The fundus oculi is brick red in color, stippled all over with a duller red. Toward the upper portion of the area several bright red choroidal vessels are evident. The white disk is covered with the rods of the pecten—a peculiar fold projecting inward from the choroid through the retina. The pecten is a structure which is not developed in mammals. It carries the nutrient vessels of the retina, and may be alternately filled with and emptied of blood at short notice. In a word, it is a special gland which nourishes the eye with blood—blood being as necessary to the eye for sight as it is to the brain for thinking.

Now although the pecten had been identified in the eyes of all other birds, it was supposed to be absent from the eye of the kiwi, until discovered by Mr. Head in the year 1900. The structure is very dark brown in color, cone-shaped, with coarse nerve fibers all round it. It comes nearly up to the lens; and as it originates low down in the eye it is apt to be mistaken for part of the iris, which it resembles exactly in color. This peculiarity, as we have said, led to the actual statement that the kiwi was the only bird without a pecten in its eye, until the error was corrected by Mr. Head.

In describing the above-mentioned pictures, it has already been shown that the normal condition of the fundus oculi in certain animals resembles a quality which, in the human eye, would indicate the presence of disease. Medical men will at once recognize this fact when looking at Figs. 1, 2 and 3, for example. Mr. Head's pictures should therefore prove to be of considerable assistance to oculists in enabling them to form correct diagnoses in several diseases of the human eye; they should also become of great importance to professors and students as a means of readily imparting and emphasizing instruction.

The whole subject of the eye and the power of visicn is fraught with fascinating interest. This statement applies especially to birds. In a preliminary paper on his studies, Dr. Wood tells, albeit in scientific language, an entrancing story of the miracle of a bird's eye, and whets the appetite of the reader for the revelations which will be made subsequently in the *magnum opus* for which Mr. Head's series of pictures is being prepared. Dr. Wood insists that bird vision is the very highest expression of eyesight. Beginning with the eyelids, he dilates upon the fact that in addition to the true upper and lower lids, birds possess a third eyelid, such as is found in reptiles, but only as a vestige in mankind. With this third eyelid a bird protects its eye when fighting or seeking food—swiftly drawing down the curtain, as it were. Simultaneously with the sweeping of the third eyelid across the eyeball, a special gland comes into play, shedding a copious supply of tears, which disinfect and cleanse the corneal surface, of foreign bodies.

The retina and the optic nerve are very highly developed in the bird's eye, and closely resemble man's. But some birds possess a double macula, or visual area, in the eye, so that they are able to see before and behind at the same time. This double macula, which furnishes stereoscopic vision, and all the advantages of binocular sight, doubtless explains the wonderful range and accuracy of the monocular eyesight of eagles, hawks, and vultures. Another notable feature of the bird's eye is the big muscle which encircles the globe, enabling its shape to be changed in accordance with the distance of objects which are being regarded. In a word, this muscle enables the eye to be converted instantly from a telescope into a microscope. Thus is it that a bird can see a tiny object at a distance of a mile, and can still pick up from the ground seeds so minute that the human eye could only distinguish them from dust with the aid of a magnifying lens.

The brightness of a bird's eye must have often attracted the attention of the reader. This characteristic is accounted for by the fact that practically every bird has a cornea (or horny, transparent membrane through which the light passes) much more conical than man's. Besides accounting for the brightness of the eye, the conical cornea explains in large measure the wonderful power and range of the vision. All these and many other points of entrancing interest relating to birds' eyes and birds' vision are discussed by Dr. Wood in his preliminary paper.

In conclusion, a word must be added as to the adventurous side of Mr. Head's experiences as a delineator of animal's eyes. To examine at close quarters, and for lengthy periods, the eye of a lion or an alligator calls for courage of no common order on the part of the student. These with elephants, hyenas, bears, and snakes are a few of the beasts whose eyes have been studied and portrayed by this dauntless artist. A lion being held only by a chain, Mr. Head tells how his cheeks were wet, and his mustache dripping, with the moisture of the animal's breath. In spite of the lion's resentment, Mr. Head calmly continued his investigations and drawing until suddenly the great beast broke away with a roar and romped round the building, greatly to the discomfort of the artist and the two keepers within, and to the alarm of the crowd without. The darkness of the shed was in favor of its human occupants. The lion was at length cornered; and Mr. Head escaped with nothing more serious than a long scratch upon the back of his hand.

Mr. Head ran a grave risk in order to secure his drawing of the eye-ground of the Mississippi alligator in the London Zoological Gardens. Although the reptile had been in captivity for a considerable period, it remained quite intractable, and was in every respect a most undesirable subject for close study. However, the tank in which it lay was drained, a rope was passed around its huge jaws to prevent it from snapping at the investigator, and the creature was held in position by a number of keepers. Mr. Head then spread out his materials, lay down on a plank beside his gigantic subject, and so commenced his labors—alternately peering through the ophthalmoscope into the depth of the alligator's eye and transferring to paper what his investigations revealed.

Some of Mr. Head's drawings of animals' eyes were exhibited in the science section of the Franco-British Exhibition. The artist was awarded both a gold and a silver medal. Mr. Arthur W. Head has would-be correspondents in many parts of the world, and he desires it to be known that his address is 26, Dornton Road, Balham, London, England.

Aluminium Coins.

In 1907, the French government proposed to replace the bronze pieces of 5 and 10 centimes with coins of pure nickel, but the project was abandoned because of the expense which it involved. This objection does not apply to the present proposal to substitute aluminium for bronze.

Aluminium is a bluish white metal, which is very malleable when pure. In hardness and tenacity it is comparable with silver. Experiments in abrasion conducted at the French mint have proved that aluminium coins will be less rapidly worn by use than coins of gold, silver, or even bronze. Aluminium has a metallic ring and is unaffected by exposure to the air at any ordinary temperature. Its extreme lightness is another advantage. It is only 2.56 times heavier than water and is four times lighter than silver. Hence aluminium coins could be carried in considerable quantities without inconvenience and they would be easily distinguished from silver coins by their lightness.

The total nominal value of the bronze 5 and 10 centime pieces in circulation is estimated to be about 56 million francs (about $10,800,000). According to Cosmos, it is proposed to replace some 50 million francs' worth of these coins with aluminium coins of the same denominations, to the nominal value of 63 million francs, this expansion being made to meet the normal increase of demand during the ten years allowed to accomplish the substitution. The aluminium coins are to have the same diameters as the bronze coins, about 1 inch and 1¼ inch, but they will weigh only 2 and 3 grammes (about 31 and 46 grains), while the bronze pieces weigh 5 and 10 grammes (77 and 154 grains). About 2,000 tons of aluminium, worth 44 cents a pound in blanks ready for stamping, will be required. This represents an outlay of nearly 11 million francs, which the cost of minting will increase to 12 million francs, but this will be more than covered by the profit derived by the government from the expansion of the currency, without counting the revenue derived from the sale of the 5,000 tons of bronze obtained by melting the old coins.

Wine Making in the Province of Shantung, China.

Near Tsingtau, in the Province of Shantung, China, chiefly on the southern slopes of the Laushan Mountains, large quantities of grapes are grown, a variety much resembling the Tokay grape of California being the commonest. A kind of sweet water grape and one named "Markobrunner" are also grown, but blue and black grapes are unknown in the region. The grapes are sent to Shanghai and other places for table use, but no attempt to turn them into wine is made.

In the Chefoo district of northeastern Shantung, the hills surrounding the city of Chefoo have been terraced and a large winery has been in operation for several years. It is said that white and red wines, as well as champagnes, have been made, but none has yet been offered for sale. As the making of wine has been going on for ten years, there is a large quantity on hand, and it is said that the wine is to be put on the market this year. The wine is to be sold in China only, and, considering the amount of money that has been expended, the price will probably be pretty high. The hill-land near Chefoo was bought by a rich Chinaman and grapes from the principal wine-producing countries of Europe were planted under the supervision of a European expert, who still has charge of the vineyards and winery. More land is being bought and planted, but, other Chinamen having embarked in the business, the price of suitable land has gone up considerably. It is reported that some of the vines have been attacked by phylloxera, but most of them seem immune to the pest. The winery is in the environs of Chefoo and the wine is stored in large casks, made in sections in Austria and put together in Chefoo. Each barrel is marked with the kind of wine contained in it and the year of production. The cellars in which the wine is stored are below the level of the sea and at first were flooded, frequently. Now they are lined with concrete. Two years were expended in their construction.

The Current Supplement.

The general principles involved in the design of a vessel are excellently set forth by the famous shipbuilder Leslie Denny in the current Supplement, No. 1737. The recent flights of the Zeppelin airship are discussed. The best-known type of friction brake for imposing an artificial load on engines in order to measure their horse-power is the widely-used and much-abused Prony brake. G. Everett Quick writes instructively on the subject of using the Prony brake in practical testing. Underground temperature and radium is the subject of a paper by the distinguished geologist Prof. John Joly. This year, as the subject of his course of lectures at the Royal Institution, Prof. Sir Joseph J. Thomson selected the properties of matter. His first lecture is summarized in the current Supplement. How narrow-gage rolling stock may be handled on broad-gage railroads is told by the English correspondent of the Scientific American. Caligula's galleys in Lake Nemi is the subject of a scholarly article in which the secret of the waters of Nemi is explained. Prof. Jacob Reighard begins an exhaustive treatise on the photographing of aquatic animals in their natural environment.

Testing Gasoline for Automobile Engines.

BY RANDOLPH BOLLING.

Every consumer of gasoline for automobile engine use should know how to test gasoline. As everyone knows, gasoline is a petroleum distillate; it is among the numerous oils that come over when crude petroleum is subjected to distillation. In the trade gasoline is known as 64-degree, 72-degree, and 86-degree. This standard is based on the Baumé hydrometer scale, which in turn is based on the specific gravity of water, which is 1.000 at 60 deg. F. Baumé for convenience sake made salt solutions of 10 per cent, 20 per cent, and so on, and got out an empirical scale on this basis. The only practical way, therefore, to see if gasoline is up to the test you desire to use, is to take its specific gravity. This can be done in three ways—first, by the pycnometer or so-called specific-gravity bottle; second, by the hydrometer, which is standardized on the stem of the tube to read degrees Baumé; or, third, by the Westphal specific-gravity balance. Of these three methods the Westphal balance is by far the most accurate and convenient. With the pycnometer a high-grade analytical balance is required and some knowledge of the metric system and manipulation. With the hydrometer you cannot be sure that the graduations given by the manufacturers are correct. With the Westphal balance all these troubles vanish. You have a neat physical instrument, held in a small wood box and the most accurate system of measuring specific gravity known to science; besides, the instrument is sold at an exceedingly low price by chemical and physical supply houses. If the reader has on file the Scientific American Supplement of March 21st, 1891, he will find an exceedingly good cut of this apparatus in use with special cooling or heating device, that is ordinarily not required, as all that is necessary is to chill the gasoline to 60 deg. F. and take the reading.. On using the Westphal balance, the instrument is adjusted so that the needle points match. Then the glass cylinder is filled with gasoline and the riders suspended on the arm until the needle points again match. The specific gravity can then be read off the arm directly. In order to convert specific gravity into degrees Baumé, at 60 deg. F.:

Specific Gravity.	Deg. Baumé.
0.7777	50
0.7734	51
0.7692	52
0.7650	53
0.7608	54
0.7567	55
0.7526	56
0.7486	57
0.7446	58
0.7407	59
0.7368	60
0.7000	70

This test of gasoline by taking the specific gravity is the only one that can be depended on.

Correspondence.

A CORRECTION FROM PANAMA.

To the Editor of the SCIENTIFIC AMERICAN:

On page 118 of the current volume of the SCIENTIFIC AMERICAN is shown a picture entitled "New Police Headquarters." People seeing this illustration will think us a rather unruly lot to require such a large general police office. The building is really the new administration building, and houses the offices of the governor of the Canal Zone, the sanitary departments, the quarantine offices, the police offices, the collector of revenues, customs and posts, the office of the secretary of the Commission and of the Canal Record and a pay office.

On page 119 is shown "one of the better-class residences." This is in no way one of the "better-class" residences, but is one of plain boards, cheaply constructed and shoddy in every particular. "Better-class residences" in Panama are of stone, brick, cement or *mamposteria* (a sort of mixture of large and small stones and mortar).

Thinking you might wish to correct so false an impression as the illustrations will no doubt make, I am taking the liberty of sending you this information.

Ancon, Panama. E. C. MCFARLAND, Chief Clerk.

RAINMAKING BY EXPLOSION.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of March 27th you criticise severely—and perhaps justly—attempts to create precipitation by means of explosions in the upper atmosphere. But have you touched the root of the subject?

There is water in the shape of vapor at *some* altitude everywhere, even over the most arid parts of the globe. This has been well proven. To cause its precipitation, all that is needed is a local fall of temperature in the moisture-laden layer to the dew point, and perhaps the presence of a certain amount of dust particles or their equivalent. Such a fall is brought about naturally by impact, either against a cold layer above or below, or the chilled slopes of a mountain range or peak. Such impacts result from complex movements depending upon the rotation of the globe on its axis and around the sun, and upon the aerial tides produced by the sun and moon.

You are doubtless quite right in assuming that no explosion effected by any human means would be powerful enough to act as a substitute for any of the above-mentioned processes in their entirety. But, is it not possible that an explosion, or some other impulse correctly applied at the right place and time, would produce a sudden local change of conditions sufficient to start in movement a chain of phenomena that would *naturally* lead up to a precipitation? That is perhaps all that we can hope to do. The forces about us, and particularly those that operate upon the atmosphere, are continually in a state of unstable equilibrium. The air lies (or moves) in layers, each of which differs in density, in temperature, in chemical composition, and in content of vapor. All the materials for a downpour exist. One will surely occur as soon as the proper conditions are brought about. The change has its inception in some small incident involving the expenditure of but an insignificant amount of external energy. The rest follows as a matter of course.

The use of explosives is simply an effort to start natural forces into motion, to change their direction, or to alter the procession of events to our advantage. That success is attained so seldom is probably due to the haphazard method of conducting the experiment. Before such an attempt, the condition of the air above the locality selected should be carefully studied, with the object of ascertaining as correctly as possible the altitude at which the moisture-laden layer exists at the time, the general course in which it is traveling, the temperatures above and below it, the effects of surrounding topography, etc. These known, is it not likely that explosions from captive balloons at the proper altitude would initiate movements culminating naturally in precipitation?

There are other agents also that might advantageously be employed. Take the case of a locality in some arid region, say western Kansas or eastern Colorado. Assume that experiments with kites and captive balloons proved that during July a moisture-laden stratum, traveling northwestward at an altitude of a mile, was generally to be found. Above and below it the air would have different temperatures, density, and direction. Now, what would happen if a shell, loaded with liquid air, was exploded at the right point in, above, or just below the layer containing the sought-for moisture? A trained meteorologist could perhaps answer the question.

That man will in time obtain sufficient knowledge of the phenomena of the upper air to enable him to produce precipitation almost at will, and almost anywhere, is the belief of many thinkers. The subject is one that might advantageously be taken up by the Carnegie Institution of Washington. We need specific information as to local atmospheric conditions throughout the year over regions where the rainfall is deficient. With this carefully collected and studied, there are probably several ways by which the natural course of the phenomena may be altered, at a trivial expenditure of external energy, and desired effects produced. THEODORE F. VAN WAGENEN.

