SCIENTIFIC AMERICAN

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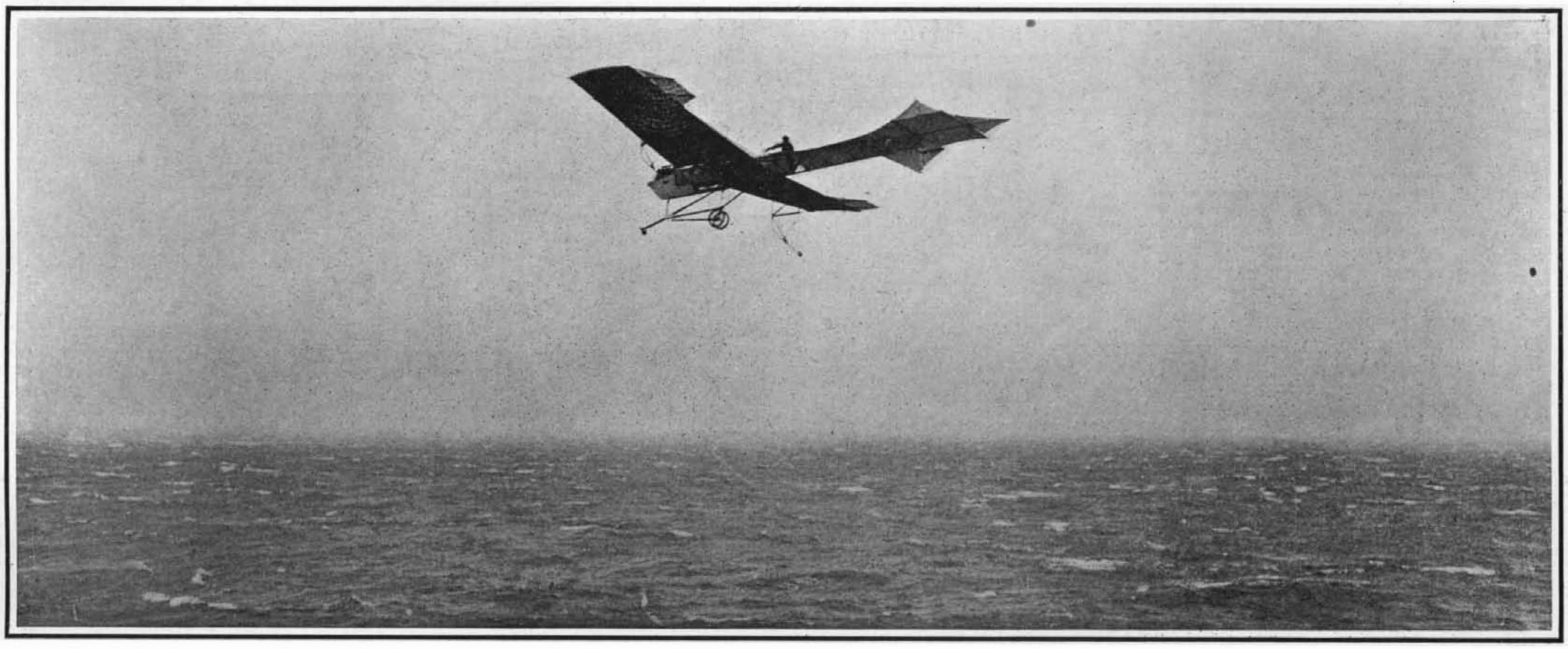
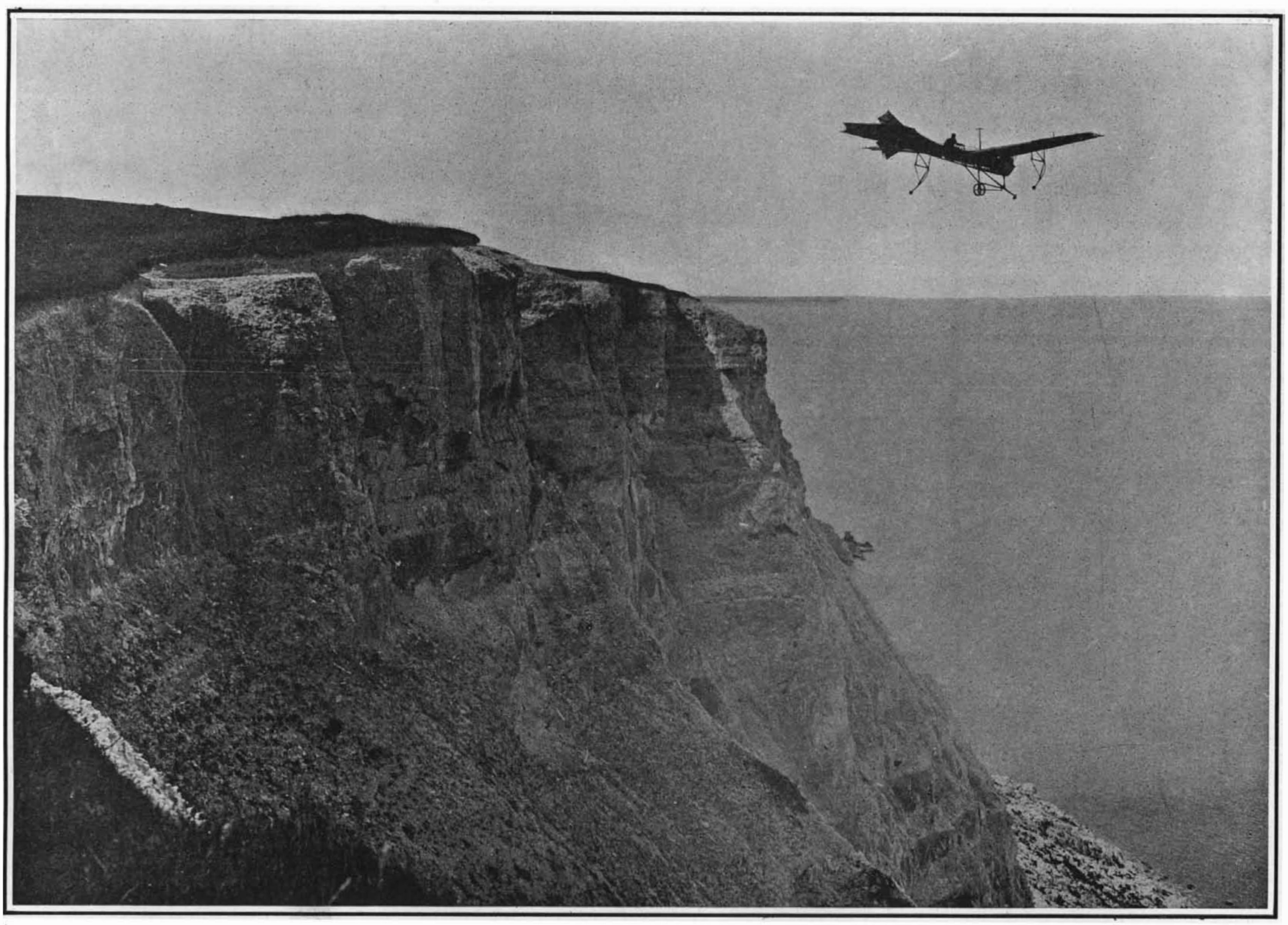


Latham's monoplane flying above the sea in its cross-Channel flight.



Hubert Latham on his 50 H. P. "Antoinette IV" monoplane starting from the high cliff at Sangatte, France.

THE FIRST ATTEMPT TO FLY ACROSS THE ENGLISH CHANNEL.—[See page 78.]

SCIENTIFIC AMERICAN
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NEW YORK, SATURDAY, JULY 31st, 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.

GOOD NEWS FROM PANAMA.

The latest official report from Panama gives some very reassuring facts regarding the question of seepage of water through the ground in the neighborhood of the Gatun dam. It will be remembered that in the controversy over this dam, M. Bunau-Varilla and others claimed that the head of eighty-five feet of water in the Gatun dam would probably produce a heavy seepage, if not through the body of the dam itself, then through the underlying material of the valley bottom on which the dam was built. The engineers of the canal, on the other hand, assert that not only will the body of the dam itself, which is to be deposited hydraulically, be so compact as to preclude any possibility of seepage, but that the subsoil in the valley is naturally impervious, or practically so, to water.

Partial confirmation of the engineers' statements is now afforded by the conditions which have developed during the excavating of that portion of the canal which lies between the Gatun locks and the sea, where one of the steam shovels has reached a depth of 32 feet below sea level. The excavation in which the shovels are at work is kept dry by four 8-inch pumps, and ordinarily these pumps are not run at their full capacity. When it is considered that a dike, a few feet in thickness only, keeps the water in the old French canal from flowing into the trench; that the sea is within two miles of the excavation; and, furthermore, that the Mindi River flows within a few hundred yards of the ditch, we are quite in agreement with the engineers that "there has been surprisingly little seepage into the excavation since the work was carried below sea level." During the latter part of June, the shovel on the lowest level was obliged to suspend for a few days on account of the inability of the pumps to throw out the water that was coming in; this, however, proved to be only a temporary condition, and the shovels were soon able to resume work. It does not take an engineer to understand the significance of these facts as bearing upon the security of the Gatun dam.

NAVAL ANNUALS OF 1909.

The public interest in naval affairs, which has been noticeably on the increase during the present decade, has received a decided stimulus from the introduction of the "Dreadnought" type of battleship and its dramatic effect as shown in the so-called British panic over the activity of Germany in rebuilding its fleet along "Dreadnought" lines. Hence, the appearance of the two best-known naval annuals, those of Brassey and Jane, affords much timely information on a subject of vital importance. The older annual, which opens with a quotation from the speech of the First Lord of the Admiralty on the Navy Estimates made last March, "The safety of the empire stands above all other consideration. No matter what the cost, the safety of the country must be assured," is divided into the customary four parts. The first contains general articles on naval subjects of prime importance, and is enlivened by some excellent half-tone engravings from wash drawings of the more notable of the latest ships built or building for the navies of the world. Part two contains Brassey's familiar list of British and foreign ships, which includes the class, displacement, dimensions, horse-power, builder of ship and engine, dates of launch and completion, cost, the position and thickness of armor on the ship; the gun positions; the armament, speed, and coal capacity. Following this are plates of the typical warships of each navy, including outboard profiles and deck plans, with a summary of the principal elements of each ship given below. This summary is a new departure in this year's Annual, and adds greatly to the value of the plates. Part three is devoted to articles on armor and ordnance, and is followed by sets of tables, giving full details of the dimensions, velocity, energy, and penetration of every gun manufactured by the principal navies and by the leading private manufacturers of ordnance. Part four, embodying the First Lord's Memorandum, gives a great variety of information as to expenditures, personnel, condition of the ships, arsenals, dockyards, etc.

There is no more satisfactory way of conveying much information regarding a warship in a limited space than is found in a broadside photograph combined with a plan and side elevation. If the latter be freely dimensioned and the group of illustrations be supplemented by a tabular description, the reader is put into possession of a *multum in parvo* of the particular ship described. Jane's "Fighting Ships" is modeled on this plan; and since it contains this information regarding every ship of importance in all the navies of the world, big or little, it can be seen the work is remarkably complete. Naturally, in view of the little argument between Great Britain and Germany on the subject of battleship construction, readers of the Annual will turn first to the pages dealing with the German navy. Germany has been unusually successful in maintaining secrecy about her new "Dreadnoughts," so much so that Mr. Jane, in spite of all his assiduity in searching for the latest naval information, has to confess that "it is not possible even now absolutely to guarantee the exact correctness of the set of plans given with this edition." He anticipates regarding them that "there will very possibly be considerable discussion."

Turning, then, to the plates of the new German "Dreadnoughts," we find that the "Westfalen" and "Nassau" (1908) are credited with ten 11-inch 50-caliber guns, mounted in five turrets disposed similarly to those of the original "Dreadnought," viz., one turret forward, one on either beam, and two astern. This on a displacement of 17,710 tons is reasonable and probably correct. We have always, as our readers will doubtless recollect, considered that the crediting of these ships with fourteen and even sixteen 11-inch guns was absurd. The "Posen" and "Rheinman" (1908) are credited with carrying twelve 11-inch 50-caliber guns, on a displacement of 19,000 tons. Commencing from the bow, the first six guns are mounted as in the "Dreadnought"—one turret forward and one on either beam abreast of each other. Aft of the superstructure are two two-gun turrets, placed *en echelon*, and astern on the center line is another turret. This arrangement gives a concentration of six guns ahead and astern and ten on each broadside. The plans of the latest six "Dreadnoughts" of the German navy call for criticism. On a displacement of 19,000 tons they are supposed to carry twelve 12-inch guns in four turrets mounted on the center line, the forward and after turrets each containing three guns. We think it is highly improbable that the three-gun turret will ever be found on the German ships or on those of any other navy. Jane credits the Japanese with carrying fourteen 12-inch guns on their latest design, six of which are carried in two three-gun turrets, one forward and one aft. There is strong objection to the three-gun turret on the ground that a single 12-inch high-explosive shell penetrating such a turret would probably put three guns out of action at once. An even more serious objection is that the greater the number of guns carried upon a single turntable, the slower the rate of fire per gun, unless indeed volley firing be adopted and all three guns are loaded and fired together, a practice which would involve enormous strains upon the turntable. If the guns are fired separately, they must wait upon each other, since the firing of any one gun, or at any rate of either of the outer guns of the three, throws the other two guns off the target and would necessitate a re-sighting. The ideal mounting for speed and accuracy would be to mount each 12-inch gun in a single turret. This, however, would involve too much turret weight and would cut down the number of guns that could be carried. The armament of the German "Invincible" type of battleship cruisers is given as ten 11-inch 50-caliber guns, mounted as in the "Dreadnought," the displacement of the ship being 19,000 tons and the speed 25 knots. The "Bluecher," of 14,760 tons, is armed with twelve 8.2-inch guns.

Next to the German navy, perhaps that of Japan will excite the greatest interest. The two new "Dreadnoughts" which are building, and the three or four others projected, according to Jane, will carry fourteen 12-inch guns on a displacement of 20,750 tons. Since it takes 26,000 tons to carry twelve 12-inch guns in our own "Wyoming," we are at a loss to understand how the Japanese are going to carry two more guns on 5,000 tons less displacement. Either the speed must be less than the 20 knots given, or the armor plan must be considerably cut down. The Annual gives particulars of the five battleships and three cruisers captured from the Russians, or raised after the capitulation of Port Arthur. The "Iwami," formerly "Orel," has not only had her superstructures and smokestacks cut down, but has been re-armed with four 12-inch and six 8-inch 45-caliber Japanese guns. The "Hizen," formerly "Retvizan," still carries her armament of four 12-inch 40-caliber and twelve 6-inch 45-caliber Russian guns. The "Suwo," formerly "Pobieda," has been re-armed with four 40-caliber 12-inch and ten 45-caliber 6-inch Japanese guns, and her efficiency is therefore considerably increased. The "Sagami," formerly "Peresviet," has been re-armed with four 12-inch 45-caliber and ten 6-inch 45-caliber guns. The re-arming of these ships has provided the Japanese navy with four effective battleships of the pre-"Dreadnought" type.

Very properly Jane has always laid great stress upon the main battery as being the principal determining factor above all others in a comparison of the fighting strength of the world's navies. On this basis he presents a table entitled "Ships Built or Building in the Principal Navies, Armed with Guns Equal or Superior to the 12-Inch 45-Caliber Gun," which is able to attack 11 inches of Krupp armor outside of 7,000 yards range. In this table the adherence for many years past of the United States to the 12-inch and 13-inch gun shows to good effect. As matters stand to-day, Japan comes first, with eleven such ships, followed by the United States with ten, Great Britain with nine, France with four, and Germany with three. In 1910 and 1911 Japan will still hold the first position, with Great Britain and the United States second, France third, and Germany fourth. In 1912 Great Britain will be first with twenty-two such ships, Japan second with seventeen, followed by the United States and France with sixteen each, Germany with thirteen, Austria with seven, and Italy with two. This forecast, however, is, of course, liable to great modification due to change of programmes.

AS OTHERS SEE US.

Any communications from our readers, which throw any light upon what the subscribers desire to find in our columns, are most welcome always to the Editor, whether such letters are in the nature of commendation or criticism. As a rule, the Editor is not able to determine whether certain features or departments in the paper are really appreciated by the readers, unless the friends of the paper will take the trouble to write the Editor and express their opinion or their preferences.

Occasion has arisen in the past when it was deemed desirable to make some change or eliminate some department of the paper, and the Editor has not been aware that such department may have been of the greatest interest to certain readers until a storm of protest leads to his restoring the omitted feature.

The following letters were received by the Editor recently in a single mail, and by their diversity and wide geographical range were of interest to him, and may be so to some of our readers:

A correspondent from Eugene, Ore., writes:

"I have enjoyed reading the SCIENTIFIC AMERICAN immensely, and hope to be able to continue it for years.

"Have a small shop and some tools and have made several things from directions given in the Handy Man's Workshop Department. Such work is, to me, great pleasure, since there is enough—without being too much or having anything omitted—in the instructions.

"I wish you unmeasured success."

The editor of a paper in Michigan writes:

"Allow me to commend you enthusiastically on the fourth-dimension contest. Without taking exception to the work of the committee, I feel very strongly that Mr. Cutler's paper in the issue of July 10th is most timely and valuable, as loose thinking on the part of readers, especially if it favors superstitious conclusions, is too common. What the fourth dimension is not is more important to persons not mathematicians than what it is."

A large firm of manufacturers in Jerome, Ariz., writes:

"We are steady subscribers to the SCIENTIFIC AMERICAN and could not get along without it."

A French correspondent in Paris writes:

"Being now a faithful subscriber, I must come and say to you that in the first place in this paper I read and use your Queries. This for two reasons: First. I do not know any other piece of any other scientific paper which gives me so many fresh and new ideas, in all kinds of fashion. Really, I take out a great deal from them, and I cannot say how sorry I was when several weeks, some time ago, my dear Queries were absent. Second. My second reason for liking the Queries so much is the pleasure one has in looking at the idleness (*sic*) of some fellows.

"Questions such as, 'Which goes fastest, top or bottom of a wheel?' or 'Why does salt freeze in summer (to cool drinks) and melt in winter (to melt snow)?' are a real pleasure to me, exactly as when you read Tit-Bits.

"It is the most diverting part of the SCIENTIFIC AMERICAN. Do not suppress it."

ENGINEERING.

The War Department exhibit at the Alaska-Yukon-Pacific Exposition contains a model exhibit of the system of protecting harbors by mines which will serve to show the people of the Pacific coast how perfectly secure against the entrance of hostile ships their harbors may be made. The terrific destruction wrought by mines in the Japanese war has rendered it certain that no captain of a costly modern battleship will jeopardize a ten-million-dollar vessel by venturing into properly mined rivers or harbors.

An important agreement has been reached between the Compressed Air Workers' Union and the employers, by which, instead of being paid in proportion to the depth to which the caissons are sunk, the men will be paid according to the amount of air pressure in which they are compelled to work. The pay will vary from $3.50 for a day of six hours at twenty-two pounds pressure to $4.50 a day for one hour and twenty minutes' work at from forty to forty-five pounds pressure.

Such rapid progress has been made on the "Florida" that she will probably undergo her trials during the next two or three months. Special interest attaches to this vessel because of the fact that she is the first of the "Dreadnoughts" designed specifically as such for our navy, and the first of our battleships to be driven by turbine engines. The "South Carolina" and "Michigan," of 16,000 tons, although they carry a "Dreadnought" armament, were originally designed to be of the "Connecticut" type.

It was recently announced by the Public Service Commission that, with a view to avoiding the objections raised by property owners to a four-track tunnel through Lexington Avenue in this city at one level, which would involve sidewalk encroachment, plans are being drawn for a double-deck tunnel with the two local tracks immediately below the street and the two express tracks immediately below the local tracks. There is an objection to this scheme from an operating standpoint, due to the longer climb necessary to reach the street from the express platforms.

The announcement of the White Star Line that their ships engaged in the Liverpool service will call at Holyhead on both the eastbound and westward voyages has been followed by a persistent rumor that the Cunard Company's ships when running westward will call at Fishguard on the southwest coast of Wales to pick up the late mails from London. These arrangements would result in a saving of several hours' time, and, in the case of the "Mauretania" and "Lusitania," it would then become possible for passengers to be landed in New York on Thursday night.

The launch of the replica of Fulton's "Clermont" and the arrival in New York of the reproduction of Henry Hudson's "Half Moon," remind us of the near approach of the Hudson-Fulton celebration in New York city. The "Clermont," which was built at the Staten Island Shipbuilding Company's yards, was christened by Mrs. Arthur Taylor Sutcliffe, great-granddaughter of Robert Fulton. The "Half Moon," although a three-masted vessel, is but 66 feet in length. She was shipped entire on the deck of the Holland-American liner "Soestdyk."

A solution of the problem of navigating streams in which shallow and deep water are alternately encountered is suggested by Mr. C. J. Bartlett of New Orleans. He proposes the construction of a submerging ship, which is designed to carry two barges when in deep water, and, on encountering shallow water will submerge, float the two barges free, and tow them through the shallower reaches. Each barge is of 1,500 tons capacity and their loaded draft is eight feet. The loaded draft of the ship is fifteen feet and in the light condition she would draw six feet.

The mere mass of the concrete floor and side walls of the locks at Gatun will be sufficient to give them great stability; but, with a view to adding a further safeguard against rupture in the event, say, of earthquake shock, the government engineers intend to reinforce the concrete by imbedding in it no less than seven thousand tons of old rail. This metal consists partly of a light rail which was used during the era of French construction, and partly of more modern American rails, which have been so badly bent that they can no longer be used in the track.

The rise of Germany in the field of yachting is as remarkable in its way as the wonderful development of her merchant marine. A few years ago yachting as a sport was practically unknown in that country. To-day, thanks mainly to the example and untiring efforts of the German Emperor, Germany possesses one of the finest fleets of large yachts in the world. The two latest and finest of these, the "Germania" and the Emperor's new schooner built this year, are probably the two fastest vessels of their class afloat. Commenting on these facts the Yachtsman, of London, says the result of this activity has been that Germany is actually a more important yachting nation than Great Britain.

ELECTRICITY.

An electric glue heater has been put upon the market which is claimed to melt glue in thirty minutes, and to keep it at a temperature of 150 deg. for several hours after the current has been switched off.

A hydro-electric power station is projected near Wadesboro, N. C., on the Rocky River, capable of producing, with the initial installation planned, 6,000 to 7,000 horse-power. The site is within a mile of the new Southbound Railway and a new town is expected to be developed by the industrial facilities.

A successful electric lawn mower, taking power from any convenient source by means of a flexible cable, has been invented by Mr. F. H. Kerr, of Chicago. He is building an improved type of machine capable of operating plows, harrows, drills, and seeders for gardens and small farms.

The largest switchboard in the world is to be installed in the New York terminal of the Pennsylvania Railroad. All the switches of the terminal are to be electrically controlled from this board. Work has just been started on the switchboard. It is to cost $500,000.

Several towns in Ohio are electric-lighted by companies which own and operate no power station, but purchase current from some central station in the district. Instead of risking the building and equipment of a power station which may not be sufficiently patronized to be profitable or waiting for the central station to reach out for the business of small country towns, companies are formed in the latter owning their own wires and buying power.

A steam-driven power plant is being built at Galena, Ill., to transmit power 25 miles north into Wisconsin. The first two units installed will be 1,500 and 1,250 kilowatt three-phase alternating-current generators driven by reciprocating Corliss engines. The current is generated at 2,300 volts, transformed to a line potential of 33,000 and reduced again to 2,300 or lower where necessary, for local distribution. This plant will supply among other places the zinc mining center at Hazel Green.

One of the largest electric organs ever built in the United States is about to be erected in the Auditorium at Atlanta, Ga. It will be played from a movable four-manual control 65 feet away by an 8-volt current from a specially wound generator, and blown by a 20-horsepower motor direct connected to a series of fans raising the air pressure by steps, either a pressure of 10, 15, or 50 inches water column being available in the universal wind chest. A smaller "echo" organ is placed at the opposite end of the auditorium, which can be played either simultaneously or independently.

In addition to the Pennsylvania Railroad, which began to send its passengers through the Hudson tunnels on July 19th, the Erie Railroad will make use of the same facilities, beginning on August 2nd. The schedule for the regular operation of trains calls for six minutes for the trip to Manhattan from Jersey City. The six-minute schedule will chop off about 15 minutes of the time it now takes the commuter to get from Jersey City to Church and Fulton Streets in New York. Arrangements have as yet not been made for the use of the tunnels by the passengers of the Delaware, Lackawanna & Western or the Lehigh Valley roads.

Although the operation of "pay-as-you-enter" cars in New York has been so successful and popular as to promise the introduction of many more, this will not require the "scrapping" of hundreds of serviceable cars of older patterns. The Third Avenue line has had in operation for about a month a double-truck car converted to prepayment service by the lengthening of the platforms. New hoods and knee braces were required but the old vestibules have been retained. The only difference from the new cars is the absence of a division between entry and exit doors, a double sliding door extending the whole width of the car and entry being divided from exit only by the vestibule rail. The operation of the adapted car has been so satisfactory that it is proposed to reconstruct 200 more in this way.

Experiments have been made in Italy to discover the best form of insulator for high-tension transmission lines which run near the sea. It is found that in the vicinity of the sea a thick layer of salt accumulates on the insulator, and serves as a conductor to cause leakage of the current to ground. The Italian experimenters have discovered that the incrustation forms chiefly on parts which are not protected from the wind and rain. The ordinary insulator for high-tension purposes consists of a number of petticoats or bells, in which the salt accumulates to a considerable depth. For this reason it was found best to provide an insulator with an almost flat bell, which would be so exposed to the weather that the crust could not form to any harmful extent. Insulators of this type were used with perfect success over a period of eighteen months on a 25,000-volt line. Under tests in the laboratory they withstood 75,000 volts dry, and 30,000 in a heavy rain.

SCIENCE.

The teaching of cooking is a science in Germany, as is everything else in that Teutonic empire. Traveling cooking schools are now sent about, for the purpose of instructing peasants how to cook cheaply and well. Since country people cannot go to school, the government will send schools to them. These traveling kitchens are now established in Hesse, Nassau, Franconia, and the Palatinate, as well as in Bavaria.

Metchnikoff, in "The Prolongation of Human Life," blames the lower intestine for most human diseases, and consequently for our early death. Dr. Distaso of Paris not only agrees with him, but even advocates the entire removal of the large intestine in childhood, in order to ward off old age as long as possible. Distaso claims to have confirmed Metchnikoff's statements that the large intestine is the breeding place of most harmful germs.

Some idea of the general use of false teeth may be gathered from the statement that 20,000,000 of them are exported from America to England every year. When we consider that probably not more than half the inhabitants of Great Britain indulge in the luxury of false teeth, no matter how many grinders they may have lost, these figures would seem to indicate that nearly everyone in England suffers from defective or missing teeth. As far as observation goes, the United States is no better off than England in this respect.

The Academy of Sciences of France has awarded a prize of $140 to Prof. E. W. Brown of Yale University for his researches relating to the theory of the moon. The sum of $200 has been awarded to Lieuts. Jaence and Colin for their improved wireless telephone. Out of the sum of $20,000 settled upon the Institute by Prince Roland Bonaparte, the sum of $800 has been set by for the encouragement of researches by Prof. Cayeux of the School of Mines, University of Paris, for the particular object of enabling Prof. Cayeux to proceed to the United States and continue his remarkable researches with reference to deposits of ancient minerals.

Prof. W. P. Bowen of the Michigan State Normal College presents a most helpful exposition of what constitutes fatigue, in Hygiene and Physical Education, and what counterfeits it. Some people are evidently simply born tired. "There is much misinformation as to what fatigue is. It is not simply a 'feeling of uneasiness' and discomfort. There is a motor as well as a sensory side which is even more important." Some of the counterfeits of fatigue are drowsiness, weakness, and discomfort from breathing bad air; aversion to work, termed *ennui* by the French, *Müdigkeit* by the Germans; lack of suitable food, loss of sleep, faulty nutrition, indigestion, adenoids, and the early stages of many diseases. One of the commonest forms of fatigue in children arises from the suppression of natural activities by the maintenance of one position for long periods.