Zacatecas, Mexico.

FORMULÆ FOR OBTAINING INTEGRAL SIDES OF RIGHT-ANGLED TRIANGLES.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent edition of the SCIENTIFIC AMERICAN there appeared several formulæ, derived by Dr. Hands, of Victoria, B. C., for obtaining integral sides of right triangles. While these formulæ are very ingenious, they distinguish two cases, namely, odd and even. I venture to suggest the formula n^2+1, where n^2+1 is the hypotenuse, and n^2-1 one leg, irrespectively of the character of n. The second leg is necessarily $2n$.

Thus $n=2$ gives 5, 3, and 4.
$n=3$ gives 10, 8, and 6.
$n=4$ gives 17, 15, and 8.
$n=5$ gives 26, 24, and 10, etc.

When n is odd, the results may be divided by 2. When $n=1$, the hypotenuse and leg are equal and coincide.

JOSEPH F. RITT.

College of the City of New York.

To the Editor of the SCIENTIFIC AMERICAN:

Dr. Hands's interesting letter has put me in mind of a small investigation of my own, which may or may not be original.

There exists a general type of quadrilateral figure, which may be called a *birectum*, having two opposite angles right-angles, and consequently

$$a^2+d^2=b^2+c^2$$

Find a general method by which *integral* values may be provided for a, b, c, d.

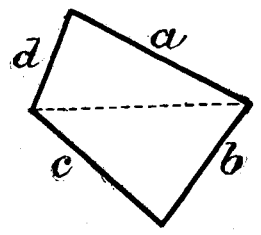
From the question, we have

$$a^2-c^2=b^2-d^2$$

or $(a-c)(a+c)=(b-d)(b+d)$

It is clear, therefore that the process will consist in factorizing some number in two different ways.

Moreover, a little consideration will show that, in both cases, the factors must differ by an *even* number [since, for instance, $(a+c)=(a-c)+2c$].



No *prime* number gives two factorizations; but take an odd number, such as 15, that is not prime.

We have $15=3\times5=1\times15$.

The factors differ by 2 and 14 respectively, and so we may write the equation of factors

$$(4-1)(4+1)=(8-7)(8+7)$$

whence $4^2-1^2=8^2-7^2$

and $4^2+7^2=8^2+1^2$

In the case of an even number, such as 24, the factorization 1×24 gives a difference of an *odd* number between the factors, and so is unsuitable.

But $24=4\times6=2\times12$

whence $(5-1)(5+1)=(7-5)(7+5)$

$$5^2-1^2=7^2-5^2$$

or $5^2+5^2=7^2+1^2$

[The factorization 3×8 would be unsuitable.]

And so in other cases.

It will be noted that a circle can always be described about a *birectum*.

IMMO S. ALLEN.

London Institution, Finsbury Circus, London.

Motor-Boat Races at Monaco.

The motor-boat races at Monaco last week were very interesting. Among the competitors were the "Dixie II.," which won the international race in Long Island Sound last fall, and the "Standard," another new American boat, with very powerful double-acting gasoline engines.

The chief race, the first day, was for the prize of Monte Carlo. This race was for the high-powered racers, and was over a 50-kilometer (31.07-mile) course. There were five starters, the first boat across the line being the "Alla-Va," which was of the hydroplane type. The "Panhard-Levassor," which has the same power plant as last year, namely, four 4-cylinder, 120-horse-power motors connected together in pairs and driving twin propellers, crossed the line second, and was closely followed by the "Wolseley-Siddeley II." The last-named boat quickly overhauled the Panhard, and was in first place before the first round was half over. The "Alla-Va" abandoned the race in the first round. The "Wolseley-Siddeley" and the "Panhard" ran a very close race. The "Wolseley" increased her lead up to the last round, but in this round the "Panhard" gained three seconds, and at the finish she was showing greater speed than at any other time. The "Dixie II." could not be driven at full speed on account of the rough sea. The official times of the English, French, and American boats were 49 minutes 4-5 second (37.95 miles an hour); 49 minutes 14 3-5 seconds (37.85 miles an hour); and 1 hour 28 minutes 2-5 second (23.08 miles an hour). The failure of the "Dixie" to make her usual speed on account of the rough sea was a disappointment to American enthusiasts. Those interested in hydroplanes were also shown that these speedy craft could not operate in rough water. The pounding of the waves against their flat bottoms would soon demolish them. An incident of the first day was the sinking of the German racer "Prince Heinrich." This boat was built and launched in seventeen days, but she was so flimsy that the hull split open and the boat sank. All the crew were rescued. Another race on the first day, April 5th, was for single-cylinder cruisers. A 50-kilometer course was covered by the "Sizaire-Naudin" in 1:43:13, and the "Nautilus-Anzaui II." was second in 2:12:33.

The second day was taken up with races for the 8- and 12-meter cruisers. These races were run under good weather conditions, although the sea was more or less agitated. Fifteen boats started in the 8-meter cruiser race, and six abandoned the race before it was half over, one of these being Mr. Moore-Brabazon's "Brabançonne," which was the favorite. The race was won by another English boat, the "Gyrinus II.," which was built and engined by Thornycroft. She covered 50 kilometers (31.07 miles) in 1 hour 31 minutes 53 seconds, at an average speed of 20.29 miles an hour. The "Fleur-d'-Eau," a Swiss boat, was second, and the "Excelsior Buire V.," a French boat, was third. In another 50-kilometer race, in which ten boats started, there were four hydroplanes. All of these craft suffered from vibration and pounding of the waves. The race was won by a boat of the ordinary type, the "Liselotte," the hull of which was built by Tellier and fitted with Mercedes engines. The time was 1:6:37—an average speed of 27.98 miles an hour. The Fauber hydroplane, fitted with a Motobloc engine, was second in 1:16:11; and the "Ricochet XII." third in 1:22:29. The 12-meter boat race was won by the "Delahaye" hydroplane, which shot ahead at the start and maintained its position to the finish, although buffeted by a heavy sea. The time of the winner was 1:13:55. The "Alexander-Mercedes II." was second in 1:23:46, and the "Megevet-Picker IV." third in 1:24:50.

On the morning of the third day three 18-meter cruisers covered the 50-kilometer course in fast time. The sea was calm, which enabled them to make an excellent performance. The winner was the "Chanticleer," fitted with a Brasier engine, its time being 1:9:2. The "Tele Mors" was second in 1:13:50; and the "Lorraine" third in 1:28:20. In the afternoon the eliminating contest for the French boats for the International Grand Prize Race was held. The "Panhard" led throughout, and finished the 50 kilometers in 1:47:24, an average of 17.37 miles an hour. The "Ricochet" was second in 2 hours 17 minutes, and the "Fauber" third in 2 hours 52 minutes. The last two boats mentioned were hydroplanes. They and the "Panhard" were the only boats that finished out of eleven starters.

The long-distance race was held on the fourth day. Out of 33 cruisers which started in this 200-kilometer (124.3-mile) race, only five finished. The winner was the "Chanticleer." Her time was 4:45:58. corresponding to an average speed of 26.08 miles an hour. The "Tele Mors" was second in 5:6:36, and the "Alexander-Mercedes II." third in 5:42:27. The "Megevet-Picker IV." and the "Odette" were the only other boats that finished. The "Gallinari" held third place until within half a mile of the finish, when she broke down.

The most important race, called the "Coupe des Nations," was run under ideal weather conditions on April 9th. The distance was 100 kilometers (62.14 miles). There were seven starters. France was represented by the "Panhard-Lavassor," the "Fauber-Labor-Motobloc," and the "Ricochet XII."; Germany by the "Liselotte"; Italy by the "Nibio"; Great Britain by the "Wolseley-Siddeley II."; and America by the "Dixie II." The "Standard," which had been practically rebuilt, cracked one of her cylinders while being tried out, and was unable to enter the race. The start was a fine one, the "Wolseley" leading over the line and being closely followed by the "Dixie II.," the "Panhard," and the "Liselotte." At the end of the first round, the "Wolseley" led the "Panhard-Levassor" by but 20 seconds, while she was a full minute ahead of the American boat. The other craft were left far behind. On the second round the "Panhard" appeared to be losing, and at the end of the fourth round the British boat was three minutes ahead of her, was running better than usual, and taking the turns at high speed. An exciting moment was at the end of the fifth round, when the "Dixie II.," which had been gradually gaining over the "Panhard," caught her at one of the turns, the two boats rounding the buoy together. After three more buoys had been passed, the "Panhard" again forged ahead of the "Dixie," but the latter made faster time on the straight-away, and before the end of another round she again passed and left behind the "Panhard." At the end of the eleventh round the "Wolseley" was 9 minutes ahead of the "Dixie," and the latter was 2 minutes ahead of the "Panhard." The "Liselotte" was lagging far behind, but running steadily. Just after finishing the thirteenth round the "Dixie II." abandoned the race, owing to the breaking of its water-circulating pump. Two minutes later the "Panhard" came to a stop; a connecting rod had broken and punched a hole in the bottom of the boat. She was towed to the pier, and sank just after reaching it. With these two boats out of the race the "Wolseley-Siddeley" won easily in 1:55:3-5. Her average speed was 32.25 miles an hour. Both the "Fauber" and the "Ricochet" hydroplanes had engine trouble during the race. The latter boat abandoned the race in the tenth round. The Italian boat covered but three rounds. Late in the afternoon the "Gobron" racer took fire and was considerably damaged.

THE ALASKA-YUKON EXPOSITION.

BY WILLIAM H. RAYMOND.

YUKON and Alaska will be commemorated this year in a brilliant exposition located on a site which was once a virgin forest of the Northwest, but which now presents an array of glittering palaces. In this city it has installed a more modern electric equipment than has the town of Seattle itself, a water system which is supplied by a glacier-fed lake high in the Cascade Mountains, and a splendid sewer system. A quarter million electric lamps light it by night, and 5,000 kilowatts electric power, generated by a plunging river in the hills, turns the multitude of wheels.

That the Northwest may give the Alaska-Yukon-Pacific Exposition to the world during the coming summer, it has expended in twenty-four months ten million dollars, and has performed such feats of engineering and construction that, in these features alone, it will be worth a transcontinental trip.

The site is upon the banks of two gem-like lakes which lie within the limits of Seattle. They are girt with woods of Douglas fir, and their banks, except upon the city side, merge rapidly into the snow-capped mountain ranges which are the city's ramparts. Almost overlooking the grounds, and forever in view, are Mount Rainier, the highest peak in the United States, Mount Constance, and the spire of Mount Baker, a magnificent ampitheater in which to hold a world congress.

The exposition is now more than ninety per cent complete, and the opening day is June 1st, which is ample assurance that, when the day arrives, the exposition will be finished to its most remote detail. It will be the only world's fair which has opened complete the day first promised.

Modern French renaissance prevails in the architecture, with the exception of the group of buildings erected by the United States government, which are in the Spanish renaissance. Construction has been carried on with every regard for the natural beauty of the grounds, and as much of the original forest cover as could be, has been preserved, with the result that domes and cornices and pergolas of glowing staff gleam through the intense greens of the native woods. Not less than three of the exposition buildings are of permanent concrete and brick, while four others are of brick, hewn timbers, and heavy frame and log construction.

When the State appropriated a million dollars for the fair, it was with the proviso that not less than $600,000 of the sum should go into permanent structures which, at the end of the exposition, should revert to the University of Washington, the exposition grounds being upon a portion of the magnificent estate with which the State college is endowed. Thus, while many of the exposition buildings are of the conventional construction of plaster staff, the most notable among them are fireproof structures.

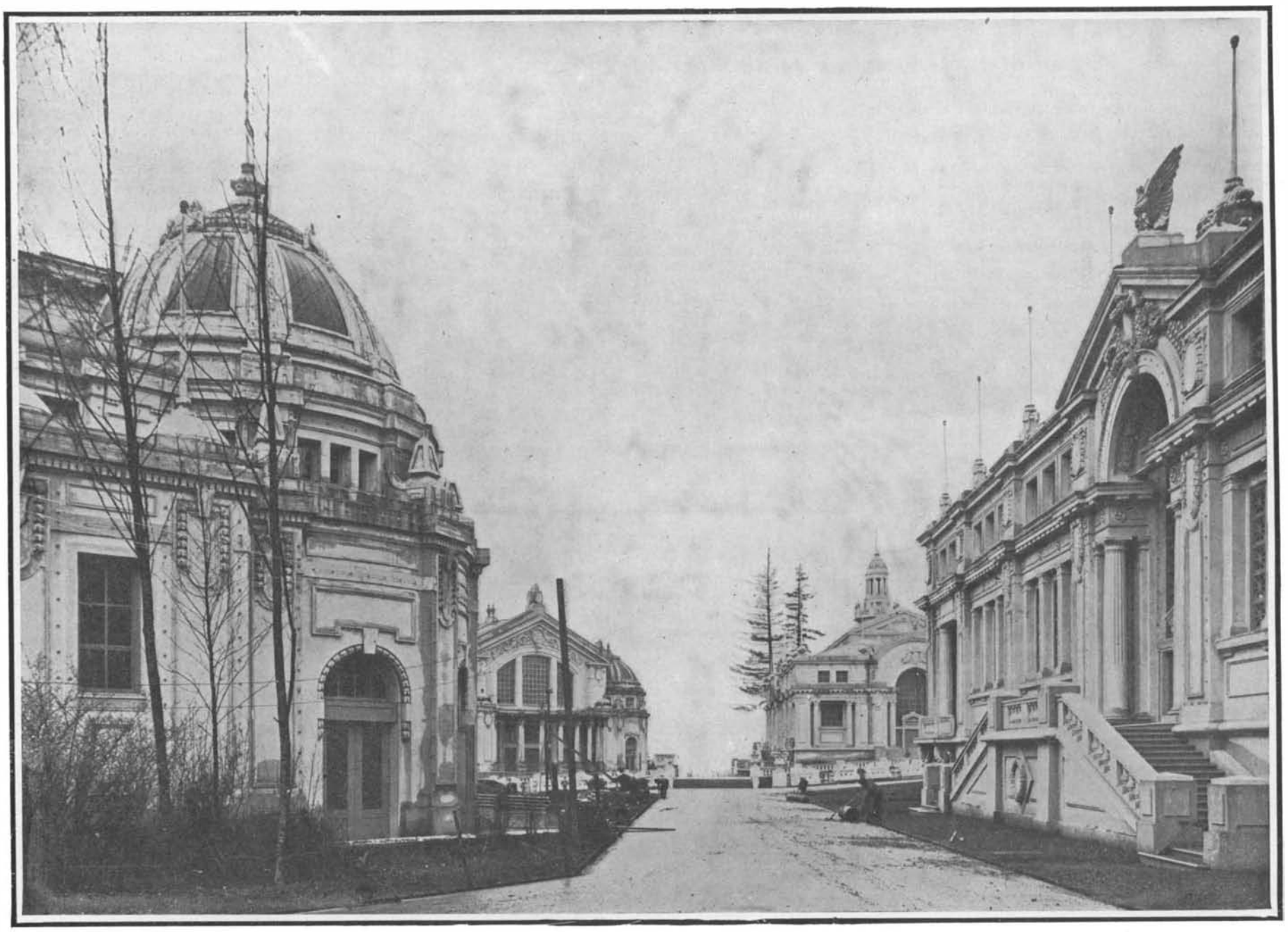
Of all of these permanent structures, probably the auditorium is the finest. It has a reinforced concrete foundation and brick walls. While its floors are of hard woods, it is otherwise fireproof. It has a seating capacity of 4,000 on the main floor, with half as many more in its balconies. During the exposition it will be used for all extraordinary indoor gatherings and special day celebrations. It will later be used by the University as a general assembly hall and lecture room. So large is it, that it will more than supply all of the needs of the University in this line for the next twenty years.

The Fine Arts Palace of the exposition is to become the school of chemistry of the University. It is absolutely fireproof in construction, the floors being of reinforced concrete and the walls of brick. Its sills and all courses are of pressed steel. During the exposition it will house the most notable art display ever made by an exposition, France and Italy having been more than generous in the way of loan exhibits, and artists the world over having competed for entry.

Machinery Hall, when the exposition has passed, will become the University School of Engineering. It is another of the fireproof structures very similar in its essentials to the Fine Arts Palace. These three buildings are finished in terra-cotta brick. Indeed, terra cotta will be the exposition color, in so far as all exteriors are concerned. All of the staff structures will be of this tone, the eye-racking white of other expositions having been done away with.

The Washington State building and a pumping station which will provide 8,000 gallons of water per minute for the Cascades and Geyser Basin, with a huge structure of fir logs, none of them of a less diameter than five feet, complete the list of permanent buildings. The log building will be used during the exposition for the forestry exhibit. At the end of the fair it will become the forestry school of the University. It is a stupendous pile; in many respects the most remarkable structure on the fair list, and, for the thousands of pre-exposition visitors who daily flock to the grounds, it is the chief point of interest.

The central feature of the exposition scheme is the Cascade Court. Down it for a distance of 500 feet, thousands of gallons of water plunge over a series of dams, which break the stream into a raging, crystal torrent. At the foot of the fall is a huge basin, in which is reproduced "Old Faithful," the geyser which has contributed most largely to the fame of Yellowstone Park. The exposition's "Old Faithful," like the original, sends jets of water high into the air at one-minute intervals, and presents a truly splendid spectacle.



Looking down Yukon Avenue.

THE ALASKA-YUKON EXPOSITION.

By night, the cascades are made to glow by powerful electric lamps placed under the water at the lips of the dams, where they are amply protected by heavy hoods. The lamps are behind glass of the prime colors, and the shading is from the lighter tones, in the center, to the darker tones on the edges. Geyser Basin is similarly illuminated.

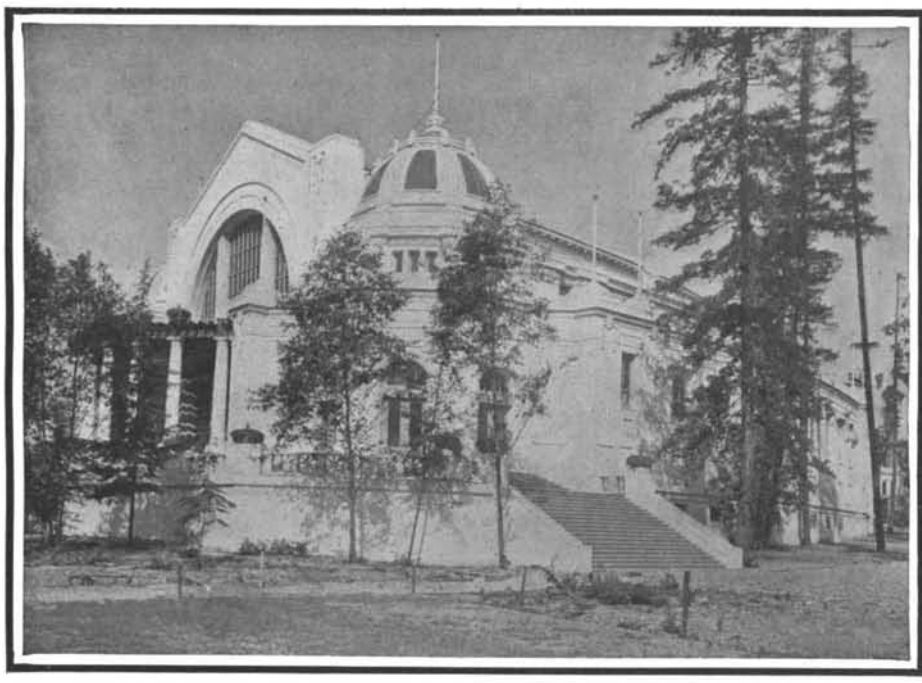
It is not to be taken from this that the Alaska-Yukon-Pacific Exposition will rely solely upon beauty, natural and enhanced, and upon theatrical effect, to attract. Quite the contrary. Nature has provided so much and at so little expense to the exposition that, magnificent as the scenic properties are, they are altogether incidental, from the exposition standpoint.

It is upon the unusual that Seattle places its chief reliance. The exposition will show more things and people that have never been shown before, than any other exposition has ever shown. It is not to be an exposition of "Vienna Praters," "Old Heidelbergs," Belgian laces, and Bohemian glass, although all of these things will be there.

At no world's fair has Japan made such an exhibit as it is now installing at the Alaska-Yukon-Pacific. The same may be said of China. The United States

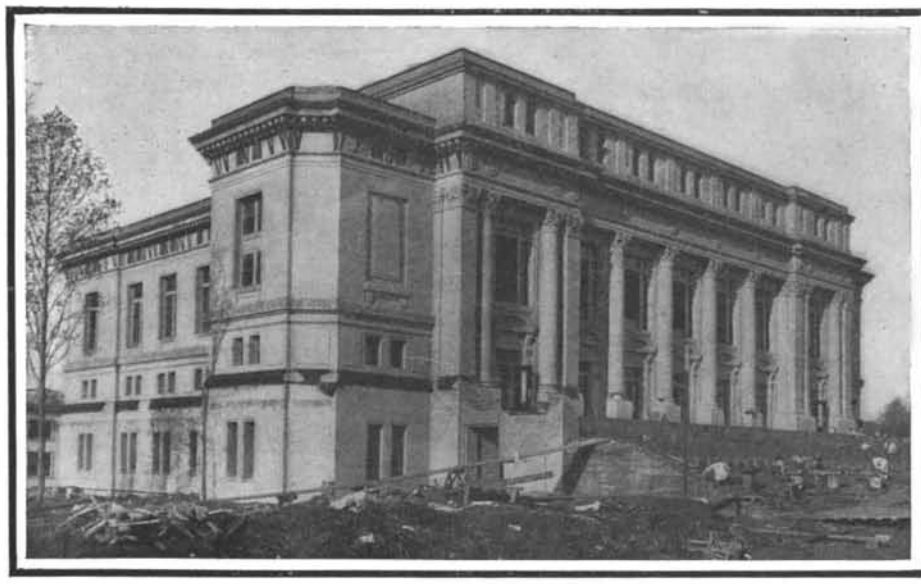
Oregon State building.

Machinery hall, one of the permanent structures.

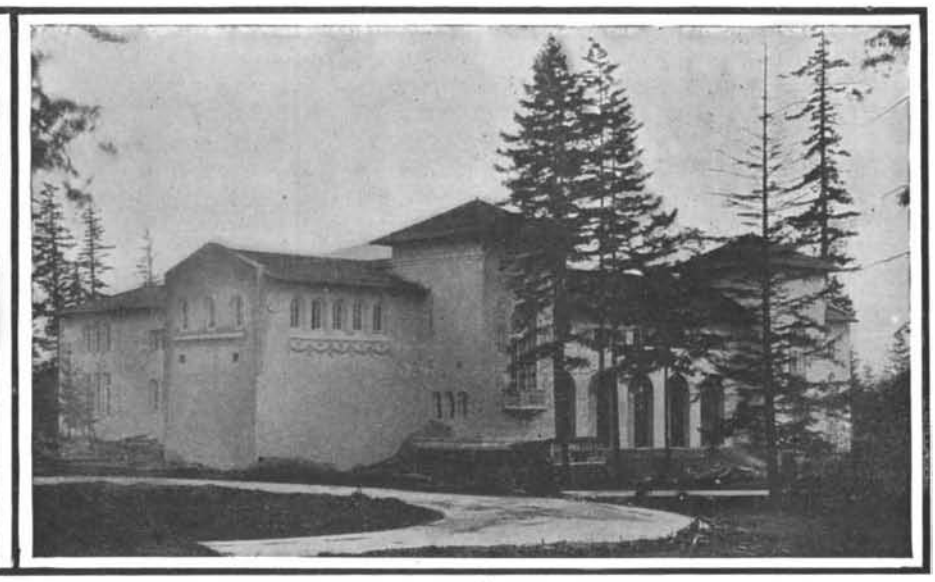


A view of the manufacturers' building.

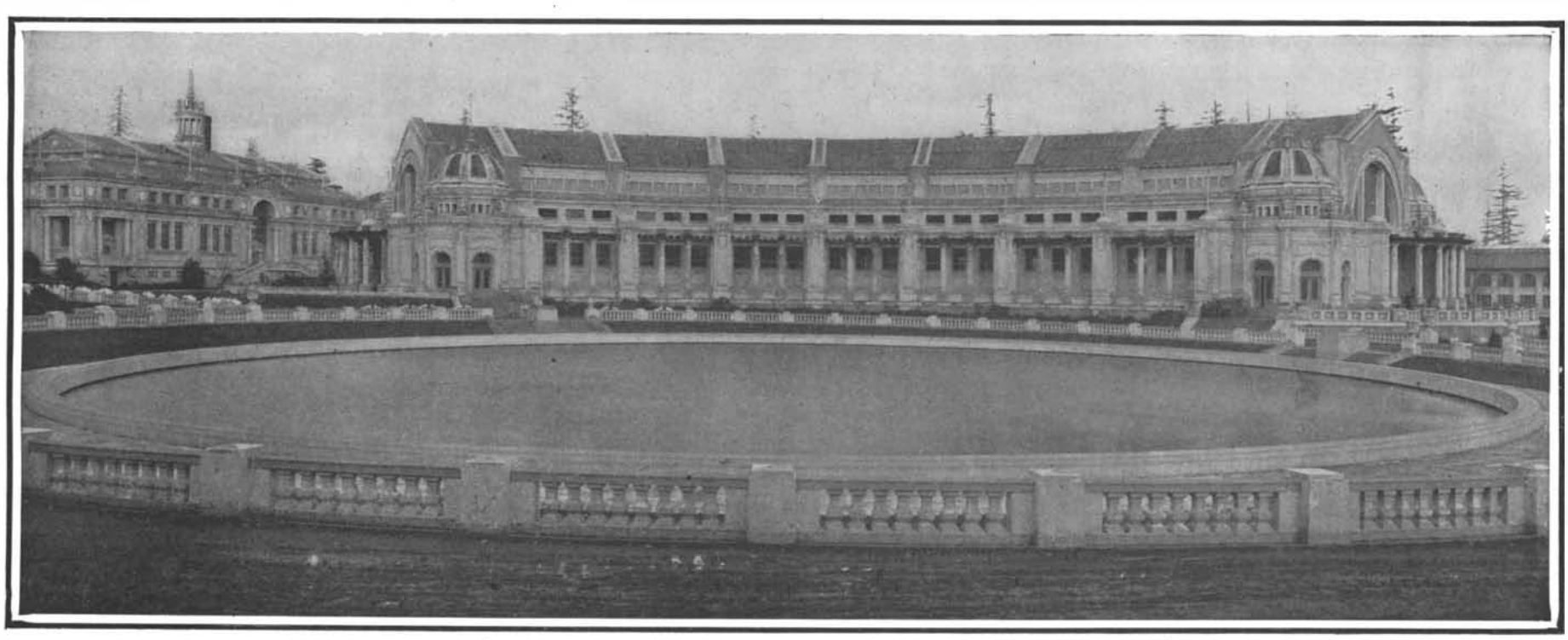
Lake Washington in the foreground; the Cascade Mountains in the background.



The Auditorium, one of the permanent buildings.



California State building.



The manufacturers' and mines building and geyser basin.

THE ALASKA-YUKON EXPOSITION.

government is expending $600,000 that the Philippines, Hawaii, and Alaska may be shown for the wonderful lands they are, instead of the very queer and unprofitable places contemporary romancists have made of them.

Oceanica and the South Seas, which means Tahiti, Samoa, and the other picturesque and prolific isles, will be shown for the first time in their history. One idea is obtained of these countries from a Midway "concession," and another from correct and comprehensive exhibits of their people and products. Seattle will offer exhibits, not concessions.

Canada, with its rich provinces, and its tremendous wealth-producing reaches to the north, will be given such exploitation as never before. The Dominion itself has appropriated $100,000 for this purpose, its railroads are spending an equal amount, and its provinces, individually, very much more. Taking advantage of the same opportunity are the Pan-American republics and South America generally.

Bringing the matter of exhibits down to the United States, no exposition in history has attracted such lively interest among manufacturers. Seattle has long been called the "Gateway to the Orient," for the reason that the route to Yokohama and Hong Kong is three days shorter by the northern passage than by any other. It is in the Orient that the Occident is preparing to do the major part of its business—make the most of its millions—during the centuries to come, wherefore America's captains of industry are more than eager to take full advantage of an opportunity to show the Orient what it has that the Orient needs, and learn at the same time what the Orient has by way of barter.

Some idea of the scope and volume of the resultant display is to be had when it is known that, by conservative estimate, the intrinsic value of exhibits now on the grounds of the exposition is $55,000,000.

But neither do trade and scenic beauty make the ideal exposition combination. When the world takes a day off, it is for the pleasure and recreation that are to be had of it. All trade would make anyone tired, and even the Alps grow stale, so, by way of leaven, the Alaska-Yukon-Pacific has given as much thought, almost as much money, and quite as much interest to its out-and-out amusement features as to any other consideration. In Chicago it was "The Midway," in St. Louis, "The Pike." In Jamestown it was the "War Path," and in Portland, the "Trail." In Seattle, it will be the "Pay Streak." The Streak as at present laid out is three-quarters of a mile long, and for every site upon it there were not less than ten applications. As a result, the concessions department has been able to choose only the highest class features that the world has to offer, and a cosmopolitan selection it has made of it. It will be fun as the Turk has it, as the Arab sees it, as it is in Canton and Singapore. The "cut-ups" of every nation have been conjured to make the Seattle show notable, and consequently there will not be an amusement feature shown, which does not at the same time offer an actual educational value. One Chinese concession is expending $15,000 on its staff buildings alone; while a Japanese company, which will install a typical Tokyo tea garden and theater, is spending 25,000 yen on its preliminary arrangements. It costs much money to move a bit of old Japan to Seattle, without losing any of its glamor.

So far as the Northwest is concerned, the exposition is no longer an experiment, and Seattle will be found hereafter a vehement exponent of the exposition idea. Were that to happen to-day which would stop every wheel and prevent the fair, the Northwest would none the less count an ultimate profit, although with much regret. The value of the advertising which the Northwest has received as a direct result of its exposition enterprise, is beyond computation. It has served more than all other advertising and exploitation of whatever nature to lead the East from its smug provincialism to a realization of the West's trade importance.