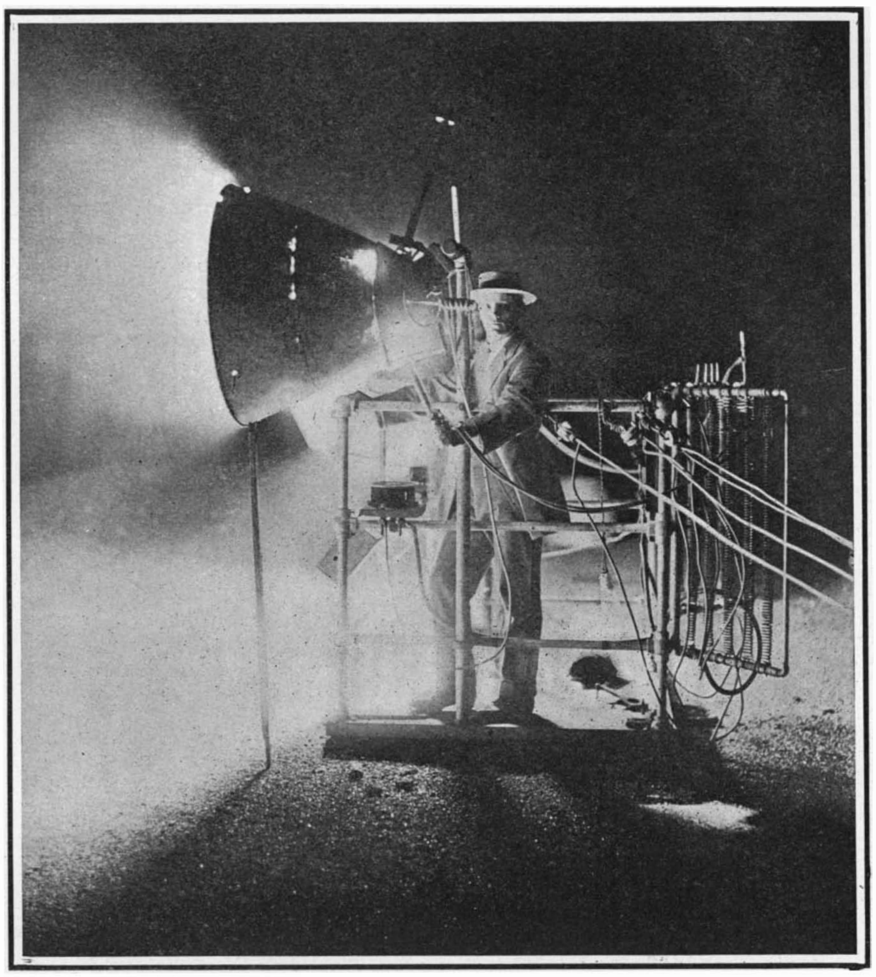
As a result of archæological studies pursued during many years J. Prestel claims to have discovered the essence of the method employed in the manufacture of ancient Roman pottery (*terra sigillata*) and its homogeneous glaze. According to Herr Prestel, the secret lies, not in the chemical composition of the paste but in the treatment applied to it and to the colored glaze. The clay was prepared by aging, followed by washing, kneading and stamping. Before firing, the ware was exposed to the sun and air, but sheltered from rain, until it appeared quite dry. The frequent changes of temperature and humidity and the alternation of sunlight and darkness which occurred during this slow process of drying insured uniform shrinkage in firing and durability of the finished ware. When a glaze was used it was applied to the moist ware immediately after the latter was shaped, so that the glaze became intimately united with the body of the ware during the slow drying process. Firing then produced a brilliant gloss and imperishable colors.

Dr. L. A. Bauer has raised the question whether magnetization alters mass. His observations were made upon bar magnets in both the magnetized and demagnetized states and in various orientations with respect to the earth's field. It is obvious that if there be local disturbances of the field, the weighings may give different results for different positions of the magnet, since it is not simply the force of gravitation which is being measured, but in addition the magnetic forces which act upon the bar. Experiments conducted by Dr. Morton G. Lloyd seem to indicate that magnetization to a flux density of 13,500 gausses does not alter the true weight of the specimen by as much as one part in 15,000,000; certainly not as much as one part in 8,000,000. If we make the usual assumption that mass is proportional to weight, we may say that, within the same limits, the mass is not altered. Since in Dr. Bauer's experiments the flux density was probably not in excess of 3,500 gausses, and since the difference found by him amounted to more than one part in 1,000,000, it is necessary to conclude that these differences are due to other agencies.

BASEBALL AT NIGHT.

The experiment of playing baseball by night was successfully made recently in Cincinnati. As may be supposed, powerful searchlights were employed to illuminate the baseball field. The Cincinnati National League Baseball Park, where the first game was played, was encircled with 100-foot steel towers, each carrying two extremely powerful carbon lamps, capable of illuminating the entire park. Every corner of the field was brightly illuminated.

Although we have been unable to obtain engineering data on the construction of the lamps, we are informed that the carbons alone are 1⅜ inches in diameter. Three lamps were found almost sufficient to illuminate the park; but to make the undertaking absolutely successful, fourteen lamps were employed to cast their rays upon the grounds. Three-phase current was supplied by a 250-horse-power 60-cycle dynamo, having a speed of 345 revolutions per minute. The voltage is 235. The amount of current generated was enough to run twice the number of lamps, for which reason huge rheostats are employed to take care of the excess. Two of these powerful lamps are mounted behind each fielder. Others cast their rays from the roof of the grand stand and the covered bleachers. The inventor of the lamps is George F. Cahill, who has taken a great interest in what may be termed the mechanical improvement of baseball playing. He is the inventor of an ingenious baseball pitching machine, which has been used with success.



ONE OF THE POWERFUL PROJECTORS.

The Collateral Value of Sanatoria.

BY JOHN B. HUBER, A.M., M.D.

Bodington began, in Sutton Coldfield, England, an institution for the treatment of consumption on "principles natural, rational, and successful." He insisted on generous diet, fresh air day and night; the air within the house was to be as pure as that without, nor could it ever be too cold for a consumptive patient. Here then, was established in 1840 probably the first tuberculosis sanatorium in the modern sense. Its fate? Bodington was regarded as a lunatic; he was contemptuously opposed by many a colleague; his patients were driven from his institution, which he thereupon turned into an asylum for the insane, in which, we now believe, many of his neighbors might fittingly have found an abiding place.

Next in the history of santoria comes Brehmer who, having been attracted by the ideas of "that obscure country doctor" in England, determined, with true Teutonic stubbornness, upon making them enduringly effective. Like Bodington, Brehmer had to endure the lot which so frequently falls to genius and altruism; he also met with much opposition and ridicule, but he persisted until he convinced both his profession and the laity of the soundness of the methods he elaborated. The result is the institution established at Goerbersdorf, in Prussian Silesia, which has from small beginnings, become of world-wide beneficence and influence. It is due to Brehmer's grit that we have now tuberculosis sanatoria over all the civilized world.

Since this inception of the work the building of sanatoria has oftentimes, though not always, been accomplished despite opposition, virulent and most discouraging to those who would believe that our race has really advanced in human emotions. Yet demonstrably the properly conducted sanatorium can hurt no one; on the contrary, it is beneficent from every conceivable viewpoint. A great deal of "phthisiophobia"—from which arises opposition to sanatoria—is based upon ignorance of the nature of infection in tuberculosis. Such infection is not air-borne, as in scarlet fever or measles. Practically speaking, it is conveyed from the consumptive to his fellow human beings only through the sputum. And when this sputum is properly disposed of there is no danger of tuberculous infection. With regard to the danger of infection to the community in which a sanatorium is placed we have but to cite the experiments made at Saranac Lake, where Trudeau established the first American institution upon the modern principles of phthisiotherapy. All the dust in a room of one of the cottages occupied by consumptives was gathered, and a culture made from this dust was, when injected, insufficient to cause tuberculosis in a little guinea pig. A scientifically ordered sanatorium, rather than a menace to any community, is on the contrary a decided influence making in it for healthful living in every possible meaning of the term; its neighbors learn to spit less, to keep their windows open day and night, to live the hygienic life generally. The tuberculosis sanatorium has invariably raised local health standards.

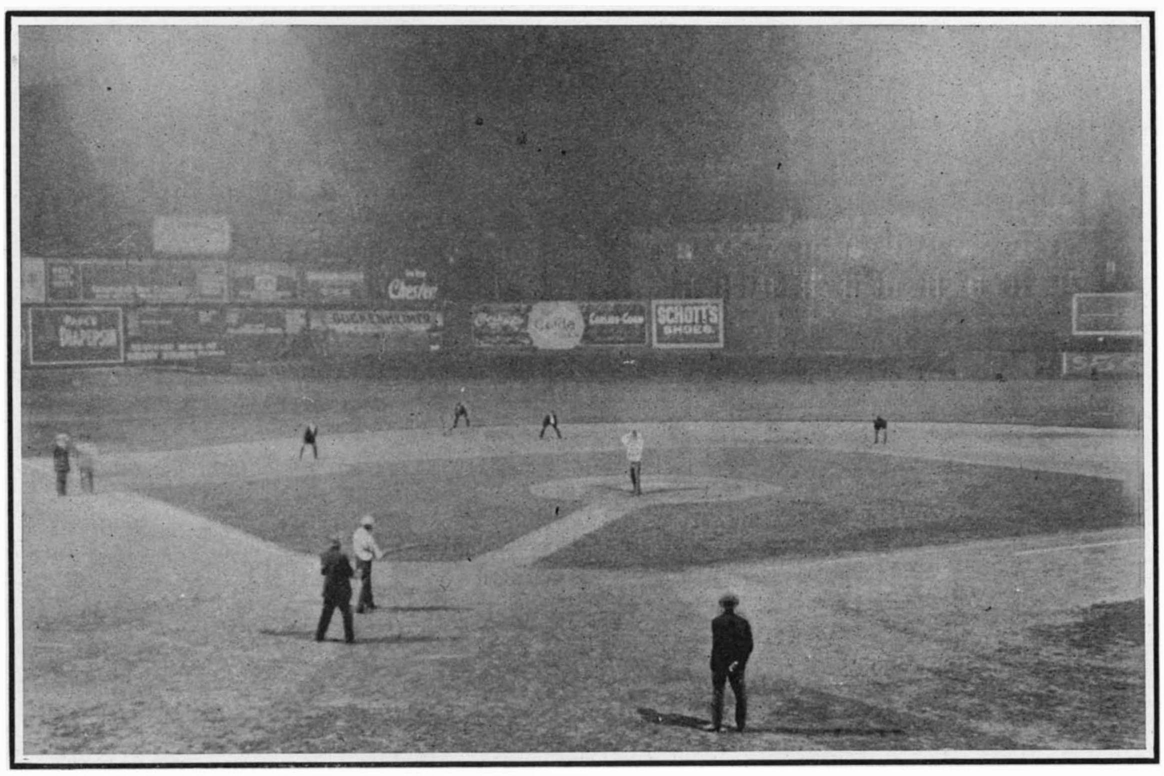
In the sanatorium the consumptive gets well under circumstances the best for all concerned. While there he does not infect his family, his fellow-workmen, and his community; when he leaves he goes forth as a missionary disseminating the precepts of sanitation and prophylaxis he has imbibed. The only trouble is, there are not and probably never will be enough of these institutions to accommodate all the sufferers from this disease; as it is now, only about five per cent can be treated in sanatoria. The rest must get well—and it is quite possible for them—in their own homes.

In the merely commercial sense the sanatorium is a factor decidedly not to be ignored. The rural citizen may begin with fighting its establishment in his vicinity; but give him a little time, and he will probably reason as follows: The sanatorium patients are treated in such manner that so many dozen eggs are required for it every day; also so many hundred quarts of milk, so many pounds of butter, so much cereals, meats in proportion. And where or how could the sanatorium managers get these staples better than from the farmer folk in the neighborhood? If now it is explained to him that the prosperity, for example, of Goerbersdorf has trebled, as has also its population, since the beginning of Brehmer's work, the ruralite will probably begin to "sense" the wherefore of this; then, no doubt, he will throw away the stick he has been whittling, shut up his jackknife and conclude that, for his part, the building of the contemplated institution need not be delayed.

In point of fact, rather than being detrimental, the sanatorium actually causes real estate values in its locality to rise. The National Association for the Study and Prevention of Tuberculosis has gathered from twenty-two States, covering every section of our country, convincing data to this effect. The Survey (June 19, 1909) has summarized these reports: Over 67 per cent of the sanatoria have exerted a favorable influence on surrounding property, and in almost as many cases their effect in raising assessable valuations has been direct and measurable. In most of the other instances no differences were observable; in only three localities was it claimed that residents had been repelled. In the neighborhood of a sanatorium at Portland, Ore., land has more than doubled in value in three years, the greater demand being close to the institution. At Aiken, S. C., land in the vicinity of the sanatorium has quadrupled in value since it was built; at Asheville, N. C., vacant lots near one of the sanatoria sell at four times their price in 1900, and others farther from the institution, but nearer the city, are less valuable; in Hebron, Me., the advance has been 20 per cent. Like results are reported from Luzerne, Pa., Liberty and Saranac Lake, N. Y., Pittsford, Vt., Mt. Vernon, Mo., and Silver City, N. M.

In these places the sanatoria form an important part of local business and it would hardly be fair perhaps, to make them criteria; nevertheless the effects on values are the same in the big cities—New York, St. Louis, Philadelphia, Brooklyn, Boston, Pittsburg. Not a single instance was reported where the presence of a santorium, camp, or dispensary in a large city has had a detrimental effect on the value of nearby property. And the courts of Massachusetts, North Carolina, and Virginia have decided that a tuberculosis sanatorium is not a menace to the health of a community, or to the property in its vicinity.

Finally, the fact that any given locality is selected as desirable for the establishment of a sanatorium in it makes for a guarantee and an advertisement that it is a salubrious region; health resorts get built around it; private cottages are erected. Would the Adirondacks, for example, have become so extensive and profitable a summering place had its destinies not been shaped in Saranac Lake?



BASEBALL AT NIGHT.

Electric freight locomotives have been ordered by the New York, New Haven & Hartford Railroad for trial on its main line.

THE FIRST ATTEMPT AT A CROSS-CHANNEL FLIGHT AND NEW FRENCH CROSS-COUNTRY RECORDS.

After meeting with so much success in flying over *terra firma*, it is little wonder that some of the leading French aviators wished to attempt to fly across the English Channel—a distance of but 21 miles—to England, in view of the prizes, amounting to $7,500, that have been offered for this feat.

Hubert Latham, the successful driver of the "Antoinette IV" monoplane, after elaborate preparations, attempted the trip early in the A. M. of July 19th, and our frontispiece this week shows him leaving the cliff at Sangatte (near Calais) and also flying above the Channel. Unfortunately the motor stopped after the monoplane had been in flight about eight minutes, and the machine came down in the sea. As the water was not rough, and as the built-up wings of the monoplane were air-tight and covered with water-proof material, the machine floated gently upon the waves until picked up by the French torpedo-boat destroyer "Harpon," which had been sent out ahead for this purpose. Latham was found at ease in his seat, smoking a cigarette. The monoplane was somewhat damaged in getting it aboard the destroyer, but as soon as it was brought ashore, arrangements were made to repair it, and Latham stated that he would try again on the 23rd instant. M. Louis Bleriot, whose cross-country monoplane record of 33 miles we reported in our last issue, shipped his machine to Calais with the intention of making an attempt before Latham could get his machine repaired, but owing to bad weather he was unable to do so. Count de Lambert is also about to try to cross with a Wright aeroplane. On the same day M. Paulham, with a Voisin biplane fitted with a Gnome revolving-cylinder motor, made a flight from Arras to Douai, a distance of 20 kilometers (12½ miles) in 22 minutes, or at an average speed of 37.2 miles an hour. The day before he beat Wilbur Wright's 360 feet height record by rising to a height of 450 feet.