When the gates close upon the Alaska-Yukon-Pacific Exposition next October, the eminence of the Northwest in the world's future trade relations will be admitted, and no longer denied, and, in the mind of the Northwest, that's worth ten millions of money any day in the 365.

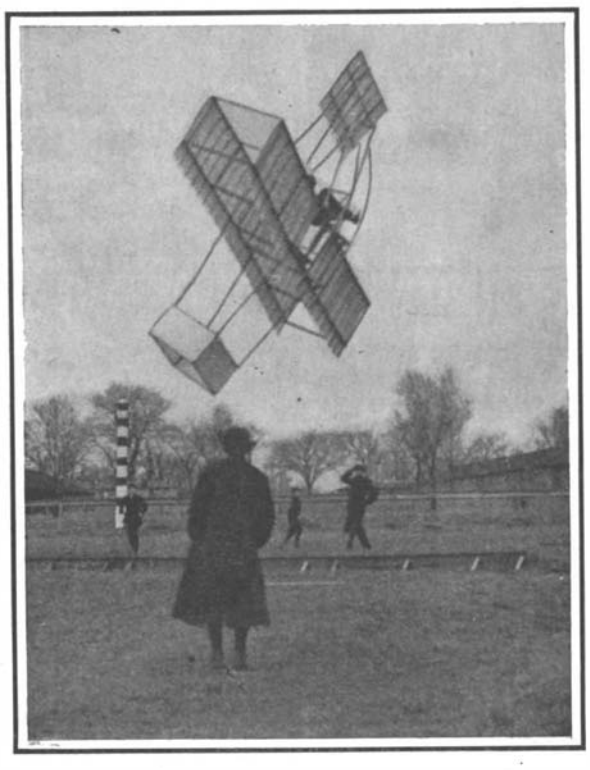
The Museum of Safety and Sanitation.

The Museum of Safety and Sanitation has its office at the United Engineering Societies Building, 29 West 39th Street. The objects of the Museum are to study and promote means and methods of safety and sanitation and the application thereof to any and all public or private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain expositions, libraries, and laboratories and their branches, wherein all matters, means, and methods for improving the general condition of the people as to their safety and health may be studied, tested, and promoted, with a view to lessening the number of casualties and avoiding the causes of physical suffering and premature death; and to disseminate the results of such study, researches, and tests by lectures, exhibitions, and other publications.

Announcement has just been made of the election of the following officers of the Museum of Safety and Sanitation: Acting president, Philip T. Dodge; vice-presidents, Charles Kirchhoff, T. C. Martin, Prof. F. R. Hutton, and R. W. Gilder; treasurer, Robert A. Franks; Plan and Scope Committee, Prof. F. R. Hutton, William J. Moran, Dr. Thomas Darlington, H. D. Whitfield, and P. T. Dodge; director, William H. Tolman. Among the charter members are C. H. Dodge, Elbert H. Gary, Richard Watson Gilder, Dr. Thomas Darlington, Charles Kirchhoff, T. Commerford Martin, Philip T. Dodge, Prof. E. R. A. Seligman, Irving Fisher, William J. Moran, Henry D. Whitfield, A. R. Shattuck, and Prof. F. R. Hutton.

AN EXPERIMENT WITH A GLIDER.

At Morris Park recently Mr. Wilbur R. Kimball, the secretary of the Aeronautic Society, tried a Chanute-type glider in a new way. Instead of hanging from the machine and jumping off an elevation, as is usually done with a machine of this kind, Mr. Kimball tried launching it upon a starting rail by means of a catapult consisting of a dropping weight like that used by the Wright brothers. This catapult and starting rail was built by members of the Aeronautic Society last fall, but it had never been used before. The glider to be tested was fitted with runners and was mounted upon two small wheels, so that it could run



KIMBALL'S GLIDER TURNED UPWARD BY A WIND GUST WHEN SHOT FROM THE CATAPULT AT MORRIS PARK.

along the rail. The rope from the catapult ran around a pulley at the end of the rail and then back to the glider. A loop in the end of the rope was slipped over a hook so placed on the glider that when it reached the end of the rail, the rope would slip off automatically and allow it to soar.

When all was ready, Mr. Kimball seated himself in the glider and grasped the handle that worked the horizontal, or elevating, rudder. Just as the weight fell, a sudden gust of wind struck the aeroplane and lifted it in front. The rope slipped off, and the machine shot skyward, as shown in our photograph, Mr. Kimball being unable to regain control of it by means of the horizontal rudder. It quickly fell again, while remaining in the position shown, and was reduced to a mass of broken sticks and cloth. Mr. Kimball sprained his back, but was otherwise uninjured. Had it not been for the sudden wind gust and the detaching of the rope, it is probable that a good glide would have been made. Nevertheless, it is preferable, in making gliding experiments, to run down an incline against the wind, rather than to be projected suddenly forward.

Death of Dr. William H. Edwards.

Dr. William Henry Edwards, the naturalist, died on April 3rd, 1909, at his home, Coalburgh, W. Va. He was 88 years old.

Dr. Edwards was born in Hunter, Greene County, New York, in 1822. He was graduated in 1842 from Williams College, which later gave him the degree of LL.D. In 1846 he made a trip up the Amazon, studying butterflies chiefly, but collecting other objects of natural history. He published "Voyage Up the Amazon," and later traveled over this country studying butterflies, and published in 1879, 1884 and 1897 three series on "The Butterflies of North America," which were so costly as to be used almost exclusively by reference libraries. He also contributed 160 papers on *Lepidoptera* to the Canadian Entomologist, and wrote entomological papers for other journals.

San Francisco Catches a Wireless Telegraph Message from Japan.

For four months past the operators of the United Wireless Company on Russian Hill, San Francisco, have heard indistinct signals, which they believed to come from some amateur operator trying to send messages. But when they were heard regularly on "good wireless nights," the operators thought that they came from some station on the Atlantic coast. On October 11th wireless telegraphic communication was established between San Francisco and Honolulu, the operators at which cities were in communication daily. Early in November a new receiving apparatus was installed at the Russian Hill station and the messages began to be heard with much greater clearness. The Honolulu operator had said that he believed them to come from Japan; and the San Francisco operator, finding that they were not in the International Code, began to be of this opinion also, Japan and China being the only two countries that use their own codes in transmitting wireless messages. At last a copy of the Japanese code was found, and some of the code words were translated. In the early morning of November 24th Lawrence Malarin, one of the operators at the Russian Hill station, felt certain that he heard one Japanese station in communication with another. As the nearest wireless station in Japan is Yokohama, the message must have come 5,761 miles at least. This is a world's record for receiving a wireless message. San Francisco wireless telegraphists are already discussing the possibility of establishing regular communication with Japan; but the small receiving instruments at present in use in Japan will prevent the Japanese from picking up a message from any great distance.. The latest receiving instruments are patented and are not on sale; so that Japan could have the use of them only by permitting the company that owns the patent to erect a station in Japan. As no one but a native Japanese may hold a patent in Japan, and the secrets of the wireless companies are said to be too well guarded to permit of the Japanese copying the instruments, it does not seem likely that there will be regular wireless communication between Japan and the United States for some time to come.

Lawrence Malarin says that, before picking up the Japanese message, he received one from the battleship fleet, 800 miles out from Honolulu, and one from an army transport that was 1,200 miles beyond the Hawaiian Islands. Malarin has received several letters of congratulation from wireless telegraph experts on his remarkable work.

Fluorine in Enamels.

Compounds of fluorine, including fluor spar and the fluorides of sodium and aluminium, separate or combined as natural or artificial cryolite, are now employed with advantage in the production of enamels, and especially of opaque white enamels. According to a French writer the influence of fluorine has been greatly exaggerated and misunderstood. In firing the fluorine is entirely eliminated in the form of the volatile fluoride of silicon and the resultant enamel should contain no fluorine if the original mixture is quite homogeneous. Hence the fluorine has no effect on the opacity of the enamel, which is due to alumina or silicates of alumina. Nevertheless, the fluorine compounds possess the merit of lowering the fusing point and facilitating the perfect fusion of the enamel, especially if they are very thoroughly and intimately mixed with the other ingredients.

The Japanese Telegraph Code.

The Morse signals used in telegrams written in the Japanese characters are fifty in number, in addition to those representing figures and the signs of punctuation, etc., says a writer in St. Martins LeGrand. These signals are partly composed of those representing the Morse alphabet, and partly of additional combinations of dots and dashes.

Telegraphically speaking, about 3.65 Japanese letters are equivalent to one word in English, which on an average consists of 4.67 Morse letters, and therefore one Japanese Morse signal. It may be perhaps interesting here to note how Japan is related telegraphically to foreign countries. Of the whole number of foreign messages forwarded or received, and which amount to some 800,000 a year at present, about 40 per cent are credited to Korea, 28 per cent to China, 9 per cent to England, 7 per cent to the United States, 4 per cent to France, 2 per cent to Russia, and 4 per cent to all other countries.

Handy Man's Workshop

FURNISHING THE WORKSHOP.—VI.

BY I. G. BAYLEY.

(Continued from the issue of April 3rd.)

THE LATHE.

The lathe shown in dotted lines, in Fig. 13 of the last instalment, is illustrated and described in the following notes.

The legs, *A*, are made from 2 x 4-inch timber, 3 feet 3 inches in length. They are spread 5 inches at the top, and 1 foot 6 inches at the bottom; the 4 x 6-inch pieces, *B*, being cut to fit between each pair.

The lathe-bed, *C*, is 5 feet 6 inches long, made of 3-inch by 7½-inch lumber. A 2-inch-wide slot is cut out of the center, running the length of the pieces, to within 2 inches of each end, as shown in the general view of the lathe, and in larger detail in Fig. 17. A more accurate job will be the result, if a slot is cut in a solid piece of timber, instead of using two lengths, joined together at each end, with distance pieces.

The right-hand pair of legs shown in general view, Fig. 16, is 6 inches from the end of lathe-bed, while the other pair is 9 inches, on account of the head stock which overhangs them. The half joints for these legs are marked 1 in Fig. 17, a section being given bearing the same number.

The joints, marked 2, are for the head stock, *D*. There is need for only one of these, on the belt side of the lathe, but two are shown in case the lathe should be turned into a foot-power machine. A section is given marked 2, to correspond with the plan, in which it will be seen that the slope of the cuts is about ½ or ¾ of an inch from the edges of the 2-inch groove, or slot, at the top, and the same distance from the outside edge at the bottom.

Fig. 19 shows the details of the head-stock, *D*, and tail-stock, *E*. The tongue of the latter must have a moving fit, so that when the wedges are taken out, the stock can be adjusted to suit the various lengths of material to be turned. The tongue of the head-stock, *D*, can be a tight fit, and when once set up accurately, need not again be moved.

The height of the head-stock is 10 inches, including the tongue, which is 6 inches. The running length is 6½ inches, the width being the same as the bed of the lathe, namely, 7½ inches. The V-shaped opening for the belt is 2½ inches wide, being a continuation of the section marked 2, in Fig. 17. The mortises for the wedges are spaced 1½ inches from the ends and should be cut 2¾ inches from the bearing face of the head-stock, so that when the wedges are driven home the stock will be drawn up tight. The wedges are made from hard wood, rounded along the edges and ends. They are about 6 inches long, and should have a taper of about ½ inch, likewise the mortises.

The tail-stock, *E*, is 7½ inches wide, to suit the width of the lathe-bed. The guide, *a*, is 1 inch thick by 7½ inches long. It is secured to the stock with screws, allowance being made for enabling the stock to slide, as already referred to. It is 4 inches wide, there being but one wedge. The full height, including the tongue, which is the same as that of the head-stock, is 13 inches. The location of the plates, *g*, referred to elsewhere, will depend upon the size of the bearings, *I*, shown in detail in Fig. 18.

The tool rest and clamp *F*, *G*, and *L*, can be made of either hard wood, or metal. The length of the clamp *F* is 9 inches, width 2 inches, and thickness 1 inch, the body for the rest being 2¼ inches deep. A small plate *c* is tapped for a thumb-screw *f*, about 7/16 inch diameter. *L* is an ordinary square-headed bolt of suitable length, ⅝ inch diameter, furnished with a cruciform claw, 4 inches square, outside dimensions. A metal nut, *d*, 1¼ inch square, shaped to fit the groove in the clamp *F*, is threaded to take the bolt, *L*. The rest, *G*, can be made of either metal or wood. The pulley, *H*, has a 2-inch face, and is 3½ inches diameter. It is made of hard wood, and is secured to the spindle, *K*, in the same manner as the 6-inch pulley of the saw, described in the previous article. A plate, *J*, is secured to the outside edge of the head-stock, to take the thrust coming upon the spindle, or chuck, *K*, when work is being turned in the lathe. At *M* is shown a ⅝-inch adjusting screw, with the end brought to a cone-shaped point. The plates, *G*, are tapped to suit, and are secured to the stock, flush with the outside face, with wood screws. The corners throughout the job are chamfered, and the surfaces made smooth.

The power is obtained by running a belt from the 6-inch pulley under the table of the saw, as shown in dotted lines on Fig. 13, or can be run direct from the driving wheel, by lengthening the saw belt. Should it be desired to make a foot-power lathe, a couple of bearings can be secured to the blocks *B*, and a crank shaft run through. The fly-wheel should be heavy, and a light guard should be placed around, as it will have to be on the outside to come under the head-stock pulley, *H*.

Almost any kind of wood will do for the general construction, but yellow pine will be found serviceable, and give weight to the lathe, otherwise it may be found necessary to anchor it down to the shop floor, if driven by power from the saw.

In Fig. 20 are given the changes necessary for a foot-power lathe. A blacksmith will make the crank shaft for a small sum. The wheel can be procured from almost any junk dealer. The treadle is made from two 1-inch by 4-inch strips, hinged to the back stay, and a distance piece. An ordinary staple, clinched on the underside, will do for holding the eye end of the connecting-rod, a hook being formed at the other end to slip over the crank.

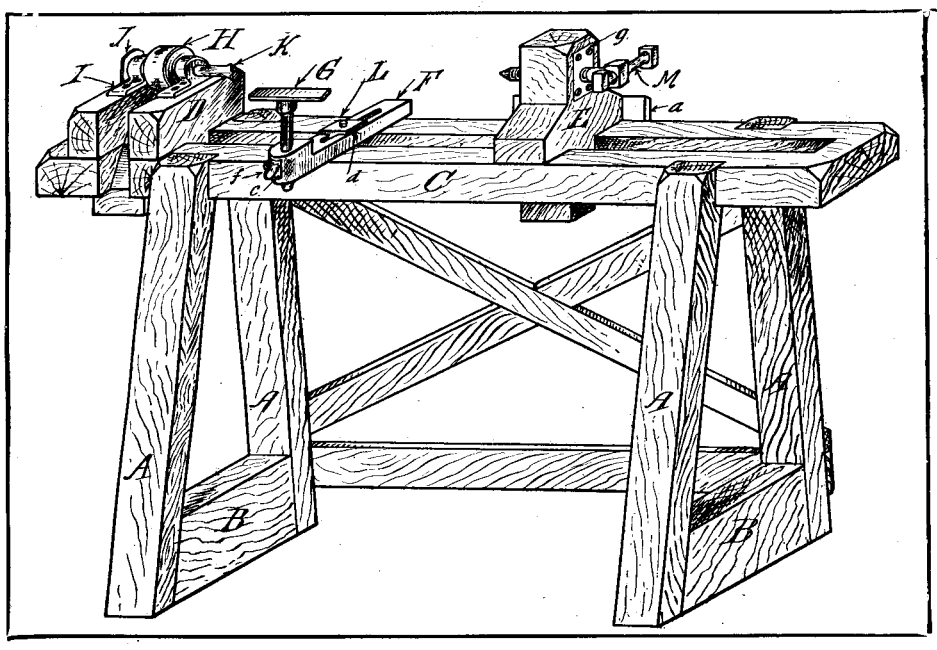


Fig. 16.—THE COMPLETE LATHE.

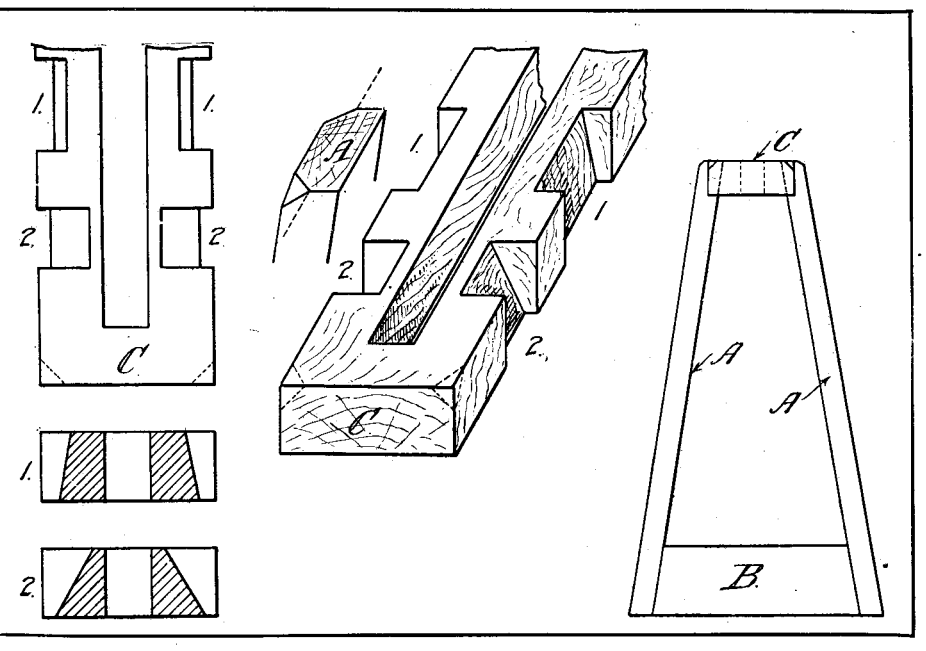


Fig. 17.—CONSTRUCTION OF FRAME.

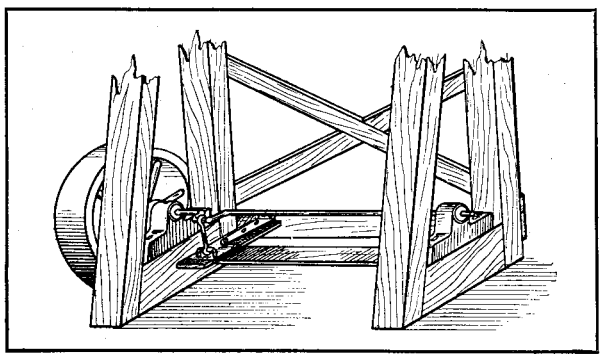


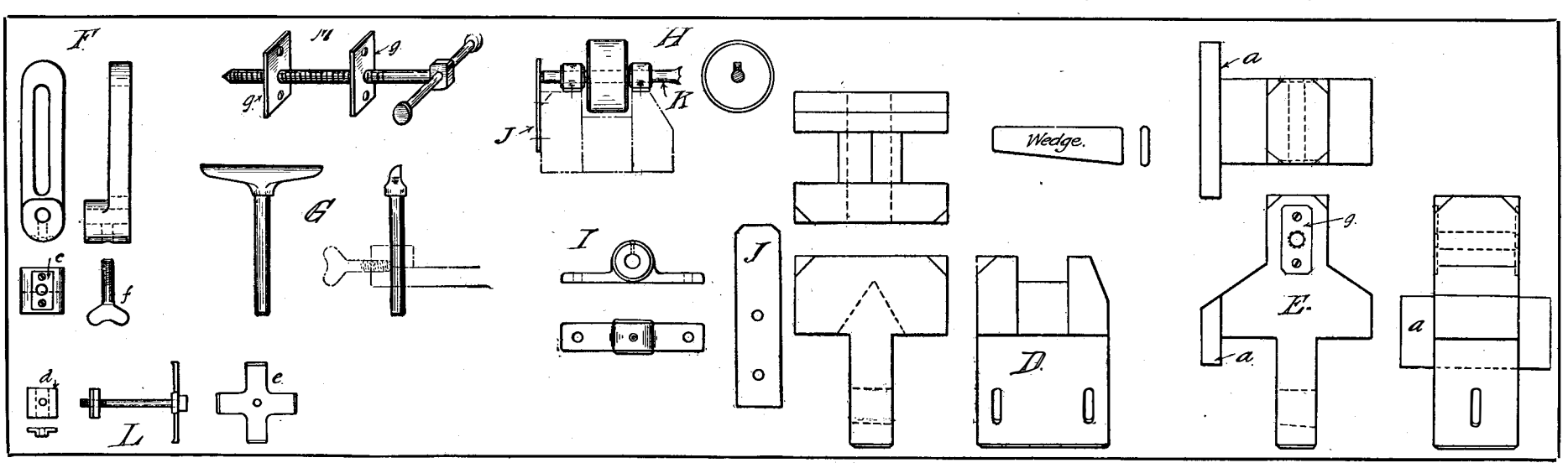
Fig. 20.—THE TREADLE MECHANISM.

CHEMICAL FLASKS FROM ELECTRIC LIGHT GLOBES.

BY K. RAGAN.

To those who work in chemistry, whether as amateurs or professionals, there is no more useful piece of apparatus than a flask. Anyone who can procure old electric light globes can make all the flasks he needs in a short time and at practically no expense. Various sizes of globes, from the small 2 candle-power to the 32 candle-power, may be used, thus giving a number of different sizes.

All the apparatus or tools needed are a Bunsen burner if gas is available, if not, a gasoline torch, and a three-cornered file. First hold the base of the lamp in the flame a few moments, until the wax holding it on is sufficiently softened to allow of pushing off the brass base with the tang of the file. Clean most of the wax off the glass, and with the file carefully make a scratch all around the glass just back of the place where the tube holding the filament is sealed in. The end will then, if struck a light glancing blow, break out, leaving a clean round hole. With



Figs. 18 and 19.—DETAILS OF THE TOOL REST, HEAD-STOCK AND TAIL-STOCK.

a little practice this can be accomplished quickly and neatly. Now hold the sharp edges of the opening in the globe in the flame until soft, and quickly, with the tang of the file, smooth down and turn out the edge into a sort of a flange, taking care to keep the hole round. When the globe has cooled, hold it with a cloth and place the large end in the flame until it softens. Then press it down on a dry board until the bottom is sufficiently flattened to make the flask "steady on its legs." The flask is now finished with the exception of annealing. When several of the flasks are finished, they should be placed in a vessel of brine and gradually heated up to the boiling point, and then set aside to cool. They can now be used in the same way as the ordinary commercial flask.

ROTAGONS.

BY E. F. PABODY, JR.

There is a class of geometrical figures possessing peculiarities which possibly have not been investigated or published before. For the sake of a title, and owing to the relation these figures bear both to circle and polygon, let us arbitrarily name them "rotagons." A rotagon is a plane figure whose perimeter is composed of an odd number of circular arcs such that each point where two arcs meet is the center from which the opposite arc may be described.

Referring to diagram No. 1, the figures *A*, *B*, *C*, and *D* show four out of an infinite number of forms which the rotagon may take. It may be observed that these figures have the same width in all directions, that the sum of the arcs equals a semi-circle, that the sum of the points of the inscribed star is therefore 180 degrees, or in other words, the dotted line and arcs represent the overlapping sectors of a semi-circle, and that these dotted lines may be conceived as link work whose limit of motion is reached in the figure *A*. When inscribed in a square or rhomb, rotagons may be conceived as turning around while remaining at all times in contact with the four sides. When regular in form, they may turn in any regular polygon

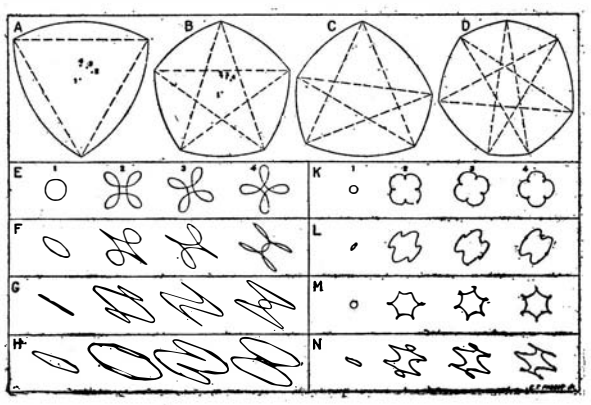


Fig. 1.—FIGURES PRODUCED BY ROTAGONS OF VARIOUS FORMS.

the number of whose sides is one more or one less than the number of arcs, and they will maintain contact with all of the sides. It follows that the same motion is possible within any combination of three or more sides of the polygon, which, if produced, will close.

The motion is complex and the complete orbit of any given point consists of a number of elements (*glissettes*) which may be either elliptical, circular, or straight. These orbits, by reason of their composite nature, are of curious and even fantastic forms. Some idea of their endless variety may be gained from the accompanying diagrams, which were developed graphically by means of cardboard models. As the figure *A* turns in a square (see Fig. 1), the points 1, 2, 3, 4, describe the paths shown in section *E*. Sections *F*, *G*, and *H* contain the orbits of the same points as the figure turns in rhombs, whose minor angles are respectively 75, 60, and 45 degrees. Sections *K*, *L*, *M*, and *N* show the corresponding curves for points 1, 2, 3, 4, in the figure *B*. When *A* revolves once in a square, its center of gravity at point 1 makes three revolutions in an opposite direction in an orbit composed of four elliptical arcs. Regular rotagons produce symmetrical orbits, but irregular figures such as *C* and *D* produce unsymmetrical orbits. That such

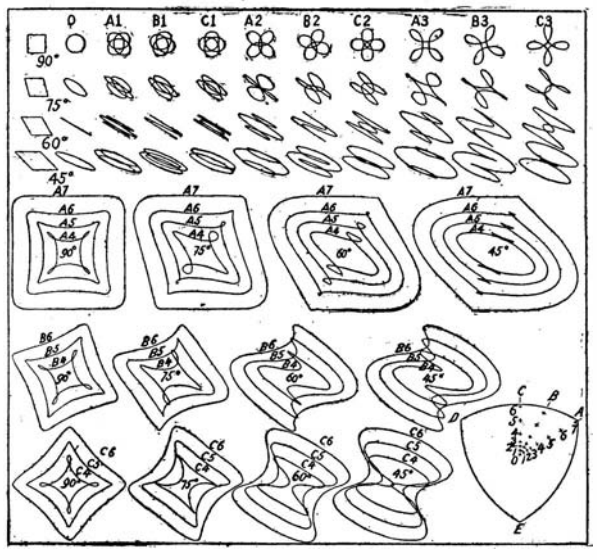
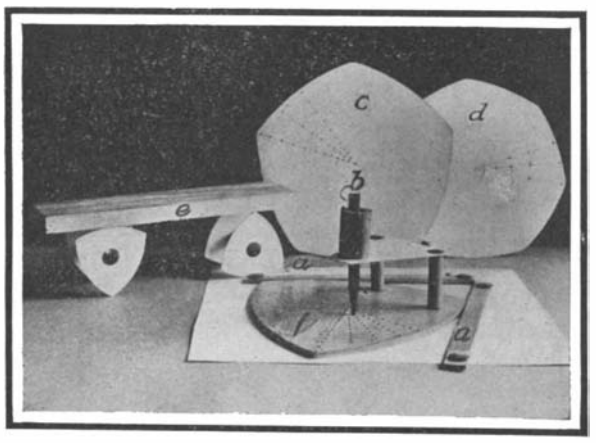


Fig. 2.—MOTIONS OF A TRIANGULAR ROTAGON IN A SQUARE AND RHOMBS OF VARIOUS ANGLES.



ROTAGON APPARATUS FOR PRODUCING GEOMETRICAL FIGURES.

complex and intricate motions are possible in a single moving part under such simple conditions of operation, seems almost incredible until one has made the experiment. There is a singular grace and beauty in some of the curves, which suggest possible adaptation in the field of decorative design.

Diagram No. 2 shows more fully the motion of the triangular rotagon. Twenty points are taken in the figure *DAE*, the point *O* being at the center and points 1, 2, 3, etc., being on the three axes *A*, *B*, and *C*. Each point and its corresponding orbit is indicated by the axis letter and the number of the point on that axis. The orbits marked 90 degrees are described by these points when the rotagon moves in a square, and the other orbits are developed by turning the figure in rhombs, whose minor angles are 75, 60, and 45 degrees, as indicated.

In the illustration herewith, the model *f* is shown ready for operation. The weighted pencil *b* is inserted in one of the holes in the cardboard and the model is turned around by hand and at the same time kept in contact with the guides *aa*, which may be set at any angle. As the motion is determined by two contact points, the other two sides are unnecessary. The model used is about six inches in diameter, and from the orbits drawn by the pencil, free-hand ink tracings were made in order to facilitate reproduction in the accompanying cuts. This accounts for some roughness in the curve, which does not exist in the pencil drawings. Five-sided and seven-sided models (*c* and *d*) are shown in the illustration, and also a piece of wood *e* resting on "three-cornered rollers." When set in motion *e* travels in a straight line, exactly as if supported on cylinders, while the motion of the supports is alternately circular and cycloidal. The same motion would follow with any other form of the rotagon. To most persons it will come as a surprise to realize that a cylinder is not the only form of roller which will impart straight-line motion to a supported body.

The rotagon may possess little interest for the mathematician and may be without value in the realm of mechanics, but its properties are so unique and the infinite variety of its fixed motions is so startling that it becomes worthy of investigation, even if regarded only as a scientific toy.

NOVEL HEAT MOTOR.

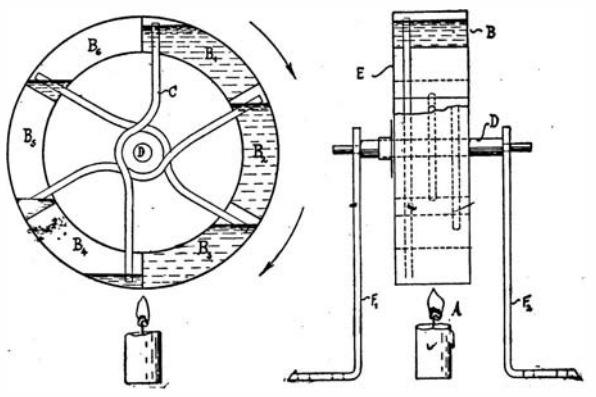
BY R. V. HEUSER.