On July 23rd Henry Farman, with his new biplane, made the longest cross-country flight thus far recorded. Starting from the parade grounds at Chalons, he flew to Suippes, covering about 40 miles in 1 hour and 5 minutes, and keeping at an average height of about 150 feet throughout the trip. This flight demonstrates without question that the aeroplane as a means of transportation of individuals has now to be reckoned with. Both a biplane and a monoplane have lately flown with three people aboard. On a machine of the former type M. Gobron carried Mme. Collieux and Mr. d'Almeida for five minutes on July 3rd at Chalons, while M. Bleriot took M. Fournier and Santos-Dumont on a 1,000-foot flight last month at Issy. Thus it is mainly the question of a reliable aeronautic motor that is keeping the aeroplane from being put into immediate use, both as a vehicle of sport and transport.

Orville Wright's Flights at Fort Myer.

After a week of failure to make a successful flight, as reported in our last issue, Orville Wright finally got in the air again and made a 16.53-minute flight on Saturday afternoon, July 17th. The following Monday, the day that Latham attempted to fly across the channel, Mr. Wright made two excellent flights of 25 and 30 minutes duration, making 25½ and 29½ circuits of the parade ground at Fort Myer, respectively. The machine made large and small circles and sometimes passed beyond the borders of the parade ground. It flew at an average height of about 75 feet. On July 20th Orville Wright beat his last year's record of 1 hour and 14 minutes by remaining aloft 1 hour, 20 minutes, 45 seconds. During this flight he made exceedingly sharp turns and rose to a height of 150 feet at times. His perfect control of the machine was apparent to all. The next day, after replacing the 10-tooth sprockets on the engine with 9-tooth sprockets and thereby increasing the speed of the motor from 1,200 to 1,400 R. P. M., two short flights of 3 and 11 minutes were made.

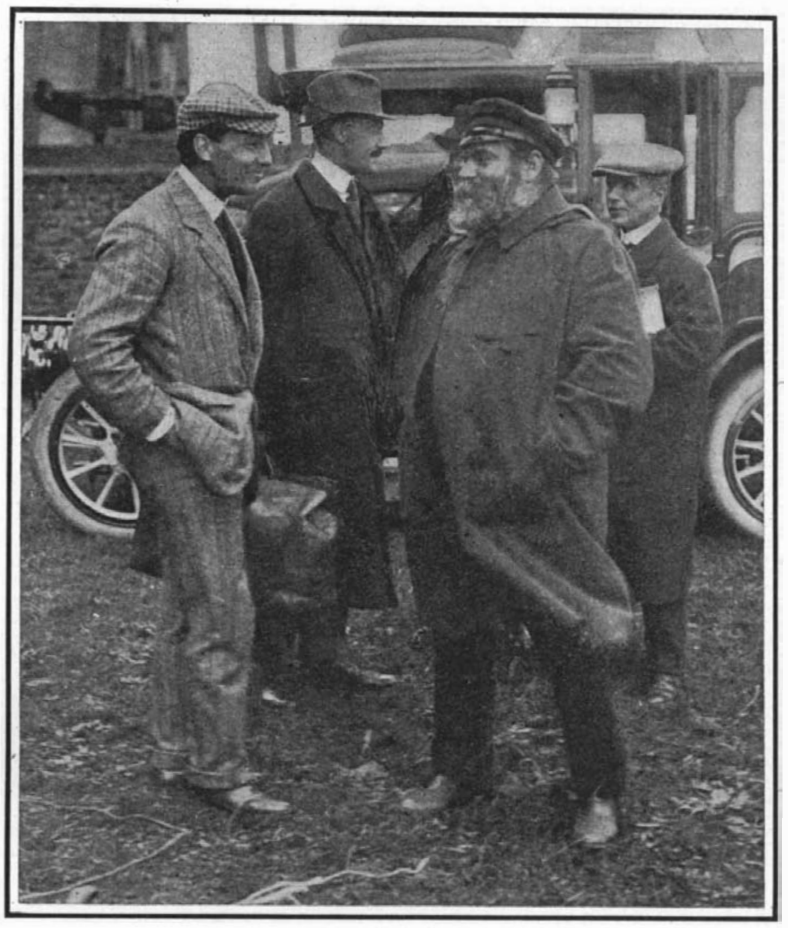
The Greatest Wireless Station.

The United States navy is to have the greatest wireless system in the world. Some little time ago it placed with a Pittsburg firm a contract for the machinery necessary to generate sufficient power to send wireless messages three thousand miles. The machinery is now all ready for installation, but as yet there is no place to install it nor a tower high enough on which to place the equipment for sending messages so great a distance. It was suggested by one of the officials of the Navy Department that the Washington Monument be used for the purpose, but the proposition was met with such a storm of protest from the public, that the idea was quickly abandoned. And now the government is to build a special tower for the purpose.

This tower will have a base of fifty feet in diameter, tapering to eight feet at the top, at which point it will be just six hundred feet from the ground level. When completed it will be in a class all by itself, no other wireless station ever having been built to such proportions. This tall chimney-like structure will be built of steel and concrete. On account of the recent development of the efficiency of concrete, it was decided to use this character of material. The tower, of course, will be at Washington, and it will be located in Rock Creek Park, and the top will be reached by a spiral stairway.

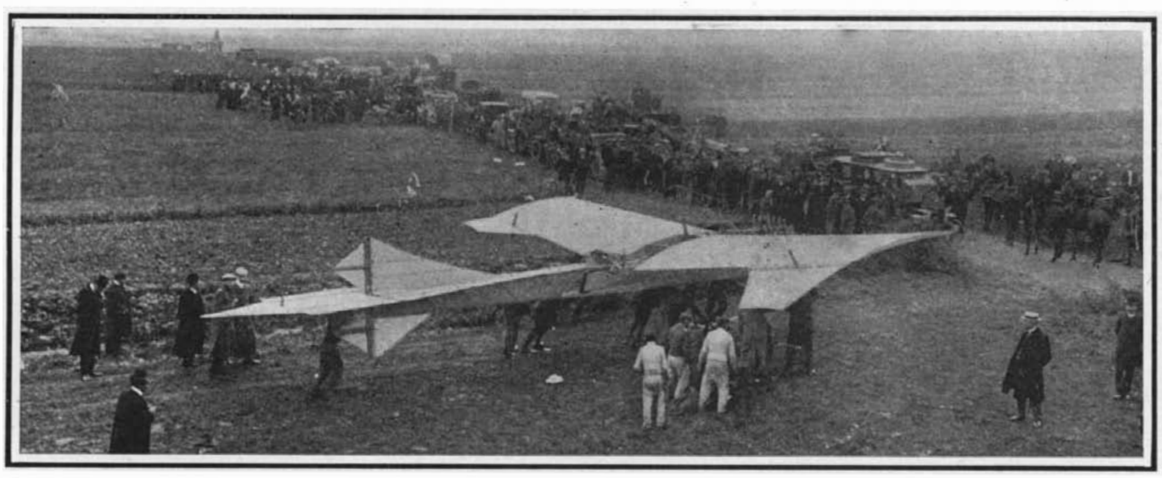
The whole scheme for building this gigantic wireless station was brought about through the Navy Department because of its desire to reach its ships at sea. The machinery for operating the station is guaranteed to deliver to all instruments keyed to receive it within a radius of 3,000 miles. To-day wireless can be depended on to reach no farther than 1,000 miles, and the delivery even at this distance is uncertain.

The cost of the installation of the new station will be $300,000.



Hubert Latham, aviator, and M. Levavasseur, designer and builder of the "Antoinette" monoplane and motor.

M. Latham holds the monoplane record of 1 hour 7 minutes in flight, while M. Levavasseur is the designer and constructor of the machine and its 8 cylinder V-type water-cooled motor.



Latham's "Antoinette IV" monoplane being wheeled out to the cliff for the start.

THE "ANTOINETTE" MONOPLANE, ITS BUILDER, AND OPERATOR.

A New Domestic Yeast Formula.

BY CHARLES CRISTADORO.

Statistics tell us that 84 per cent of our loaves are baked at home, but 16 per cent being credited up to the commercial bakery.

Every woman, and baker as well, has a way of her or his own of making bread. As to yeast, no two women, as a rule, agree. The sour lump of dough from the previous baking, leaven, is frequently used, and such was the "yeast" brought to Plymouth Rock by the Mayflower Pilgrims. Undoubtedly in New England bread, in some cases, is made to-day from leaven handed down from successive doughs, an unbroken line of descent from the first baking at Plymouth. French bread is always made from this sour dough saved out from the previous baking. Yeast, compressed or dried, is rarely, if ever, used in the making of genuine French bread. When bakings take place but once a week the leaven is apt to be very sour and impart an acidity to the bread not over-pleasant.

Housewives brew their own yeast, using hops, malt, etc., as do the bakers in some instances.

Yeast and boiled potatoes, sugar, etc., are brewed together and the liquid stored away and used as wanted, a fresh renewal of potatoes, etc., being made to the old stock. Yeast of this kind is carried along year after year, and when, if moving from State to State, the housewife guards her yeast jar as she would gold.

The compressed yeast cake and the dry yeast cakes have come in to lessen the yeast troubles, not only of the housewife, but the baker as well.

Here is a domestic yeast formula that seems to surpass in reliability even the manufactured products:

3 tablespoonfuls Durum wheat flour.

1 teaspoonful malt extract.

¼ dry yeast cake, or ⅛ compressed yeast cake.

Pour one teacupful of boiling water upon the flour and stir. Cool to 120 deg. F. Add the malt extract and yeast and beat for one minute with a rotary egg beater. Cover bowl, put in warm place throughout the day and use at bread-setting time at night.

It should not take three minutes to prepare the above yeast. The malt extract made by a hundred different manufacturers is in common use by all first-class bake-shops, and can be procured for 25 cents, more or less, per pint. Here is the philosophy of this yeast: For yeast to grow it must have air or sugar to feed and thrive upon, and a warm environment, preferably 80 to 90 deg. F.

The scalding hot water turns the raw into gelatinized starch. The diastase in the malt extract inverts the starch into grape sugar, and this sugar coupled with the air beaten into the dough mass by the egg beater, supplies sugar and air for the yeast cells to feed upon, thrive, and multiply.

The bowl of yeast is one mass of lively fermentation by evening, and proves to be a yeast mixture simple, economical, and absolutely reliable.

A paper on "Inductance and Resistance in Telephonic Circuits" was read by Dr. J. W. Nicholson at a recent meeting of the Physical Society. A general formula for the effective inductance of a circuit consisting of two long parallel wires has been given by the author, and is suitable for cases in which the current distribution in either wire is greatly affected by the frequency of alternation. In the present paper certain important cases are examined in detail, and formulæ are obtained capable of immediate use. A calculation of the effective resistance is also made in each case. Attention has been mainly directed to that of the simple telephone circuit, in which the leads are not twisted round each other in order to annul the inductive effects of the earth and of neighboring circuits. Throughout the investigation only iron and copper wires as the two extreme cases are considered. The large permeability of iron completely changes the character of the effect of frequency on its self-induction. To all metals greatly used in practice except iron, the formulæ developed for copper wires may be applied.

Liquid Crystals.

BY PROF. OTTO LEHMANN.

The treatises on crystallography define a crystal as a solid, homogeneous, anisotropic body. Living organisms have curved forms, while crystals are polyhedra bounded by plane faces. Organisms are soft, and the simplest organisms, such as amœbæ, are liquid, while crystals are rigid. Curved and liquid crystals would contradict the fundamental definition of a crystal, and also the theory of molecular arrangement adopted by all crystallographers. Snow and ice crystals, and other crystallites, are apparently curved in form or structure. Hence it was considered necessary to regard them as aggregates of very small crystals (globulites). But the author's experiments, first published in 1876, prove that the form and structure of some of these crystallites are certainly curved at every point and represent states of transition to homogeneous crystals.

Hence physical homogeneity must be eliminated from the definition of a crystal.

Polymorphous transformation, which was formerly explained as a rearrangement of the molecules, must be regarded, in view of the writer's discovery of the temperature of transformation, as a change in the molecules themselves. According to these researches, molecules of a single kind can assume only a single arrangement; they cannot even form a structureless or amorphous mass, or a liquid or gas. Amorphous solids, produced by cooling below the fusing point or by supersaturation of solutions, are always mixtures of unlike molecules, and for this reason they cannot grow as crystals do. Amorphous solid bodies are not phases.

It was formerly believed that all the molecules of a crystal are alike, that a crystal is necessarily chemically homogeneous. But this view has been disproved by the writer's discovery of mixed crystals and of their transition to crystalline aggregates and curved crystals.

Hence chemical homogeneity must also be eliminated from the definition, and a crystal may now be defined as a solid continuous phase, which is anisotropic with respect to at least one property, growth, for example.

The necessity of retaining the adjective "solid" appears to be proved by the polyhedral form apparently maintained in opposition to the forces of elasticity and surface tension, but doubt is awakened by the writer's observations on silver iodide, and especially by his experiments with crystals of ammonium oleate which, when suspended in the solution, flow and bend round air bubbles as if they were merely doubly-refracting portions of the liquid. Two of these crystals melt together, like two liquid drops.

The directions of extinction always correspond to the axes of the molecules, for no casts or fragments are formed. The molecules tend to assume the parallel arrangement (spontaneous homeotropy), but complete parallelism is prevented by the formation of twin crystals and by the walls of the containing vessel. Hence an apparently crystalline fluid of this character is usually composed of many individual parts and is consequently turbid. For this reason it has been confounded with emulsions, but the latter do not form polyhedra or exhibit dichroism or double refraction.

When the polyhedral form of apparently liquid crystals is disturbed it is immediately restored by an automatic extension. The "force of configuration" which thus acts cannot be elasticity, but must result from the tendency to expand which is due to the movement of the molecules. The expansion is anisotropic because the molecules are anisotropic. The anisotropy of the molecules is shown also by their parallelism to the line of flow (forced homeotropy) when the mass is mechanically deformed and by their arranging themselves perpendicular to two panes of glass between which the mass is pressed, or even to one pane of glass to which a thin layer adheres (pseudo-isotropy).

Hence the word solid must be eliminated from the definition, for there are really liquid crystals.

Liquid crystals of two sorts can diffuse into each other and form mixed crystals. This result is caused, not by osmotic pressure alone, but also by the attracting and directing forces acting between the molecules.

There are also liquid crystals which are destitute of force of configuration and, consequently, present themselves as perfectly spherical, freely suspended drops, but reveal their internal structure by peculiar filaments, dichroism and double refraction. These "crystal drops" are crystals which are not physically homogeneous, but the directive force of the molecules of solid crystals in contact with the fluid crystalline mass may cause the formation of extended homogeneous liquid crystals, which can be shown by the ordinary optical methods to belong to recognized crystalline systems.