Owing to the fact that water in liquid form is nearly incompressible, it cannot be used to perform a cycle of operations such as take place in the steam engine. Theoretically, however, any substance having a temperature above its surroundings is capable of serving as a power generator. Disregarding the possibility of thermo-electric conversion of energy, useful mechanical work can be derived through the expansion of vapors of volatile substances. Many liquids are known to pass into vapor under a feeble heat, such as, for instance, the sun's rays.

If other media than water are used as heat carriers, it becomes indispensable to recover the original liquid by means of condensation for economic reasons.

A simple apparatus, which can be made by the Handy Man, will demonstrate that a very small degree of heat is sufficient for performing light mechanical work.

A disk *E*, mounted on shaft *D*, serves as support for six compartments, B_1, B_2, . . B_6, concentrically arranged about *D*. These as well as the disk can be made of tin soldered together. Two opposite chambers, for instance, B_1 and B_4, are connected by a small brass tube *C*, bent outward at the center to clear the shaft *D*, and projecting through the chambers nearly to the outer cylindrical wall. Two uprights, F_1 and F_2, support the wheel at a proper distance over a small flame *A* or over a basin filled with hot water. One of each pair of chambers is filled with ether or acetone, while the other contains only the vapor of the liquid in an expanded state, but no air at all. The liquid is introduced into the chambers through small holes, and after the air has been blown out (by heating this



A SIMPLE HEAT MOTOR.

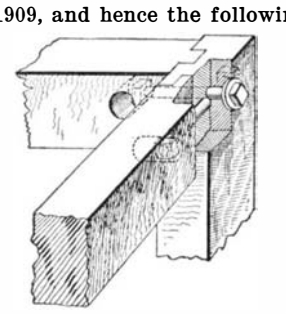
liquid to the boiling point) each hole is sealed with a drop of solder.

Evidently, when one chamber passes through the hot zone, the liquid vaporizes and passes through the tube to the opposite chamber where it condenses. Thus the center of gravity is constantly changed, causing the wheel to revolve.

ANOTHER JOINT FOR HANDY MAN'S WORK BENCH.

BY CHARLES LURCOTT.

The joints of a work bench are sure to work loose in time, and it is important that they be constructed in such a way that they may be tightened from time to time. No such provision was made in the bench described in the Scientific American for December 19th, 1908, or in the joint described in the issue of February 6th, 1909, and hence the following suggestion



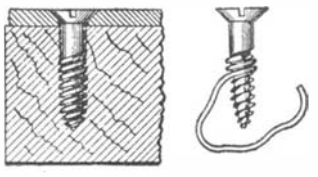
A JOINT FOR THE WORK BENCH.

may prove of value. The construction is one that the writer has used with perfect satisfaction for years. The frame of the bench is made of 2 x 3 inch sticks. Sockets are cut in two adjoining faces of the post to receive the tongues formed on the horizontal sticks of the frame. The sockets are made deeper than the tongues, so as to permit of adjustment. A hole is bored through the post and endwise into one of the horizontal sticks through the tongue. A bolt is fitted into this bore and is screwed into a nut which is introduced into the stick through a transverse hole. In the same way the other stick is secured to the post, care being taken to have the second bolt hole at a different level so that it will clear the first one. The bolts can be drawn up very tightly, so as to make a firm joint. When the joint works loose it can be tightened up with a wrench in a moment's time.

A REMEDY FOR LOOSE WOOD SCREWS.

BY G. W. NAYLOR.

A convenient method of making a loose screw hold is illustrated herewith. Take a soft piece of copper wire, and wind it around the threads of the screw as



A REMEDY FOR LOOSE WOOD SCREWS.

shown, thus in effect increasing the diameter of the threaded part. This will save plugging or using a larger screw.

HARDENING COPPER.

BY H. D. CHAPMAN.

Copper treated as follows becomes harder and tougher than commercial hard copper: Take 2 pounds of alum and 8 ounces of arsenic, and mix well. Forty pounds of copper is to be used with this quantity of alum and arsenic. When the copper is thoroughly melted the alum and arsenic are poured in the crucible, and mixed well with the melted copper. The copper is then poured, and allowed to cool gradually.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SPARK-PLUG.—G. P. B. HOYT, New York, N. Y. This invention relates to igniting devices of the make and break contact type, and its object is to provide a new and improved spark plug for use on internal combustion engines and other apparatus, and arranged to insure the production of a powerful spark with great accuracy.

COMBINATION WIRELESS-TELEGRAPHY INSTRUMENT.—J. E. OSTRANDER, Staatsburg, New York, N. Y. The invention pertains to certain improvements in instruments used in wireless telegraphy, and more particularly to an improved coherer and mechanism for use in breaking the circuit therethrough. In this instrument the passage of the current through the coherer not only operates the sounder but also controls mechanism operating to completely break all circuits passing through the coherer.

Of Interest to Farmers.

AGRICULTURAL IMPLEMENT. — W. WRIGHT, Brookside, Ala. One purpose of the inventor is to provide an agricultural implement that may be used as a cotton chopper and also as a field or garden hoe, capable in light or garden work of being pushed by the operator without interfering with the free use of the hands, and which when used for field or heavy work can be drawn by one or more draft animals.

CULTIVATOR.—A. C. NEWCOMER, Newburg, Iowa. The invention has for its object to provide an improvement which may be applied to the Tower or other similar cultivators. The improvement may be applied to the ordinary type of cultivator, it being only necessary to enlarge the orifice in the rake carrier. When this is done the additional parts may be assembled in place to produce the desired result.

GANG-PLOW.—W. HUBBELL and C. L. HILTON, Wilton, N. D. One purpose here is to provide a plow which in operation will clear itself from stones or similar obstacles and the plow beams whereof are free to automatically rise and fall their full length, or independently at the front or at the rear, as occasion may demand, which beams are also capable of lateral movement, being spring-controlled in all directions of their movements.

CULTIVATOR AND COTTON-CHOPPER.—H. N. HARPER, Monroe, La. This wheeled implement is of the general type of cotton choppers in which hoe carrying arms rotate in a plane transverse to direction of travel of the implement. The invention provides a seemingly efficient and simple arrangement by which the hoe arms are mounted on a shaft geared to the axle and journaled to the frame in the rear of the axle, the frame being adapted to be raised and lowered by a lever.

INSECT-DESTROYER. — J. A. HAEFELE, Rogers, Ark. In this patent the improvement provides a means for catching the codling moth, canker worm moth, plum curculio, tent caterpillar, and other orchard insects. The lamp is placed in the orchard. The intense light attracts the moths, which fly toward it. Those that strike the chimney or flue fall into the oil, and others are attracted by the bright rays reflected from the oil, and fly thereinto and are destroyed.

Of General Interest.

HIGH-PRESSURE HOSE.—T. B. FORD, New York, N. Y. This hose is more especially designed for use with fire-fighting apparatus, and provided with an outer or a main hose, and an inner hose spaced from the outer base to allow the water flowing through the inner hose to fill the space between the outer hose and the inner hose, whereby the outer hose is subjected only to pressure and not to the friction of the moving water thus reducing wear and tear, incident to the flow of the water, to a minimum, and rendering the hose capable of withstanding high pressure and allowing replacing or repairing of the inner hose.

APPARATUS FOR STORING AND FEEDING HYDROCARBON LIQUIDS.—J. B. EVANS, Selma, Ala. This apparatus is for use in storing and feeding hydrocarbon liquids, especially such volatile liquids as gasolene used as a motive agent in internal combustion engines. The loss by evaporation is not appreciable and the danger of explosion materially lessened, also such water as the gasolene contains when introduced in the tank is separated therefrom.

APPARATUS FOR STORING AND DISPENSING HYDROCARBON LIQUIDS.—J. B. EVANS, Selma, Ala. The invention is an apparatus for storing and dispensing hydrocarbon and such volatile liquids as gasolene. The tank is at all times kept filled, whereby evaporation of liquid is substantially prevented and the danger of explosion practically eliminated. It is for use of retailers, garages, etc., more especially where water pressure supply is not obtainable or convenient.

APPARATUS FOR DISPENSING HYDROCARBON LIQUIDS.—J. B. EVANS, Selma, Ala. The object of the invention is to provide, in connection with a suitable tank supplied with liquid pressure, as water, a gasolene tank for measuring off and discharging a predetermined quality of the hydrocarbon liquid, the same being introduced into the measuring tank by the passage of the water therefrom into the reservoir, and being expelled by the water pressure in the reservoir.

BRUSH.—K. WATANABE, Seattle, Wash. The invention relates to flexible brushes, and has for its principal object the production of a brush adapted to be flexed in one direction to conform itself to the curvature of the object to which it is applied, but so constructed that it will automatically return to its normal position to form a straight line brush.

PROCESS FOR PRODUCING ELECTRO-DEPOSITS WHICH CAN BE REMOVED FROM THEIR BASE.—H. SCHMIDT, Cologne, Germany. The improvement is in the production of electrometallic deposits, which can be readily removed from their base (cathode) and is characterized by anodically polarizing the base in the electrodepositing bath by an electric current whose electromotive force is such as not to produce a visible change of the base whereby there can be produced metal sheets or foil, having glossy surfaces without burnishing. It can be employed to produce metal foil in an endless strip and hollow bodies.

GUN-SIGHT.—C. H. TESSEY, Leadville, Col. More particularly the invention relates to such sights as can easily be attached over the ordinary sights as aids in shooting in poor light. It provides a serviceable sight which can easily be fitted over the ordinary sight, and which has means for rendering it luminous in the absence of strong daylight.

PAINT-POT.—J. C. ROSE, Hickory Valley, Tenn. The improvement is in painters' buckets or pots, having for its purpose suitable heating means in connection therewith to keep the paint hot at the time it is applied, the construction of the pot being such as not to interfere with carrying it about or using same in the ordinary manner.

CEMENT.—T. JONES, Acme, Texas. The object here is to produce a material of the general nature of so-called Keene's cement, the product being a material of the highest grade and excellence and made by the most direct method and at the least possible expense. Only one calcination is employed. The plasticity and ultimate hardness of the product are brought about by chemical substances added together.

GAGE-COCK.—A. H. JETTINGER, Delphos, Ohio. Any corrosion or other foreign matter may be removed from this cock or repair made to the valve while the pressure is on the boiler. It is preferably constructed of two plugs or shells, each having a valve seat, and one of them provided with a hollow stem carrying a valve adapted to seat on the seat of the other plug. The plug having the hollow stem, which is the outer one, has the usual opening for the discharge nozzle and carries the customary valve for controlling communication through the hollow stem and opening.

HITCH-STRAP HOLDER.—B. K. HENDRICKS, Mendon, Ill. This device may readily be secured upon a saddle, or on the driving harness for a horse, and afford convenient reliable means for quickly securing the free end portion of a hitch strap or halter in doubled condition on such a support, when the strap is not in use, and thus dispense with the need of tying the strap in or upon a terret ring or like projection from the harness, when the animal has been released from the hitching post.

BOTTLE CASING AND CLOSURE.—D. A. WILLIAMS, Represa, Cal. This improvement is in bottles for catchup and the like, and consists in a construction whereby the bottle is protected and concealed by an ornamental casing, and whereby the casing cannot be removed without disfiguring it or breaking the bottle. The casing carries a closure for the bottle to take the place of the cork which is removed at the time the bottle is inserted within its casing.

BOTTLE SEAL AND CLOSURE.—D. A. WILLIAMS, Represa, Cal. The aim in this case is to provide a casing for covering the entire bottle, the upper portion of the casing forming a sealing cap covering the cork and holding the latter in place. The cap is so secured to the bottle neck that it cannot be removed without breaking the bottle or cutting the cap, and the cap is so secured to the cork that upon the cutting of the former, the cork and separated portion of the cap may be removed together.

CUSHIONING DEVICE FOR CRATES AND OTHER PACKAGES.—J. STEINBUCH and L. KAUFMANN, New York, N. Y. The object of the invention is to provide a new and improved cushioning device for use in such packages, to securely but yieldingly hold the vessel to prevent breakage thereof while in storage or in transportation, and to allow convenient insertion and removal of the vessel from the package.

DIE FOR PRESSING BRICKS.—C. E. SIMPSON, Portsmouth, Ohio. In this instance the object is the provision of means for forming an improved die, and a construction for the die which will enable the liners or liner plates to be reversed after one side becomes worn. In this way the inventor substantially doubles the period of usefulness of the liner plates.

DENTAL INSTRUMENT.—R. H. GALLAGHER and R. E. DUTCHER, Plainview, Neb. The object here is to furnish a device for extracting the roots of teeth, in which a firm hold may be secured upon the root without danger of splitting the latter. The device does not require a preliminary cutting action in order to secure a good hold upon the tooth, and in which therefore, the suffering occasioned by the use of the instrument is eliminated.

APPARATUS FOR MINING GOLD AT THE BOTTOM OF FLOWING STREAMS.—L. F. GILMAN, Sacramento, Cal. This invention pertains to placer mining for gold, and has for its object to provide a novel method and means for automatically removing water from within the dam, for exposure of the inclosed bottom soil, and thus enable the excavation of gold bearing sand and gravel.

PNEUMATIC FLOATING DOCK.—J. LÖFFELHOLZ, Sterkrade, Germany. The present invention has reference to the type of floating dock, in which air is compressed in chambers, reserved for that purpose in the pontoon and side walls, by means of water entering those chambers from below while the dock is being submerged. The air is afterward utilized, so as to save power in the working of the pumps while raising the dock.

Hardware.

REAMER.—A. FISCHBACH, Tonopah, Nev. This reamer is durable and inexpensive to manufacture. The cutter can be mounted upon an ordinary reamer spindle and employed in the usual manner, and it can be used for reaming out the wrist pin holes of locomotive cross heads or side rods, without taking down the cross heads or side rods.

COLUMN-CLAMP.—J. E. LANGFORD, Ottumwa, Iowa. This invention refers to the manufacture of wooden stave columns, and its object is to provide a column clamp, arranged to securely bind the freshly glued staves or sides of the column together, until the glue has set and hardened and the column is ready to be turned in a lathe.

LOCK.—G. H. PINGS, New York, N. Y. The invention relates to locks and particularly to that type employed on bags, satchels, dress suit cases, and light trunks. These locks usually comprise a hasp which is adapted to snap into engagement with the lock. It comprises a sliding button which may release the hasp, unless the key has been applied to lock the hasp in position.

Heating and Lighting.

SUPERHEATER.—S. MUNSON, Fowler, Col. The special object of the present invention is to avoid leakage of steam from the superheater, by eliminating the separate tubes and the front and rear headers shown in a former patent granted to Mr. Munson. The superheater can also be used in stationary boilers.

WATER-GAGE.—L. KAPLAN, Clinton, Conn. One special object in this case is to provide an improved form of magnet, having the float and weight carried thereby so disposed as to reduce the strain upon the pivot of the magnet and permit a free movement. A further object is to provide a controller for the magnet, so designed as to prevent rapid movement of the magnet during rapid variations in the water level.

SHIELD AND BURNER.—N. B. CREIGHTON, New York, N. Y. The invention pertains to reverberatory furnaces and ovens using hydrocarbon fuel, and its object is to provide a shield and burner, arranged to permit of conveniently opening and closing the burner entrance of the furnace or oven, and to simultaneously operate the hydro-carbon burner in unison with the shield.

Household Utilities.

REFRIGERATOR.—G. M. WALKER, Lincoln, Neb. More particularly the invention refers to a special construction whereby the storage or provision compartments may be cooled either by the continuous circulation of a stream of water in the water jacket surrounding the compartments, or may be cooled by the use of ice, the drip water from the ice passing through the jacket.

Machines and Mechanical Devices.

SHAFT-ALINER.—A. S. CHURCH, Bath, Mich. Means are provided in this invention for supporting shafts, and holding them in proper alinement while the bearings thereof are being babbitted or adjusted. The support is capable of attachment to various sized shafts and to hold them in any desired position in respect to a wall, ceiling, or other stationary body.

REVERSING-PULLEY MECHANISM. — J. DARLING, Chicora, and J. W. CULBERTSON, Knox, Pa. The pulley is for use in connection with non-reversible engines, whether gas engines or others used about oil wells. but the invention is of use for other purposes such as various forms of machines in which it is desired to operate driving wheels or pulleys in one direction and at other times in the other direction.

VACUUM DRUM-FILTER FOR SEPARATING SOLID SUBSTANCES FROM LIQUIDS.—H. HENCKE, Kantstrasse 38a. Charlottenburg, near Berlin, Germany. Suction of the liquid from the drum filter or its chambers is effected at a place located in the interior of the drum. By this means the suction effect is distributed more uniformly over the surface of the drum and thus produces a more uniform and effective suction. Means are provided by which the drum chambers are divided into two equal halves exposed to the same suction effect.

MACHINE FOR REGISTERING COMMERCIAL TRANSACTIONS BY DOUBLE ENTRY.—M. PIONZIO-CAVAGNINO, Turin, Italy. This machine registers commercial transactions connected with a business according to the rules of double entry book-keeping. It is fitted with keys corresponding to various operations that it may be required to perform, each of which keys is connected with auxiliary devices making apparent to the operator the necessary directions for the registration of the transaction effected so that it may be duly recorded on suitable sheets of paper.

CRACKER-SANDWICH MACHINE.—H. H. OESTREICHER and A. J. CLARK, New York, N. Y. The invention relates to depositing the filler for making cracker or cake sandwiches, and it relates especially to such machines as are to operate upon a heavy, sticky filler substance, such as marshmallow. In the practical operation of such machines, on account of the sticky, pasty nature of the marshmallow, it is difficult to form the fillers for the sandwiches from the mass of marshmallow in the feed reservoir.

MAGAZINE TALKING-MACHINE.—C. E. KRUEGER and W. H. KRUEGER, Minneapolis, Minn. The invention relates to talking machines, the purpose being to produce a device in which a large number of distinct operations are performed automatically, so that the machine requires a minimum of attention. One advantage is that certain parts of the machine may be thrown out of action at will so that the records may be changed automatically, a single needle being used to operate upon all of the records in succession.

SHIP'S DAVIT.—E. W. MYERS, Port Tampa, Fla. This davit is simple and durable in construction, easily manipulated, and arranged to allow of conveniently raising the boat from the water and placing it in a position of rest on the deck of the vessel, and to permit swinging the boat clear of the chocks and lowering it at the side of the vessel, and controlling the lowering from the boat.

ROAD-MACHINE.—M. M. SICKLER, Buffalo, N. Y. The purpose of the invention is to provide a road scraper which may be made very light and strong, and advantageously used upon mountain roads. Another purpose is to provide means for steering the machine under ordinary conditions, and auxiliary means that act in conjunction with the main steering means, enabling the machine to turn sharp corners or curves, since it can be turned practically in its own length.

EGG-PACKING MACHINE.—H. H. STORY, Butte, Neb. The means provided in this instance assemble a number of eggs transferred from a container in bulk, to nest with a standard packing cap. The objects are first, to provide a means of transferring a quantity of eggs in bulk to a numerical container, whereby facility is afforded in dealing them out to a purchaser in number; and second, to facilitate their packing for transportation and insure their protection against breakage.

ATTACHMENT FOR WOODWORKING-MACHINES.—E. SODERGREN, New York, N. Y. The invention is an improvement in attachments for wood-working machines particularly variety molders having a revoluble vertical cutter, and has for its purpose to provide an adjunct to such devices by which moldings, panels, etc., can be cut rapidly and with accuracy without requiring any particular skill.

MACHINE FOR BRUSHING FELT.—J. B. WOLFSDORFF, New York, N. Y. The invention pertains more particularly to improvements in machines for brushing that type of felt employed in the manufacture of hats. The object is to provide means whereby a plurality of circular pieces of felt may simultaneously be brushed while in a moistened condition.

ROPE-MEASURING MACHINE.—A. HALLY, New York, N. Y. The invention relates more particularly to that type of machine designed for measuring rope or the like, as it is unwound from the spool and sold. One of the main objects is to provide improvements in the detail mechanism, whereby the dial may be set back to zero without necessitating the rotation of the measuring wheels in the reverse direction.

AUTOMATON.—C. W. CLARK, New York, N. Y. The invention has reference to certain improvements in automatons or mechanically-operated dummy figures, and relates more particularly to the mechanism for oscillating the head and eyes of the figure. The figure is adapted for use as an advertising medium and may be placed in store windows or where it is desired to attract attention of passers by.

CAGE-LOCK.—J. W. UNGER, Christopher, Ill. In operation the car is run onto the platform, which may be provided with tracks for this purpose, and hoisted to the top of the shaft. When in position for dumping, the treadle is engaged and depressed by a trip to withdraw the dogs or bolts, and the handles are grasped to tilt the frame. After the car is dumped the frame returns to its normal position by gravity.

FRICTION-CLUTCH.—A. N. WOODS, Corvallis, Ore. The clutch is for use in traction engines and other machines, and arranged to permit convenient manipulation on the part of the operator for throwing the clutch in or out of gear, to powerfully transmit the motion of the driven shaft to other machinery and to insure long life to the working parts.

MACHINE FOR PERFORATING PAPER.—M. M. LINDSAY and J. W. HEDGEPETH, Ripley, Tenn. In this machine instead of providing punches or the like for forming the perforations, the invention provides a plurality of drills, and so construct the machine that the drills are operated simultaneously. The paper

is rigidly clamped to a support and said support may be moved toward and from the drills and also in the direction of the length of the row of drills.

MACHINE FOR MAKING CELLULAR BOARDS.—S. M. Langston, Camden, N. J. The invention pertains to improvements in machines for making cellular board or double-faced corrugated paper, and relates more particularly to a machine for applying the second facing sheet to the single faced corrugated paper and subdividing the resulting product into sections.

APPARATUS FOR LAUNCHING TORPEDOES UNDER WATER. A. E. Jones, Fiume, Austria-Hungary. The improvements are in movable shutter apparatus for use in launching torpedoes beneath the level of the water through the sides of a vessel in movement, and it relates more particularly to the arrangement of the shutters forming the torpedo support, their locking, opening, and closing mechanism.

Pertaining to Recreation.

TOY PISTOL.—J. Darling, Chicora, Pa. The improvement is in toy pistols and has for an object the provision of a novel construction of pistol adapted for shooting marbles or similar spherical missiles. Ratchet teeth pressed by a spring engage with the hammer which latter when released by the trigger projects the missiles which may be of different sizes.

Prime Movers and Their Accessories.

STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.—A. C. Wells, Amityville, N. Y. This invention refers to certain improvements in devices for use in controlling the starting crank of an internal combustion engine and for detaching the crank from the engine in case of a "back fire." The device is made up primarily of two main members, one non-rotatably mounted, the other rotatable with the starting frame.

Pertaining to Vehicles.

FENDER FOR ELECTRIC CARS AND OTHER MOTOR-DRIVEN VEHICLES.—A. Flandes, Mexico, Mexico. The objects of the invention are: to obtain a safety device that will prevent any obstruction passing under the wheels of the vehicle, thus removing all danger, and, to obtain by the means of the same mechanism, a brake which will act effectively as an auxiliary brake to the vehicle so as to stop the same in the shortest possible time without causing shock.

LOCKING DEVICE FOR SEAT-GUARDS.—S. E. Jackman, New York, N. Y. The invention relates to locking devices for seat-guards used on cars, boats, and like vehicles, such as are run on inclined pleasure railways and such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Jackman. The object is to provide a device, arranged to prevent passengers in a vehicle from tampering with the guard thereof during the ride.

ROAD-DRAG.—E. J. Mills, Webb, Iowa. The purpose of the inventor is to provide an economic machine of light draft that will effectually gather the earth from the sides of the road and distribute it at and in the direction of the crown or center of the road, thus building the road up in the most approved manner.

TIRE-BOLT.—J. M. Fellows, Burlington, Ind. An object here is to provide a bolt which has a recess therein to contain substances such as oil, grease, or the like, and which is formed to permit these substances to come into contact with the wood of the felly. Also to provide a bolt for securing a metal tire on a felly, the end of the bolt engaging a recess in the tire and thus obviating the necessity of providing an opening through the tire and a bolt head countersunk therein.

TRUCK.—W. E. Kastendike, New Market, N. J. The invention comprises means for raising a load directly from the ground, by aid of a windlass, and then drawing the weight up an incline carried by a vehicle, so as to facilitate the storing of the load within the vehicle body, and further comprises a carriage movable relatively to the vehicle, and means for locking the carriage relatively to the vehicle body, and also locking the cord for raising the weight firmly in relation to the carriage.

VEHICLE-TIRE.—B. Ross, Buffalo, N. Y. This invention provides details of construction for a vehicle tire whereby great resilience is had by the tire, due to the joint employment of a hoop of suitable material, and novel reinforced means coacting therewith, which adapt the improved tire to have superior elasticity, uniform expansion, and great durability.

Designs.

DESIGN FOR A SHAVING BRUSH.—J. L. Erskine, New York, N. Y. In this ornamental design for a shaving brush, the upper part of the handle slopes to the middle part which includes a bird claw grasping the round part of the remainder of the handle which holds the bristles. Mr. Erskine has also invented another design of a shaving brush which comprises an ornamental handle, the tapered end of which ends in an ornamental fan shaped design.

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

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

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

(12058) W. H. S. asks: A says that the outside rail of a railroad curve is not any longer than the inside rail. He claims that the wheel of a car strikes the inside first and leaves it last, making no difference in the length of the two rails. B says there is a difference. Who is right? A. There is no doubt at all that the outer wheels of a railroad car or any other vehicle travel a greater distance than the inner wheels in rounding any curve. It is for this reason that automobile rear axles have to be provided with a differential gear for turning much sharper corners than those of railroads at a high rate of speed. The difference between the distance traveled by inner and outer wheels on railroad cars is much smaller, and is provided for by slip, but on any curve the outer rail can be shown by measurement to be longer than the inner.

(12059) O. B. asks: Suppose that some salt whose temperature is 0 deg. C. or lower were mixed with some broken ice or snow whose temperature is 0 deg. C. or lower when nothing near by has a temperature higher than 0 deg. C., would this mixture then act as a freezing mixture, i. e., could the salt melt the ice and the resulting water dissolve the salt, thus making the finish temperature lower than at the beginning? A. Salt and ice will melt each other at any temperature above —22 deg. C., but ice lying in air will not melt at any temperature below 0 deg. C. This answers your question as to ice melting salt below 0 deg. C. You have yourself doubtless seen salt put upon icy sidewalks to melt ice in weather when the thermometer was many degrees below freezing in the air above the walk, and ice all about was dry and solid. The temperature —22 deg C. is the lowest possible temperature to be obtained with a freezing mixture of ice and salt. For the discussion of this point see Watson's "Text Book of Physics," under Freezing Mixtures. We send the book for $3.50. 2. Is there any reason for the early electricians or scientists having called the electrification on glass, caused by rubbing it with silk, positive instead of negative? A. The name vitreous was originally applied to the electricity with which glass was charged after rubbing it with silk, and resinous was applied to the electricity with which sealing wax was charged when it was rubbed with woolen. These names were based upon the theory that there were two kinds of electricity. Franklin proposed the theory that there was but one kind of electricity, which either was in excess or was deficient in a charged body. These states he called positive and negative, and as a result we have the names to-day, although the one-fluid theory is no longer held by scientists. Why he designated vitreous electricity as plus we do not know. The names could have been oppositely applied just as well. 3. How can I measure the hot resistance of a 110-volt incandescent lamp without using the voltmeter-ammeter method? How can I measure it with the Wheatstone bridge, for instance? A. We do not know any way to measure the resistance of an electric lamp while hot by using the Wheatstone's bridge. You do not, however, require an ammeter to make the measurement. A voltmeter alone will suffice. The method is known as the Fall of Potential Method. Place a known resistance, say one ohm, in series with the lamp. Measure the drop of potential across the terminals of the one-ohm coil and also across the terminals of the lamp with the voltmeter. The resistances will be proportional to the drops of potential; or V of coil : V of lamp = R of coil : R of lamp. 4. Ordinary charcoal sticks are such poor conductors that they cannot be used for an arc light. How can I treat them so that I can use them for that purpose? Is there any special kind of charcoal sticks that will serve the purpose? A. Sir Humphry Davy first formed the electric arc by using sticks of dense charcoal, and before the days of arc lighting the editor performed the experiment for his classes in the same way. Last year he used his old apparatus to show what an advance had been made. Hardwood or even fine willow charcoal may be used for the arc. A piece a half inch through will answer perfectly. 5. A direct current of from 400 to 500 volts may be used for the so-called water-pail forge, also for the purpose of arc welding. What other interesting experiments can be performed by means of such a current? A. The water-pail forge does not require 400 to 500 volts. We frequently use it at the usual voltage of the outside wires of the Edison circuits, 220 to 230 volts. We do not know any experiments for so high a voltage especially. We should not bring so high a voltage to the lecture table. 6. A double convex lens has a radius of curvature of 2 inches, is ¼ inch thick, and has an index of refraction of 3/2. The principal focus of such a lens is said to coincide with the center of curvature. In constructing a diagram to represent the section of this lens I use radii of 2 inches, letting them overlap ¼ inch, and I wish to locate, in the diagram, an object, say an arrow, at twice the focal distance from the lens and then determine in the usual manner, by construction, the position, size, etc., of its image which, I understand, should be real, of the same size as object, inverted and at twice the focal distance from the lens. Should I place the object 4 inches from the farthest face, 4 inches from the nearest face, or 4 inches from the optical center of the lens? If the object is properly placed and the construction correctly done, should the object and image be four times the focal distance apart, or more, or less? A. The image of an arrow which is placed at twice the focal distance from a double convex lens of 2 inches focus will be at 4 inches from the optical center of the lens and on the side remote from the arrow. The distances for both the arrow and its image are to be measured from the center of the thickness of the lens, that is, from the optical center, and not from the surface of the lens. In your case the object and its image will be 8 inches apart, four times the focal length of the lens. 7. Please give dates or number of papers or Supplements in which I can find designs of transformers which may be used to step down 110-volt a. c. I wish to make such a transformer of 150-watt capacity, more or less, and so arranged that I can get different pressures, as 100, 90, 80, 70, 60, etc. A. You will find the plans for a step-down transformer, from 110 volts to 10 volts, in Supplement No. 1572, price ten cents. You can take out loops from the secondary so as to get any intermediate voltages you may desire.