The structure of crystal drops can be twisted by adding various substances. These twisted drops rotate when suspended freely in a liquid which is warmer below than above. Some of them produce an exceedingly great rotation of the plane of polarization. Others are pseudoisotropic or are composed of very numerous discrete lamellæ of equal thickness.

It is possible to produce an indefinite number of forms intermediate between solid crystals and crystal drops, as fluid as water.

Hence a crystal must be defined as a continuous phase, which is anisotropic with respect to at least one property.

It is even possible for two fluid crystalline modifications of the same substance to exist, separately or mixed in proportions which vary with the temperature. The two kinds of molecules are then in a sort of chemical equilibrium similar to that of dissociation. Their proportions can often be recognized by the magnificent colors which are seen by reflected light or between crossed Nicol's prisms. These colors have not yet been completely explained.

On contact with air bubbles or drops of isotropic liquids of higher surface tension, liquid crystals may spread over the surface of separation like ordinary liquids. In this case the optic axes of the molecules arrange themselves normally to the surface, forming hollow liquid spherocrystals or the cylindrical forms called myelinic. Such are the liquid crystals of the ethyl ester of paraazoxycinnamic acid, which appear as if endowed with life, moving and subdividing like bacteria and other low organisms. Their movements are caused by the force of crystallization, which, like the muscular force of animals, is able to accomplish work by the expenditure of chemical energy, without loss, and without any fall of temperature. The relationship between these two forces is manifested, also, by the fact that a homeotropy similar to that of liquid crystals is exhibited by organisms, for example, in the axis of growth and the polarity of the liquid protoplasm of embryonal cells. If crystals and organisms are alike in their matter and their moving forces, how can the vital spirit of an organism direct its forces to the accomplishment of a specific object? In view of the facts of regeneration, transplantation, autodivision and conjugation, it must be admitted that spirit is divisible as well as matter, that bioblasts and atoms are animated, and that simple spirits may combine to form a more complex and perfect spirit. The atoms whose spirits are thus united are altered and no longer obey the laws of ordinary matter. In this way it becomes possible to comprehend both the directive influence exerted by the vital spirit toward the accomplishment of an object and the impossibility of spontaneous generation.

The directive molecular force of liquid crystals is probably produced by electrons revolving within the molecule. In fact, the molecules of liquid crystals behave like astatic magnetic systems, freely suspended, and hence they always, even in the act of flowing, maintain definite directions and a crystalline arrangement.

In short, the discovery of liquid crystals has filled an important blank in our knowledge of the states of matter, and has correspondingly modified our theories of polymorphism, amorphism, states of aggregation, etc. The state of aggregation of the molecules cannot affect the properties of matter as profoundly as is commonly supposed. From the fact that substances behave as if they were composed of astatic magnetic molecular systems and are capable of converting chemical energy into work, without fall of temperature, it should be possible to deduce a quantitative theory of the structure of matter and the mechanics of atoms which will promote the advancement of physics, crystallography, chemistry, biology, and the technical arts.—Translated for the Scientific American from Revue Génerale de Chimie Pure et Appliqué.

The Current Supplement.

Much work has been done recently on the economical combustion of coal, and it is possible that the average engineer is led to believe that to secure a high economy it is necessary to get a high percentage of carbon dioxide in the flue gas. Mr. James E. Steely, in an excellent article entitled "Real Relation of CO_2 to Chimney Losses," shows what theoretical combustion really is, and how erratic CO_2 can be. P. Altpeter writes on " Our Perception and Estimation of Areas and Distances." The invention of the pantograph is historically discussed. Inventions for rendering woods and textiles fireproof are described and formulæ given. The Carolina, Clinchfield & Ohio Railway, which cost more than $30,000,000 to build and which involved some extremely difficult engineering work, is described and illustrated at length. Walter Rosenhain writes on the microscope in engineering, and shows how faulty metals may be studied with its aid. O. Bechstein contributes an excellent article on liquefied illuminating and fuel gas. Animal filters and strainers are instructively described by Dr. Enoch Zander. Still another interesting paleontological article is contributed by Charles F. Holder, the subject being "Nature's Traps." The development of algebraic symbolism from Paciuolo to Newton is briefly discussed. Some good formulæ for colored fireworks are published. The engineering, electrical, and trade notes and formulæ are given as usual.

Conviction for Perjury in Patent Case.

In the U. S. District Court, Oregon, C. A. Paterson was convicted of perjury for having sworn falsely under an oath administered to him by a notary public that he was the "original, first, and sole inventor" of an improvement in buckles, for which he filed an application for a patent. The indictment was drawn under section 5392 of the revised statutes of the United States, which provides that any person who takes a false oath before an officer competent to administer oaths is guilty of perjury.

So far as we are aware, this is the first criminal conviction for swearing falsely in a patent application. The presiding judge, Woolverton, in his charge to the jury drove home the importance of the oath in patent applications in the following language:

"Such an oath, declaration, or affidavit constitutes in part the proof upon which the Commissioner of Patents acts in determining whether or not the invention claimed is new and useful, and is such a one as to entitle the claimant to a patent thereon. Thus it is that the claim for the patent forms the basis upon which this inquiry proceeds, and the oath, declaration, or affidavit subscribed in support of the application is therefore touching a matter material to the inquiry before the Commissioner of Patents, and is such a one upon which perjury may be predicated under said section 5392, if the party taking the oath or making the declaration or affidavit swore falsely with relation thereto, or if at the time of taking said oath, he did not believe the matter or facts set forth therein to be true."

The evidence showed that the defendant Paterson had stolen the underlying idea from the true inventor Van Emon. Accordingly the jury was compelled to decide as a matter of fact whether or not Paterson was the true inventor, and whether or not he conceived the idea independently.

Largest Olive Ranch in the World.

Very few eastern people, comparatively, know that the largest olive ranch in the world is located within 25 miles of Los Angeles, Cal.

This wonderful orchard, situated at Sylmar, is ten times larger than the biggest olive ranch in Spain. There are over 120,000 olive-bearing trees, and they average 50 pounds of olives to the tree. The Sylmar ranch consists of 12,000 acres, and each acre contains 110 trees, which produce 2,000 gallons of olives each season. This quantity of fruit makes 250 gallons of pure olive oil—valued at $2 per gallon—thus equaling $500 per acre profit.

The olive wood is highly prized by cabinet makers, as it is very hard and takes a high polish. The Italians consider an olive orchard as a perpetual source of wealth, as the older it grows the more valuable it becomes. The trees are supposed to live about 4,000 years, under favorable conditions. There are some olive trees now on the Mount of Olives, in Palestine, which are computed to be not less than 3,000 years old.

The olive industry has been growing steadily in California since its first introduction by the early Spanish mission fathers; and the olive culture in that State can never be overdone, since the olive can be produced on the American continent with any degree of success only in central and southern California, New Mexico, and Arizona.

The Longest Pipe Line.

Pipe-line connections have been completed by which it is possible to pipe oil from the Oklahoma wells to New York harbor. Oil has been started on the long journey of 1,500 miles. This is the longest pipe line in existence in the United States, and indeed in the world. It is not probable that much oil from the mid-continent district will be brought to the seaboard at present, and the completion of the line seems to be more in the nature of a provision for the future, or for emergencies which may arise. Oklahoma has the most active oil field in the country at present; moreover its production is increasing, while that of Pennsylvania and West Virginia is decreasing. It may not be long before the western wells will be called upon to supply the seaboard and export demand.—American Machinist.

A correspondent in Troy, N. Y., draws our attention to the fact that our mention, in a recent issue, of the New York State Barge Canal as extending from Buffalo to Albany is misleading, since the canal actually connects with the Hudson River at Troy, just above Albany. The citizens of Troy are hopeful of securing the sanction of Congress for a 400-foot channel in the Hudson to their city, and hope to make extensive waterfront improvements in preparation for the completion of the canal.

Correspondence.

A FORGOTTEN GUN.

To the Editor of the SCIENTIFIC AMERICAN:

In one of the sporting magazines I read an article dealing with the various devices used in the transition from the flint to the percussion lock gun. About sixty-five years ago I saw a combination flint and percussion lock gun. While the flint lock was even at that date being superseded, many flint-lock double-barrels were in use. At a shooting match on the outskirts of Edinburgh this gun was used. In each hammer the flint was removed and a piece of bent steel was inserted so that in firing it struck the flash pan close to the vent. The detonators were made very much like the tags on shoe laces. The fulminate was placed in one end, which was closed; in the open end a few grains of powder, closed with a little pellet of wax. When loaded the detonating tags were inserted in the vents. It never missed fire and really was the forerunner of the friction primer still used in many field guns. No mention of this style of gun has been made. It was superior to the old pile lock.

Ames, Okla. W. B. WILLIAMSON.

HOW THE PEACE COULD BE KEPT INTERNATIONALLY.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with interest your article "To Keep the Peace" in your issue of May 29th, and I think that both you and Mr. Dutton are mistaken in thinking that it would require an international army to enforce the edicts of a court. The same object could be more effectually accomplished by a decree of absolute non-intercourse until the offending power submitted to the decrees of the tribunal.

To make my meaning clearer, I will suppose that at least, at the start, all the nations adhering to the tribunal have disarmed. (Of course, nothing could be accomplished unless all the great powers became parties to the agreement to submit their differences to the court.) Now let us suppose that a power, Germany, for instance, should refuse to arbitrate with France and should hastily summon such men as she could get together and invade France.

In this case, both parties having disarmed, France would be in at least as good a condition to defend as Germany to attack. But let us suppose that the minute Germany takes this course, the tribunal issues an order of non-intercourse, viz., that no mails, no telegraphic communication, no commerce, no passengers shall be allowed to leave or enter Germany, in fact that no intercourse of any kind shall be held with the rest of the world. Would not the citizens of Germany be the first to insist that its government should submit to the decrees of the tribunal—in fact, much more quickly than it would be forced to do so by any armed force, which would be difficult to transport to the place needed, difficult to provision and perhaps be defeated by the forces of the power it was trying to coerce? H. W. BARTOL.

Nice, France.

SPEED OF THE "MAURETANIA."

ENGINEER MASTERS OR MASTER ENGINEERS.

To the Editor of the SCIENTIFIC AMERICAN:

As regards the relative position or authority of the master and chief engineer on shipboard to-day, as discussed in your recent issue under the caption "Speed of the 'Mauretania'," let me point out that if we look at the conditions obtaining about forty-seven years ago, when the "Scotia," the last of the Cunard sidewheelers, was built, the responsibilities of the master were at least equally as onerous as those of the chief engineer. Sails were also carried in those days, and here is a well-authenticated story I often heard when a boy, that the Cunard company paid the master a bonus for every lower topsail that was fairly carried away by the wind, and old Commodore Judkins obtained this bonus several times while in charge of the "Persia," and subsequently in command of the "Scotia." But if we come to more recent times, and look at such a steamer as the Inman "City of Berlin," built by Caird in 1874, we shall see that the engineer's duties were not augmented, while the master's were, or would have been had the conditions or circumstances under which he then navigated the North Atlantic been known and realized by him. The "City of Berlin," now the U. S. transport "Meade," is 488 x 44.2 x 34.9 to top of "floors." Now, from the plans I have before me, this makes her practically 37 feet molded depth. This exceeds eight-tenths of the breadth. How it is that she did not follow the "City of Glasgow" and the "City of Boston" under the exigencies of hurried loading in the North Atlantic trade is a miracle. Since becoming a United States vessel she has no doubt been carefully handled, and I may point out that no matter how deep the ship is, she can be rendered perfectly stable by judicious loading, and probably her master was aware that she was lacking "stability of form." This, however, was his burden, if he knew it.

But to return to the engine room. The "Berlin" had a low-pressure cylinder of 120 inches, or 10 feet, in diameter, the largest that ever floated; but the revolutions of this engine were only about 54, giving a piston speed of not over 600 feet per minute. Then the auxiliaries were very few. No ballast pumps, no dynamos, no economizers or feed heaters, no forced draft. She had a surface condenser, but the air, circulating, bilge, and main feed pumps were all a part of the main compound engines, and she had not more than four deck engines; so in this department the engineer's work was comparatively light, but he did not know it. Looking at him at work, you would have thought that the whole weight of the universe was on his shoulders.

But the master in those days had to consider the sails, freeboard, and stability. Unfortunately, however, for many thousands of people, this latter he did not understand. He took charge of whatever the owners gave, and they in turn trusted the shipbuilders and classification societies. This seems to show that the master of forty or more years ago had a greater variety of work than the master of a great mail steamer has to-day, while the engineer's work was more limited. In a great turbine-propelled steamer there may be some surcease of labor in connection with the propelling engines, but the number of auxiliary engines is vastly increased. In some ships, instead of ten or a dozen donkey engines there are about a hundred of such, and nearly two hundred cylinders, the operating and repairing of which the average master knows little or nothing about. Then more work has to be got out of the boilers by forced draft and higher pressure. From all this it appears to me, that in the near future the executive officer on a great steamship, instead of being the master of the engineer, will be an engineer master.

Cleveland, O. J. R. OLDHAM, N.A.M.E.

CONSTRUCTION OF AN ELLIPSE.

To the Editor of the SCIENTIFIC AMERICAN:

Having recently had occasion to perform an "envelope" construction for obtaining an ellipse, I made reference to your issue of August 25th, 1906 (page 135), in which J. B. G. gives the following envelope construction for drawing an ellipse when the axes are given:

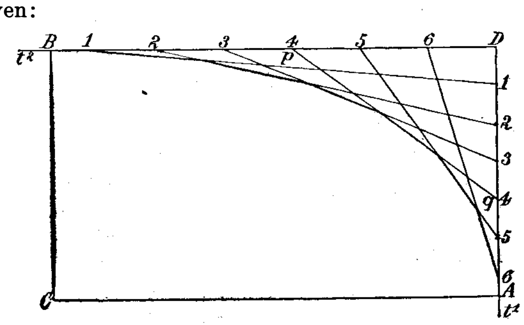


Fig. 1.

Let CA, CB be the axes of the required ellipse. Complete the rectangle $ACBD$, divide DA and DB each into 13 equal parts, and draw lines as shown, each of which will thus be a tangent to the required ellipse.

Now I wish to point out that the above construction is incorrect, or at least that it is only a rough approximation, for the lines in question are not tangents to the ellipse having the given lines as principal semi-axes.

First. Let $a\,b$ denote the magnitudes of the semi-axes. The equation of the ellipse is then

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1.$$

The condition that the right line $y=mn+c$ may touch this ellipse is that

$$c=\sqrt{a^2m^2+b^2}\ \ldots\ldots\ldots\ldots(1)$$

c being the intercept of the right line on the y-axis, and m the tangent of its inclination to the n-axis. Now consider the line 4, 4. The co-ordinates of the points p and q through which it passes are respectively $\left(\frac{7}{13}a, b\right)$, $\left(a, \frac{5}{13}b\right)$. Its equation is, therefore,

$$\frac{x-\frac{7}{13}a}{a-\frac{7}{13}x}=\frac{y-b}{\frac{5}{13}b-b}$$

Put into the form of $y=mx+c$, this equation becomes

$$y=-\frac{4b}{3a}.x+\frac{67}{39}b$$

Here $m=-\frac{4b}{3a}$, and $c=\frac{67}{39}b$, and it will be easily verified that the condition (1) is not satisfied. Hence the line 4, 4 is not a tangent. The same may be shown generally or individually for each of the other lines.

Secondly. When the axes are equal, this construction should give a circle, the form which an ellipse assumes in this special case; but that the curve ob-

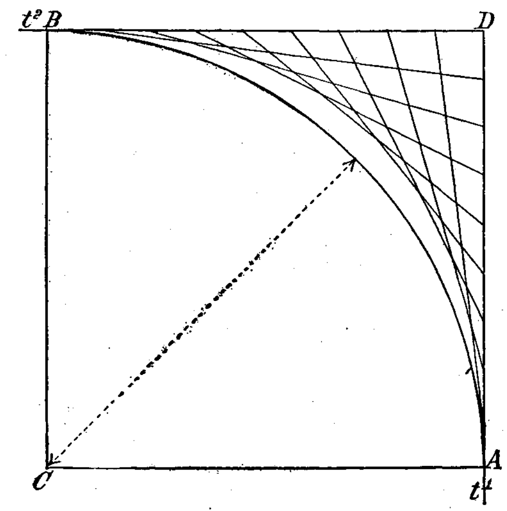


Fig. 2.

tained differs (in the case of the middle radius by as much as 4 per cent) from a true circle is seen in Fig. 2. As a matter of fact, both in this case and in the former more general case, the envelope obtained is a parabola touching DA, DB at the points t_1 and t_2.

Thirdly. An inspection of the figure in question and Fig. 1 on the page of your issue referred to will at once show that the shapes of the two curves differ considerably, though the ratios of the axes in the two cases are, by chance, the same, viz., 2 : 3; the former oval is distinctly "squarer" than the true ellipse.

I append a method of accurately obtaining an ellipse by an envelope construction. It is based on Brianchon's theorem, which states that if a hexagon circumscribe a conic, the three diagonals are concurrent, and the converse of this proposition. Thus:

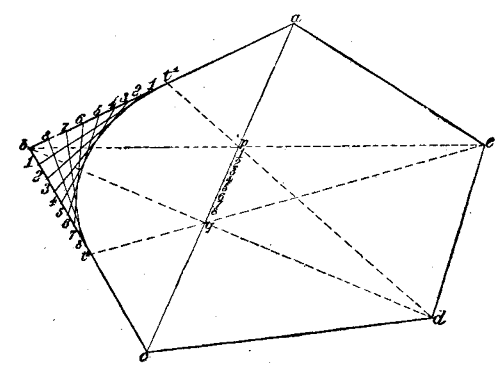


Fig. 3.

Let $a\,b$, $b\,c$, $c\,d$, $d\,e$, $e\,a$ be five given tangents to the required ellipse, which are sufficient to determine it. Join $a\,c$, $b\,d$, $b\,e$, and let the two latter cut $a\,c$ in p and q. Produce $d\,p$, $e\,q$ to cut $a\,b$, $b\,c$ in t_1 and t_2, which points will be the points of contact of the ellipse with these sides. For $a\,t$, $b\,c\,d\,e$ may be regarded as a hexagon, of which the sides $a\,t_1$, $t_1\,b$ are in a straight line and whose diagonals are concurrent; hence, by the property stated above, each of its sides touches an ellipse. Since $a\,b$ can only touch this ellipse once, it follows that t_1 is the point of contact, and the same reasoning applies to t_2. By choosing a range of some 8 points at random in $p\,q$, and by joining d and e to each of these points in succession and producing these lines to meet $b\,t_1$, $b\,t_2$ respectively, two new ranges of corresponding points are obtained; when these are joined as shown in the figure, a series of tangents to the ellipse which touches the five given lines are obtained. The remaining corners may be "taken off" in a similar fashion, but when the construction has been repeated for one of the opposite corners (d or e), with a little practice the rest of the ellipse can be sketched in quite accurately by free-hand.

This construction adapts itself particularly well to obtaining the ellipse of gyration of an area or section, in which five or six tangents are usually first obtained.

Although the following point has no bearing on the above, it might be of interest to some of your readers to know that meters may be reduced to yards by the same method that French pounds are reduced to English pounds, viz., by multiplying by 1.1. This method is accurate to ½ per cent.

WARWICK WORTHINGTON.

Pembroke College, Cambridge, Eng.

Paint for Shingle Roofs.—The wood surface to be protected must be well coated twice, at short intervals, with hot coal tar and to this coating a thin layer of pulverized screened brick-earth applied. After a few days a perfectly solid mass will have formed, which will not only protect the wood against any absorption of moisture, but at the same time obviate all fire risk, as it perfectly resists flames, especially if, after a few days, the coating is lightly renewed and so much brick-earth applied that the tar appears quite saturated.

A NEW PROCESS FOR DAMASCENING, INLAYING, AND BLENDING METALS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The beautiful art of damascening, the origin of which is buried in the depths of antiquity, but which

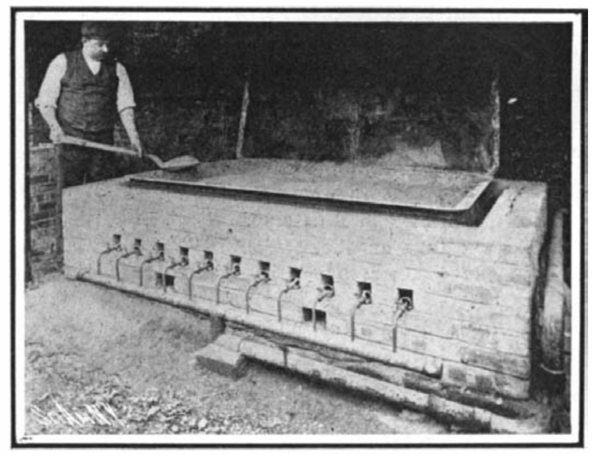
Prayer book cover in copper inlaid with zinc.

no doubt hails from the East, has been subjected to repeated modifications during the past few years in order to render it more commercially applicable than it probably ever was even in its halcyon Oriental days. The hand-wrought work so exquisitely performed at the expenditure of considerable time centuries ago is far too costly for the present age, except to the connoisseur. This process briefly consisted in chasing the design upon a metallic foundation of the object to be decorated and then filling the incisions with fine wire or strips of other metal, generally silver and gold, by means of a special tool, the whole finally being smoothed and polished. In order to render the inlay as immovable as possible, the recesses were undercut, so that the decorative metals were in reality dovetailed into the main fabric.

Such a delicate operation calls for remarkable skill and patience combined with a sensitive hand, and for this reason cannot be executed by machinery. Yet at the same time there prevails at the present day a widespread demand for metal inlay work, and various methods have been evolved for the more rapid and cheaper accomplishment of the work, such as the ether, parcel, or close plating, fusion, electrical, and lead processes. Recently, however, attention has been centered in the new system of inlaying and ornamenting metallic surfaces that has been perfected by Mr. Sherard Cowper-Coles, the well-known British electro-metallurgist, which possesses great commercial possibilities, owing to the exquisite character of the work, combined with the rapidity and cheapness with which it can be carried out.

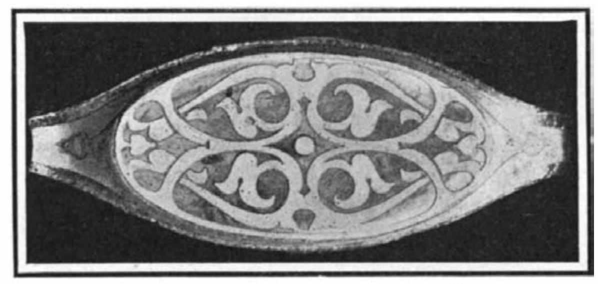
This process is based upon a discovery made by the inventor some five years ago during a series of experiments upon which he was engaged in connection with the annealing of iron. In the course of these investigations he found that metals in a fine state of division, that is in the form of powder, when raised to a certain temperature which was actually several hundred degrees below their melting point, in contact with a solid metal, volatilize or give off vapor, which condenses on the solid metal immersed in the powdered metal. Recently the inventor in following up the discovery has turned it to distinct advantage for decorative work, the results of which are similar to damascening, but with the additional and important advantage that there is no possibility of the metals so blended together subsequently becoming separated, as is often the case in ordinary damascening. At the same time it also enables a more extensive range of effects to be secured, as a large number of metals can be blended together which previously have been impossible, and alloys of many colors and tints can be obtained in one operation of baking. Moreover, the thickness and depth to which the metals are to be inlaid and onlaid can be controlled at the will of the operator.

The process is exceedingly simple. The article to be decorated is first covered with a stopping-off solution about the consistency of cheese, and can thus be easily cut with a knife. The design of the desired inlay is then executed upon this composition by means of a specially designed tool having a sharp edge.



Oven in which the damascening is done.

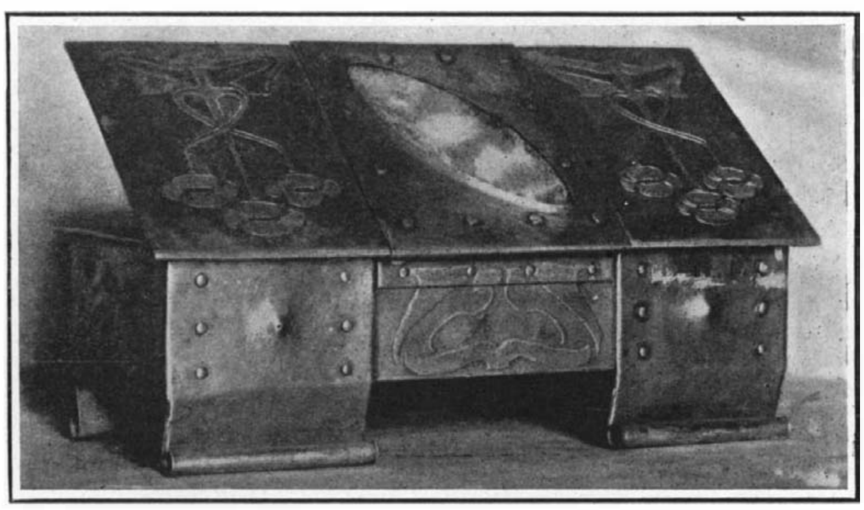
The articles to be decorated are covered with metal dust and then heated to the required temperature.



Copper tray covered with the stopping-off composition ready for baking.

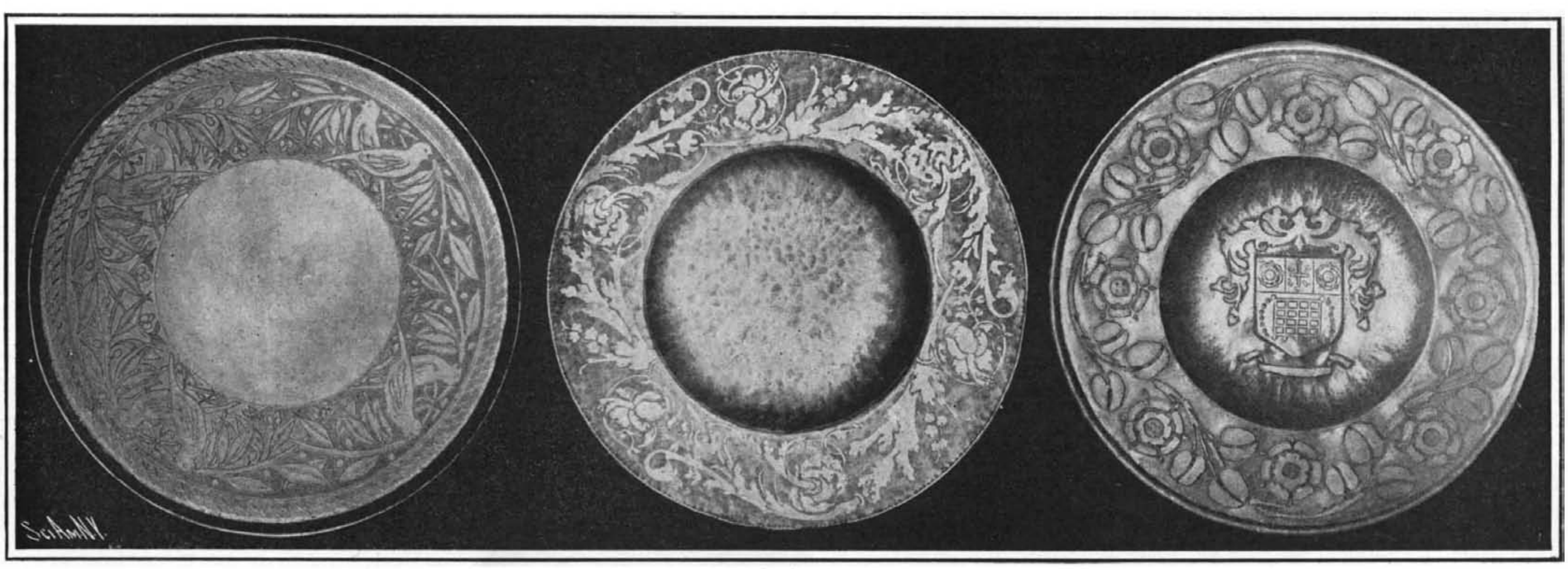
Those portions to be removed are then lifted and cleared away, leaving the surface of the foundation metal exposed. This operation completed, the article is placed in an iron box containing the metal which is to be used for the inlay in a powdered form. If, for instance, the inlay metal is to be zinc, the box is accordingly charged with zinc dust, a product obtained direct from the zinc-smelting furnaces. The iron re-

Copper teapot inlaid with zinc and brass.



Iron box inlaid with zinc and enamel.

Copper and brass vessel inlaid with zinc.



Copper tray inlaid with zinc and brass.

Foliage and birds a combination of brass and copper.

Hammered copper dish inlaid with zinc.

Hammer marks show through the inlay.

Copper dish inlaid and onlaid with zinc.

Onlay is raised as much as $\frac{1}{16}$ inch above the copper surface.