(12060) W. J. M. asks: We are having a good deal of trouble in this immediate vicinity getting water. It seems as though the water is hard to find at a reasonable depth, say below 100 feet, and from that depth on we strike what is called "shale," that is supposed to vary in thickness from 200 to 1,500 feet in thickness. I was referred to you by the American Carpenter and Builder, of Chicago, Ill. They spoke as though you could give some information as to what I would like to know. They spoke as though there were German scientists that had some method of locating water underground. I would like to know whether there are, and where the instruments could be got, if they are to be got. I wish you would give me full particulars in regard to the matter as soon as you possibly can. A. We do not know of any instruments for detecting the presence of underground water, except one of the nature of a microphone, by means of which the flow of underground streams may be heard, but not, we should say, at such a depth as you mention. There are many professional water finders who profess to be able to detect the presence of water underground by means of witch-hazel or other divining rods; and in the course of the centuries in which they have operated, their successes have been too numerous to be explicable altogether by coincidence. There is, however, no scientific explanation of their methods or results, and it is our opinion that any success they may achieve is due more to some capacity in the man—some sort of sixth sense less developed in the rest of us—than to either the instrument or the method. We know nothing of the company you mention, but there is no reason at all why a magnetic needle, either compass or declination, should be affected by underground water, except where the latter occurred with mineral. Large bodies of iron ore affect the compass needle, but the most that can be said is that they render its movements erratic; it is quite unreliable in accurately locating them.

(12061) O. J. W. asks: What is there actually known about the moon? Have any of the powerful telescopes that are used to explore the mysteries of distant stars been turned upon our satellite, and with what result? Is there a late scientific work on the subject? A. Much is known about the moon, more than is known of any other heavenly body. It used to be said that we knew the moon's surface, the heights of the mountains there, better than we knew any country on the earth. But we think this is somewhat of an exaggeration. Any book of astronomy will give many of the facts known about the moon. Pickering's "The Moon," price $10, is the latest book on the subject. It appeared very recently.

(12062) G. B. T. asks: Is ¼-inch copper wire with three groundings large enough for lightning rods on a barn 80 x 40 feet? A. We should not advise the use of copper as a lightning rod on any other ground that that it will not rust out so rapidly. A No. 4 galvanized-iron wire will act just as well or better, electrically, and cost very much less. You would do well to send 10 cents to the Weather Bureau, Washington, D. C., and get the publication, "Recent Practice in the Erection of Lightning Rods," in which you will find much of interest.

(12063) M. M. T. asks: An article was published in the Scientific American on September 22nd, 1906, that has only recently come to my attention. This article states it has been discovered that hair which has turned gray, after being exposed to the X-ray has been restored to its natural color. This interests me very much, and I am most anxious to learn more about the subject. Could you put me in communication with the writer of the article, or anyone else to whom I could write for information? A. The article to which you refer states that certain changes of color have been noted in persons' hair under the action of Roentgen rays. We do not know who wrote the article. It was reprinted in our columns from the French journal l'Illustration as a matter of news. The article concludes with a warning against the careless use of the rays for such a purpose. We must emphasize that warning, and say that any such use of the rays would be exceedingly dangerous and should not be undertaken. A prolonged exposure of the head to their action would very likely produce most serious consequences.

(12064) W. D. A. says: The explanation to question 12033 in March 27th issue of Scientific American does not seem correct. According to your explanation, the board would be placed so that its long edges would be parallel to the diagonal of the room, which would not give the longest length of board. I am interested in your explanation of the above problem, as I have been for some time looking for a solution to a similar one. The dimensions being a 10 x 5 foot room, to find the longest length of 3 feet width carpet with square ends. A. Your criticism of the answer to the problem in Query 12033 is well taken. The matter illustrates the difficulty of looking after the hundreds of questions which come to our desk each week. No one can remember or look after them all, and in going to different hands, different views may be taken by different persons. This problem of a board to be laid upon a floor comes up to us very frequently. It received an exhaustive answer in Query 10486, Vol. 96, No. 13. You will there find the general solution, in which any numbers whatever may be substituted, and the lengths of boards for any sized room whatever may be calculated. This will solve your problem for you. We thank you for calling our attention to the matter.

(12065) H. K. L. says: I have seen the statement that a room in which the air is fresh will heat much more quickly than one in which the air is bad. Will you kindly tell me if this is true, and if so, what the scientific reason is? I should also like to know if experiments have proven how much more quickly, proportionately to the size of the room, the fresh air will heat. A. Carbon dioxide, the commonest impurity in air, produced equally by respiration of human beings and animals and a combustion of a gas flame or other fire, has a slightly lower specific heat (or more accurately, co-efficient of thermal capacity) than pure air. That is to say, a given volume of it requires slightly less heat to raise its temperature by a given amount. Carbonic oxide, on the other hand, another impurity, has a slightly higher specific heat. Both are, however, much heavier than air, so much so that carbon dioxide may be poured from one vessel to another like water, and any considerable quantity of it present in the air entering, for instance, a hot-air heating furnace, would require more heat, or a longer time at the same temperature, to make the air containing it rise and heat the room. As, however, the sanitary limit is generally considered to be 6 parts of carbon dioxide in 10,000 parts of air, it is not conceivable that either of the foregoing considerations will affect the heating of a room either sensibly to the body or measurably by ordinary apparatus. If there is anything in the theory you propound, its explanation is more probably physiological than physical; an increase in the impurities in the air of a room would be felt by persons in the room immeasurably more rapidly than it could be indicated by a thermometer, even though it would not directly produce a temperature effect, and if their presence alone, breathing out heated gases, were not sufficient to maintain the temperature. Increase of carbon dioxide in the air would disproportionately decrease the oxidation of waste matter by each respiration, which would not only reduce the generation of heat in the system, but would decrease the activity of circulation of the blood, and might easily be "translated" by the brain into a sensation of cold. This is the only probable scientific explanation of your theory that occurs to us, and we hope it will be sufficient for your purpose.

(12066) F. A. G. asks: 1. I am interested in wireless telegraphy, and wish you would advise through your queries column what books or Supplements would give me information as to the different systems, and what instruments will give the greatest receiving distance. A. We can supply you with Collins's "Wireless Telegraphy," price $3, Maver's "Wireless Telegraphy," price $2, and we send you a catalogue of articles of value in our Supplement, from which you can make selection of those which pertain to your subject. 2. How far can I send with a 2-inch induction coil? A. The distance to which a coil will transmit varies greatly at different times. A 2-inch coil under favorable conditions of the atmosphere will send several miles, and at another time may not send even a mile. 3. Will a Sampson battery run a coil? A. The Sampson battery should run a coil. 4. In a store battery are the materials used up like other batteries? If so, how long will they last without renewal? A. The materials of a storage battery are not consumed by use. Recharging brings them back to their former condition and gives a renewed life to the battery.

NEW BOOKS, ETC.

ADDING AND SUBTRACTING SCALE. By E. F. Chandler. New York: Sold by J. S. Barron. Price, $1.

This little computing device should be of great value in the drafting room, as it enables one to add fractions and their decimal equivalents without any mental computation. It consists of two disks, one rotatable upon the other, and each provided along its circumference with a ring of fractions running from 1/64 up to 63/64. The figures are so arranged that the sum of any two adjacent fractions on the two rings will be found on the lower ring directly opposite a slot in the upper disk. Conversely, when subtracting, the difference between any fraction on the upper disk and the fraction opposite the slot will be indicated opposite the first fraction on the lower disk. The decimal equivalents are placed radially under each fraction.

WEIGHT COMPUTER. New York: Sold by the Edge Computer Sales Agency. Price, $2.

With a view to facilitating the work of the structural engineer in designing steel structures, a simple calculating device has been invented which will enable him to determine the weights of various structural shapes. The computer consists of two disks, one rotatable above the other, and each provided along the periphery with a logarithmic series of numbers. One scale is provided for plates, and the other for angles. To determine the weight of a plate, the upper disk is turned until the figure corresponding to the thickness of the plate comes opposite the figure corresponding with the width of the plate. The weight for various lengths can then be read on the lower scale. In the same way angle beams can be computed. Other forms can be computed if their weight per foot is known.

THE AMERICAN NEWSPAPER ANNUAL. Philadelphia: N. W. Ayer & Son, 1909. 1,350 pages royal octavo; cloth. Price, $5 net.

No publication better reflects the changes which take place in the newspaper field than The American Newspaper Annual. This book aims to give the facts which an advertiser, or anyone else dealing with newspapers, needs to know, and to bring these facts down to date once each year. The book catalogues 23,894 newspapers, magazines and trade and class publications. A very valuable feature of the book is the circulation figures. When satisfactory signed or sworn statements have been made their figures are given, otherwise the editor of the Annual has estimated the circulation from the facts at his command. Supplementary to the general catalogue are lists of daily papers, magazines, women's publications, mail order publications, agricultural and religious papers, together with all the trade and class publications in their proper groupings. While the book is large and contains a vast amount of information, it is in tabulated form with everything in plain figures, which makes it very easy to get at any information desired.

THE ZONAL-BELT HYPOTHESIS. By Joseph T. Wheeler. Philadelphia: J. B. Lippincott Company, 1909. 12mo.; pp. 401. Price, $2.50.

The author seeks to demonstrate that the earth was at one time girt with belts of planetesimal gaseous matter, somewhat similar to those encircling Saturn. Not only this, but he tries to prove that such belts existed quite recently, within the memory of primitive man, and were the cause of the ice ages. A mass of evidence is presented from the myths of early peoples to show that there is some foundation for such a hypothesis.

HEAT ENERGY AND FUELS. By Hans v. Jüptner. Translated by Oskar Nagel, Ph.D. New York: McGraw Publishing Company, 1909. 8vo.; pp. 306; 118 cuts. Price, $3.

The present volume is one of a group prepared by Prof. Hans von Jüptner on chemical engineering. The volume deals with heat energy and fuels, and contains much new data that should be welcomed by chemists, metallurgists, and engineers. The book has been widely used in Europe as a textbook and hand-book, and it should be valuable here in universities and engineering schools, and among practical engineers as well.

GUIDE TO SANITARY INSPECTIONS. By William Paul Gerhard, C.E. Fourth Edition. Entirely Revised and Enlarged. New York: John Wiley & Sons, 1909. 12mo.; pp. 229. Price, $1.50.

In revising the fourth edition of "A Guide to Sanitary House Inspection," it was deemed advisable to enlarge the scope of the book by adding considerable new matter. The matter of the original book has been thoroughly revised, and there are besides a new chapter on the sanitary inspection of public buildings and another on sanitary surveys of cities and towns. A novel feature is the embodying in the text of a large number of question schedules, relating to the sanitary inspection of city residences, tenement houses, and apartments, country houses, schools, hospitals, theatres, and institutions. The majority of these question schedules have been prepared by the author and have been found useful in his practice as consulting engineer. The chief aim of this little

volume is to outline broadly the main features of sanitary inspection work. While one of its aims is to instruct the layman, the householder, the owner of tenements, the principal of a school, the superintendent of a hospital, the manager of a theater, it is believed that the book will be also useful to health and sanitary inspectors, to boards of health, to fire department officials, insurance companies' inspectors, and to architects, civil engineers, and building superintendents in general.

ALTERNATING-CURRENT MACHINES. By Samuel Sheldon, A.M., Ph.D., D.Sc., Hobart Mason, B.S., E.E., and Ehrich Hausmann, B.S., E.E. Seventh Edition. New York: D. Van Nostrand & Co., 1909. 12mo.; pp. 353; 236 figures. Price, $2.50.

This work has been so popular among students in other than electrical courses, that the authors have entirely rewritten it, so as to particularly adapt it to this class of readers. The book will be of value to engineers who are not perfectly familiar with the subject of alternating currents, but who find it necessary in their work to know something about it. Owing to practical experience with students, the authors have found that it is difficult for a young man to understand a subject without being obliged to make numerical computations. For this reason, at the end of each chapter a set of problems is given, particularly adapted to impress the subject matter upon the minds of the students.

SCIENCE AND IMMORTALITY. By Sir Oliver Lodge, F.R.S. New York: Moffat Yard & Co., 1909. 12mo.; 294 pp. Price, $2 net.

In this able and intensely modern volume, the distinguished author sums up the status of science, faith, and theology in their bearings, separately and collectively, upon religion and immortality, and it constitutes, therefore, an extremely valuable contribution to the literature of the present important crisis in modern thought. The subject is treated under these general headings: I. Science and Faith; II. Corporate Worship and Service; III. The Immortality of the Soul; IV. Science and Christianity. This work is one of immense importance in this juncture, presenting fundamental Christian doctrine from the most modern and scientific point of view.

PHOTOGRAPHY FOR YOUNG PEOPLE. By Tudor Jenks. New York: Frederick A. Stokes Company, 1908. 12mo.; 328 pp. Price, $1.50 net.

A book which presents, not only the methods of successful photography, but the reasons underlying the various processes. It gives to the practice of photography an additional fascination, and supplies the young reader with a foundation which enables him to read other photographic literature with profit instead of confusion, and to choose intelligently his camera, lens, or chemicals. Mr. Jenks describes the use of the camera, the working of its various parts, the process of negative development, toning or developing the print, and mounting. He then treats the various phases of photography separately in greater detail: exposure; what to take and how to take it; developers; the theory of development; tank development; printing papers, their working and their comparative value; lenses; and shutters. Two chapters are given to the history of photography, and another to the chemistry of photography.

THE ARTS AND CRAFTS OF OLDER SPAIN. By Leonard Williams. Chicago: A. C. McClurg & Co., 1908. Three volumes. 12mo.; 280 pp. each. Price, $4.50.

In preparing these volumes, it has been the aim of the author to give a clear and fairly complete account of the arts and crafts of older Spain. There is room for a work of this design and scope, and there is really no good reason why so attractive a group of subjects should be so persistently ignored. The first volume deals with gold, silver, and jewel work, iron work, bronzes, and arms. The second volume takes up furniture, ivories, pottery, and glass, while the third volume is devoted entirely to textile fabrics. The volumes are beautifully illustrated by well-executed engravings. The author's account of Spanish pottery is most interesting and valuable. The study of this craft in Spain is far from definite, and therefore researches and discoveries may be hoped for at some future time. The history of Spanish arms has also suffered from unjust neglect. The author has spent several years in preparing these very interesting volumes, which will prove a most welcome addition to any library, whether general or special.

VECTORS AND VECTOR DIAGRAMS APPLIED TO THE ALTERNATING CURRENT CIRCUIT. New York: Longmans, Green & Co., 1909. 12mo.; pp. 254; 114 figures. Price, $2.50.

The use of vector diagrams has become so universal, and is so convenient a method of expressing relationship in alternating-current circuits, that a book on vector algebra is almost a necessity. The present work takes the system worked up by Mr. C. P. Steinmetz, changing it slightly to avoid complexity, and goes into the algebra of the subject. The work presupposes a thorough knowledge on the part of the reader of electrical engineering to the extent reached by a student in his third college year.

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