A NEW PROCESS FOR DAMASCENING, INLAYING, AND BLENDING METALS.

ceptacle, together with the objects to be ornamented and the zinc dust, are inserted in a suitable baking oven and heated to a temperature of about 500 deg. Fahr., while the melting point of zinc is 686 deg. Fahr. The time and temperature vary according to the thickness and depth of the inlaying which is required, and range from a few minutes to several hours. A little experience, however, soon teaches the operator the precise time and temperature necessary for obtaining given results with different metals.

When the article has been sufficiently baked, the box is permitted to cool, opened, and the articles withdrawn. Brushing with a stiff brush serves to remove the superfluous dust and also the stopping-off composition which the process of baking has loosened. The stopping-off and baking processes can be repeated several times when it is desired to inlay two or more metals.

The point may be raised that the metal box containing the metal dust will in a short time become thickly incrusted with metal, but such experience has proved not to be the case, for the reason that the metal box is hotter than the powdered metal. A useful type of furnace or baking oven for general work, such as panels, trays, and other flat articles, is that shown in the accompanying illustration. It consists of an iron vessel 8 feet in length by 4 feet in breadth and 1 foot deep. The box is half filled with the metal dust, and the objects to be treated are well immersed in the powder, care being observed that they are adequately covered over therewith. The box is covered with a lid, and over this an iron framework is placed carrying fire bricks and provided with a small central flue to draw the heat from the burners up the sides of the box and over the top, to secure even and regular heating over its whole surface. Such a furnace can be constructed at a cost of about $150 complete.

The damascening produced by this method is of a more permanent character than the ordinary ancient hand-wrought process. It is impossible for the inlay to become detached from its foundation, for the simple reason that the two under the application of the heat become alloyed together. It is also found that the inlaying metal in the case of zinc is very much harder than the brass or copper into which it is inlaid.

One very notable feature of the process, which is of considerable importance, is that a wide variety of colors and alloys can be obtained in the one operation of baking. For instance, a copper tray is to be inlaid with zinc, and at the same time it is desired to convert certain portions of the copper into brass. This is accomplished by varying the thickness of the stopping-off composition, and by baking at a somewhat higher temperature than would otherwise be employed. The result is that certain portions become converted into golden-colored brass, while the other portions remain unalloyed copper. The inlay work is carried out so delicately and evenly, that in hammered metal objects the hammer marks in the original article will show through the inlay as if the decorative metal had been hammered in. If desired, the metal foundation can possess the stippled hammered effect while the inlay has a smooth surface, thus giving a striking and pleasing contrast. Some of the effects obtained are very beautiful in character. The zinc inlay can be made so that it is surrounded by a fine line of brass, or be both inlaid and onlaid, in which event the latter ornamentation can be raised as much as one-sixteenth of an inch above the surface of the copper. Again, iron can be inlaid with both zinc and enamel, which yields an attractive effect, or a variety of hues produced by burning the whole of the copper surface with zinc and then etching the pattern down to the different alloys formed intermediate between zinc and brass. By this arrangement the variety of tones secured is both extensive and beautifully graded. It must not be thought that the effects secured are only obtainable by the use of zinc and copper. Such is not the case, since the more subtle shadings and hues between tin, aluminium, nickel, cobalt, and other metals can be as easily produced. In the photographs accompanying this article the contrasts of zinc and copper only are shown, for the simple reason that the colors possible by using other metals do not produce a sufficiently striking effect in a photograph.

Nor is the process merely confined to the embellishment of flat surfaces. It is as readily applicable to raised surfaces and objects of all shapes and sizes, such as teapots, coal vases, and other similar articles. It can also be adapted to the finest filigree as easily as to bold work, as is required in panels or heraldry. An important development has been in connection with its application to book covers, the appearance of such damascened metal-bound volumes being appreciably enhanced.

One distinct charm about this new process, and one that moreover is unique, is the absence of the sharp line of demarkation as is characteristic of damascening. Instead there is a soft transition from the inlay to the surrounding foundation metal. That is to say, where zinc is inlaid into copper, the inserted metal is surrounded by a narrow band or halo of golden-colored alloy. It is obvious therefore that very beautiful toned colored effects of great subtlety can be produced, ranging from silver white zinc to yellow brasses and bronzes of innumerable shades, graduating to red copper and gradations of yellow and golden browns.

THE FIRST OF THE 1909 FLIGHTS FOR THE SCIENTIFIC AMERICAN TROPHY.

The provisional winning for the second time on the 17th instant of the beautiful aeronautic Trophy given by this journal two years ago to further the science of aviation makes this a fitting time for us to again show it to our readers. For the benefit of those who have not seen it before, a brief description is herewith appended.

SCIENTIFIC AMERICAN TROPHY.

First competitive trial for 1909 won by Glenn H. Curtiss on July 17th.

Upon a globe representing the firmament, Prof. Langley's following-surface biplane is seen soaring through the clouds. Surmounting the globe is an American eagle holding the wreath of victory in its beak. The globe rests upon a whirl of clouds that rises from a base, from the sides of which spring winged horses carrying riders that bear aloft olive branches. This beautiful piece of silver was presented to the Aero Club of America to stand for the highest achievement in aviation the world over. At the time it was given, two years ago, no one in America, with the exception of the Wright brothers, had made a flight in a heavier-than-air machine, and the fact that these two aviators had at last conquered the air was not generally known. It was at first proposed to hold competitions at stated times and places for the Trophy, but this was found impracticable, so that now the aviator who wishes to compete is allowed to choose his own time and place and the Aero Club will send a representative to witness the flight. The winner for any year is now the aviator who makes the longest and best flight in a closed circuit during the year.

The conditions required at first were a flight of 1 kilometer (0.621 mile) in a straight line; but it was not until July 4th, 1908, that an attempt was made to fulfill these conditions. Upon that date Glenn H. Curtiss (who had been experimenting with Dr. Alexander Graham Bell in the latter's Aerial Experiment Association), made a flight of a little over a mile in the association's fourth aeroplane "June Bug," and was consequently declared the first winner of the Trophy. In view of the flights that were being made by French aviators, the conditions were then changed to 25 kilometers (15½ miles) in a closed circuit. The first of the present year the conditions were changed as above stated, 25 kilometers remaining as the minimum distance to be flown. This is 5 kilometers (3.1 miles) more than is required in the international contest for the Bennett trophy and $5,000 cash prize, which is to be held at Rheims, France, on the 29th of August.

After having built and delivered to the Aeronautic Society his new biplane that he constructed expressly for this organization, Mr. Curtiss decided that he would attempt a flight for the SCIENTIFIC AMERICAN Trophy with this machine on July 5th at Morris Park, just a year after he had won it the first time. The flight was not attempted until dusk on that afternoon because of too much wind, and when it was made it was merely a U-shaped flight of about a mile. The machine was then taken to Mineola, L. I., and on July 17th another trial for the Trophy was made. This was entirely successful, as told in our last issue. We give herewith some further particulars regarding this flight, such as the times for each round of the triangular 1.313-mile course, etc.:

TIME OF LAPS IN G. H. CURTISS'S FLIGHT FOR THE SCIENTIFIC AMERICAN TROPHY.

		Time of lap
Start	5:23:16	
1st lap	5:25:52	2:36
2nd lap	5:28:32	2:40
3rd lap	5:31:08	2:36
4th lap	5:33:48	2:40
5th lap	5:36:27	2:39
6th lap	5:39:11	2:44
7th lap	5:42:01	2:50
8th lap	5:44:45	2:44
9th lap	5:47:25	2:40
10th lap	5:50:15	2:50
11th lap	5:52:58	2:43
12th lap	5:55:50	2:52
13th lap	5:58:40	2:50
14th lap	6:01:32	2:52
15th lap	6:04:26	2:54
16th lap	6:07:14	2:48
17th lap	6;10:03	2:49
18th lap	6:12:53	2:50
19th lap	6:15:40	2:47

Total elapsed time 52 minutes, 30 seconds.
Total measured distance, 24.947 miles.
Average speed, 28.51 miles an hour.

The course was triangular, careful measurement made by Mr. Charles M. Manly after the flight showing the legs to be 2,045, 2,442, and 2,446 feet in length respectively. One circuit over the lines between stakes was therefore 1.313 miles, but the machine of course covered a considerably greater distance, as it made fairly wide turns. The speed of the aeroplane was undoubtedly over 30 miles an hour. The minimum distance required to win the Trophy was flown through with the completion of the twelfth lap, the time for this 15.73 miles being 32 minutes and 34 seconds, so that the flight was of 20 minutes more duration than was required. It was only ended because of the fresh breeze that sprang up, and also because Mr. Curtiss feared his fuel would give out and he would not be able to land within 100 meters (328) feet) of the starting line, as required in the rules. He landed within 287 feet of the line.

Mr. Curtiss's success in flying double the distance required in the Bennett Cup race, and the fact that the duplicate machine he has built to compete has a larger motor, gives him a good chance of beating whatever speedy French monoplanes may be entered against him in the race at Rheims on the 29th ultimo. Six of these machines—three Pelterie, two Bleriot, and one Santos-Dumont—and ten biplanes have been entered in the French elimination race to be held on August 22nd. Three machines have been entered by England, France, and Italy, and one each by Austria and America. Some of the contests to be held during this aviation week are as follows:

Grand Prix de la Champagne ($30,000) for longest continuous flight; speed test prize ($4,000) over distance of 30 kilometers; height prize ($2,000) for greatest altitude in excess of 50 meters; speed prize ($2,000) for the fastest circuit of the course; and passenger prize ($2,000) for carrying the greatest number of passengers 10 kilometers at the fastest speed.

THE HEAVENS IN AUGUST.

BY HENRY NORRIS RUSSELL, PH.D.

THAT the hot weather of midsummer should be an astronomical phenomenon hardly seems possible to any one who is not an astronomer. Still, everyone can determine by direct observation that the heat comes from the sun, and should be greatest when it rises highest in the sky, and shines on us for the longest time; and it is easy to see how the stored-up heat of early summer is carried on, so that the maximum temperature falls, not in June, but in July or August.

But when we ask, How hot must the sun itself be, in order to send us so much heat, at its enormous distance? the astronomer and the physicist must join in long and careful studies before the question can be answered. In the first place, the sun's temperature does not really depend on its distance at all. If it was twice as far off, and twice as big, it would look just the same, and send us just as much heat. What we receive depends on how big the sun *looks* in the heavens, and how bright it *really is per square mile* or square foot. We can therefore compare it with substances in our laboratories, which, though enormously smaller than the sun, are also enormously nearer, so that the two things balance.

Now, in the laboratory we find that all substances radiate heat to a greater or less degree, even at the lowest temperatures we can produce. Complete absence of radiation would only occur for a body at the "absolute zero" (i. e., one for which the motions of its molecules had all ceased) which can never be obtained in practice. As the body grows hotter, the radiation of heat from it rapidly increases. However, at the same temperature, some substances (such as polished metal) send out much less heat per square inch than others (such as a surface covered with lampblack).

For reasons which we have not space to detail, the blackest substances (which at a given temperature send out most heat) are taken as a standard. It is found that the amount of heat sent out per square inch by such a "black body" depends, not on the particular substance, but only on its temperature, and that as the temperature rises, the heat radiated increases as the fourth power of the temperature measured from the absolute zero. Doubling the temperature increases the radiation sixteen times, and so on. We can find by actual experiment how much heat a black body, apparently as large as the sun, sends us at different temperatures, and verify this law (which bears the name of its discoverer, Stefan). The sun itself sends us very much more heat than a body of the same apparent size, heated as hot as we can get it; but by applying Stefan's law (which there is good theoretical reason to trust) we can estimate how hot we would have to heat our experimental body (if it could stand it) to imitate the sun's condition.

The problem then reduces to the exact measurement of the heat we get from the sun. This is difficult, because our atmosphere absorbs a good deal of it, and it is hard to calculate how much. By working on a high mountain (so as to have less air above one) and measuring the heat which we receive from the sun at different altitudes (that is, through layers of air of different thickness) the problem can be solved with a good deal of accuracy.

A very careful determination, using delicate electrical apparatus to measure the heat received, has been made by Dr. Scheiner of the Potsdam University, who set up his apparatus on a mountain in Switzerland, at an altitude of 10,000 feet.

Translating his results into the units most familiar in our ordinary life, it appears that the heat which we receive from the sun (if directly overhead) per square foot would raise the temperature of a pound of water 8½ deg. F. per minute.

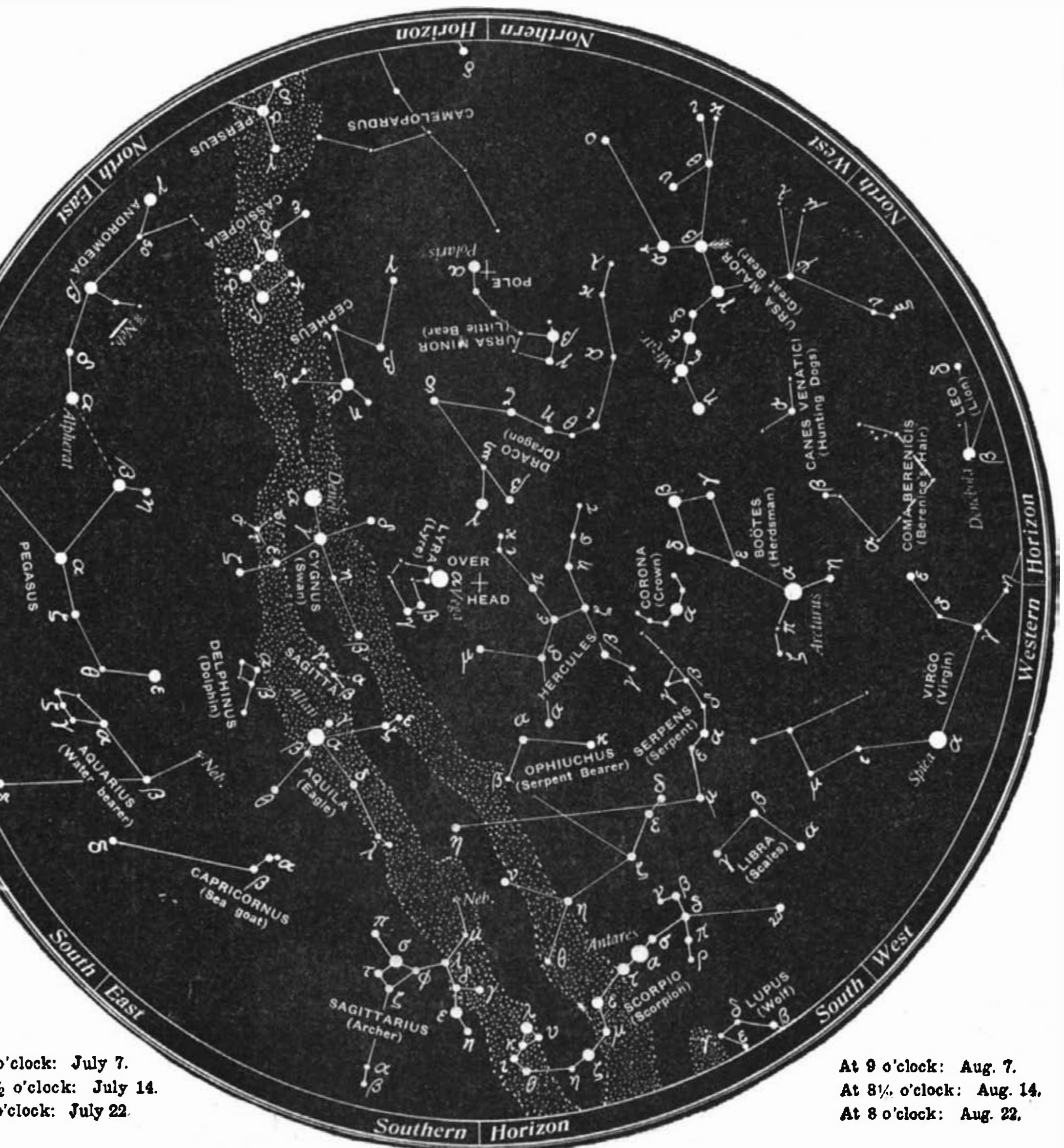
Only about half this heat reaches the earth's surface (at sea level) directly. The rest is absorbed in our atmosphere, and helps to warm it. Even so, a man lying on the ground in the sun's rays, and presenting six square feet of surface to them, will receive more heat in an hour than is needed to raise a gallon of water to the boiling point. So it is no wonder he is warm!

Working out the sun's temperature from his data, Dr. Scheiner finds it to be 5,950 deg. C., or 10,740 deg. F., with an uncertainty of about 50 deg.

This is, however, the temperature which would give us the observed radiation if the sun was a "perfect radiator," and had no absorbing atmosphere. As a matter of fact, all known substances have to be heated somewhat hotter than this theoretical temperature before they give out the same amount of heat. Also, if the sun's atmosphere stops some of his heat, the radiation from, and the temperature of, his actual surface must be greater than the *minimum* value here determined. How much allowance must be made is a matter of judgment. Dr. Scheiner estimates the actual temperature of the surface (if a good radiator) at 6,800 deg. C., or about 12,250 deg. F.

The highest temperatures attainable by artificial means (in the electric arc and furnace) are about 4,000 deg. C., or 7,000 deg. F.

The sun's surface temperature, though higher than we can produce experimentally, is hardly of a different order of magnitude. What the internal temperature may be we can hardly even conjecture, for we know too little of the properties of matter under conditions so far removed from our experience.



At 11 o'clock: July 7.
At 10½ o'clock: July 14.
At 10 o'clock: July 22.

At 9½ o'clock: July 30.

At 9 o'clock: Aug. 7.
At 8½ o'clock: Aug. 14.
At 8 o'clock: Aug. 22.

NIGHT SKY: JULY AND AUGUST

THE HEAVENS.

The most characteristic of the summer constellations is perhaps Scorpio, which can now be well seen on the southern horizon. It is the finest of the twelve zodiacal constellations, but we never fully realize its brilliancy, for a great part of it rises but a few degrees above our horizon. As our initial letter shows, the resemblance of the constellation to the creature for which it is named is remarkably good.

The great red star Antares is at the Scorpion's heart, its head and claws extend to the conspicuous vertical line of stars β, δ, π (in fact, they once occupied a large part of what is now attributable to Libra) and the long, recurved tail sweeps down to the horizon and ends with the bright star λ, which might be called the Scorpion's sting.

Several individual stars are noteworthy. β and μ are fine doubles, which are resolved into multiple systems by powerful telescopes. Antares itself has a close companion, less than 1/100 as bright as its primary, and very green. This is one of the finest pairs in the heavens, but is too difficult for small telescopes, unless the air is exceptionally steady. μ is a naked-eye double, though hard to separate except on a very clear night, and one of the components is a spectroscopic binary, remarkable for the great mass and orbital velocity of the two bright stars which compose it.

To the left of Scorpio we see Sagittarius, with the familiar "Milk Dipper" (composed of the stars λ, φ, σ, τ, ζ). The magnificent star clouds in the Milky Way, which lie in this region, can now be seen at their best.

Capricornus, with the naked-eye double α, is in the southeast, and Aquarius is rising on the left. The great square of Pegasus is almost due east, and Andromeda is in the northeastern horizon. Cassiopeia is higher up, then Cepheus, then Cygnus, nearly overhead. South of this are the small groups of Sagitta and Delphinus, then Aquila, with the bright star Altair. Vega is almost exactly overhead, a splendid mark for the zenith. Due west is Hercules, then Corona, then Boötes, with the ruddy Arcturus. Ophiuchus and Serpens occupy the upper part of the southwestern sky, and Libra and Virgo the lower. Ursa Major is in the northwest, and Draco and Ursa Minor in the north, above the Pole.

THE PLANETS.

Mercury is in conjunction with the sun on the 4th, and is invisible during the first half of August. Toward its end he can be seen just after sunset, but not as well as next month. On the 25th he is very near Jupiter, about 1 min. south of him, and should be easy to pick up.

Venus is likewise evening star, setting about 8 P. M. On the afternoon of the 12th she is in conjunction with Jupiter. At 2 P. M. they are but 12 min. of arc apart, in the same telescopic field. By nightfall in America they will have separated a little, but their distance will still be less than the moon's apparent diameter. This close approach of the two brightest planets is well worth watching.

Mars is in Pisces, rising about 9:45 P. M. on the 1st, and 8 P. M. on the 31st. He is very conspicuous, and will be an object of assiduous telescopic study, though his nearest approach to us does not occur till next month.

Jupiter is evening star in Leo, setting about 8 P. M. in the middle of the month.

Saturn is in Pisces, about an hour east of Mars, and rises about 9:30 P. M. on the 15th.

Uranus, which passed opposition last month, is in Sagittarius, well placed for observation. On the 15th he is in R. A. 19 h. 17 m. 30 s., dec. 22 deg. 44 min. south, and is moving 8 s. westward and 15 s. southward per day.

Neptune is in Gemini, observable, if at all, only in the early morning.

THE MOON.

Full moon occurs at 4 P. M. on the 1st, last quarter at 8 A. M. on the 8th, new moon at 7 P. M. on the 15th, first quarter at 11 P. M. on the 23d, and full moon once more at midnight on the 30th.

The moon is nearest us on the 3d, and farthest off on the 19th. She is in conjunction with Mars on the 5th, Saturn on the 6th, Neptune on the 12th, Mercury on the 16th, Jupiter on the 17th, Venus on the 18th, and Uranus on the 27th.

A faint comet was discovered by Mr. David at the Princeton University Observatory about the middle of June. Details of its orbit are not yet accessible to the writer.

HOW TO MAKE CONCRETE POTTERY.—IV.

BY RALPH C. DAVISON.

(*Continued from the issue of July 17th.*)

The method of making plaster molds for circular objects is somewhat similar to that described for making square or oblong molds in the last article. Instead of making the outer mold in two pieces, however, as described for square work, it is always better to make three pieces, as illustrated in Fig. 14, for

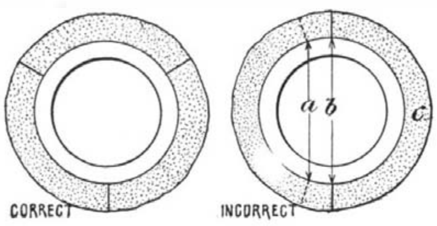


Fig. 14.—CORRECT AND INCORRECT METHODS OF DIVIDING THE OUTSIDE MOLD.

the reason that in making three pieces the liability of having an undercut or overhang on one of the halves of the mold is entirely obviated. When two pieces only are made, unless the mold is cut or parted exactly in the middle there will be an undercut on one piece of the mold, which would prevent the mold from freeing itself from the finished cast. By referring to the dotted lines in Fig. 1, the meaning of an undercut will be made clear. The distance *a* is less than distance *b*, and so the part *c* can not be removed. The method of making this outer mold is the same as was used for making the outer mold for the square form,

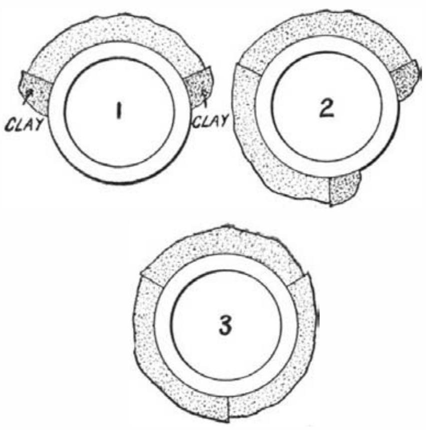


Fig. 15.—SUCCESSIVE STEPS IN MAKING THE OUTSIDE MOLD.

excepting that as above stated there are three pieces instead of two to be made.

The position of the modeler's clay and the various steps in the construction of the outer mold is clearly shown in Fig. 15. Shellac and oil the edges of each section before coating the next. The sides of the concrete or cement cast, if the object is of any size at all, should be at least one-half inch thick, and therefore the core, which is to be composed of four pieces, as shown in Fig. 16 at *A*, *B*, *C*, *D*, should always be at least one inch smaller in diameter than the inside diameter of the outside mold. The first step toward making the core is to secure a box and fit it up as

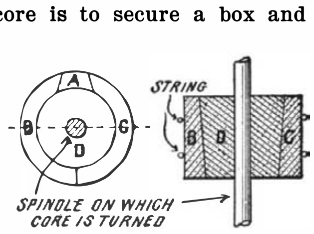


Fig. 16.—THE CORE MADE IN FOUR PIECES.

indicated in Fig. 17. The tapered center of the core *D*, shown in Figs. 16 and 18, should be made first. The foundation for this can be made by winding around the spindle in the box shown in Fig. 17 cheese cloth or mosquito netting which has previously been dipped in a thin "mixture" of plaster of Paris. After having prepared the spindle as above, a template should be cut from a piece of tin and secured to the box as shown in the plan view, Fig. 18. The tin template should be mounted on a piece of wood, to give it strength, and the wood in turn should be secured by small nails in position on the box as shown. This template should be set the proper distance from the center of the spindle, so that on turning the spindle the center of the core produced will be of the exact size and taper desired, as indicated at *D*, Fig. 16.

After having secured the template in the proper position mix up some plaster of Paris, as previously explained, and pour or throw it on the partly built-up core, at the same time turning the spindle by means of the handle. The plaster thus added will adhere to

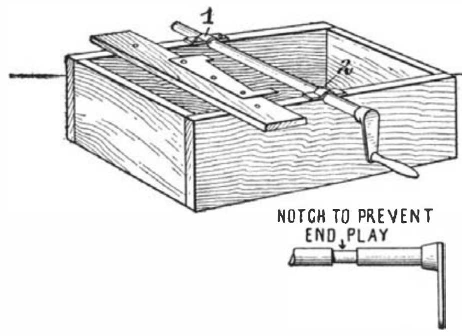


Fig. 17.—BOX FOR TURNING PLASTER.

and partly harden on the spindle. Keep adding plaster and turning the spindle until the plaster is built out to the template, which will cut or scrape it off and form it into a perfect cone. To smooth the surface of the cone, cut away all of the plaster that has adhered to the top of the template, and with your hand, which has previously been wet with water, rub the surface of the cone as it is being revolved. Now remove the template and shellac and oil the cone well with either heavy oil, vaseline, or lard.

The next step is to turn up or form the outer portion of the core. A template should be made for this

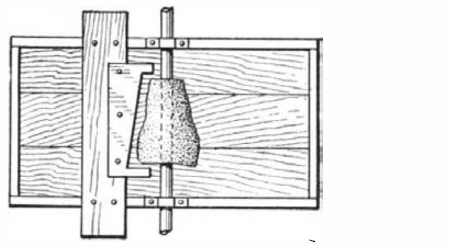


Fig. 18.—TEMPLATE FOR INNER PART OF CORE.

and secured to the box, as was done for the center of the core, care being taken to locate it in the proper position from the center of the spindle, so that the diameter of the outside of the core will correspond to the desired diameter of the inside of the finished piece to be made.

Proceed to pour or throw the plaster mixture on the center of the core, which has already been oiled, and keep turning the spindle until the plaster has been built up and scraped off by the template and the desired form produced to the outer surface of the core. Smooth the surface off, as was done with the inside of the core or cone, and shellac and oil it well.

Now remove the whole from the box by lifting up the tin strips 1 and 2 in Fig. 17, which hold the spindle in place, and part the inner core *D* from the outer section of the core by jarring the end of the wooden spindle lightly with a hammer. The next step is to cut the outer sections of the core, which is now in the form of a continuous ring, into three pieces. This

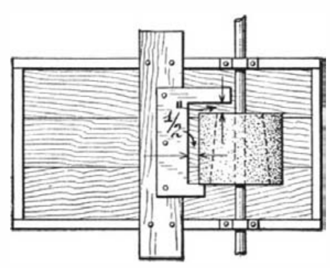


Fig. 19.—TEMPLATE FOR PLASTER MODEL.

can be done with an ordinary wood saw; the thinner the blade of the saw, the better. Use water on the saw blade while cutting, as this will prevent it from binding. Be sure to cut the sections as shown in Fig. 16. The section *A* must be wider on the inner circumference than on the outer, as shown. Now assemble the three pieces, into which the outer section of the cone has been cut, around the inner section of the core *D*, so that they are again in the same position as shown in Fig. 16, fastening them.

Then place the core as assembled in the box again, care being taken to get it into the same position as

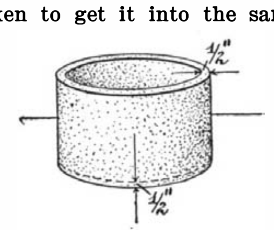


Fig. 20.—THE FINISHED PLASTER MODEL.

before removing from the box, securing it in place by placing the tin strips 1 and 2 over both ends of the spindle as before. Shellac and oil well the outer portion of the core again and then set in place on the box a tin template mounted on wood and shaped to correspond to the outer section of the finished piece, as indicated in Fig. 19.

As we are now going to make a model in plaster of the finished piece, the sides of which must not be less than one-half inch thick, the template as shown must be placed at least one-half inch from the outer surface of the inner core. After having adjusted the template, proceed to throw on the plaster and turn it up until it is built out to the template and shaped into the desired form. Smooth it off with water, and then shellac and oil. Remove the whole from the turning box, tap the end of the wood spindle, and if care has been taken to shellac and oil all of the parts as directed, the center of the core will fall out. To remove the outer part of the core, first take out the smaller piece *A* by forcing it toward the center. The rest of the core will then collapse, and we will have left a plaster model of the box, as shown in Fig. 20,

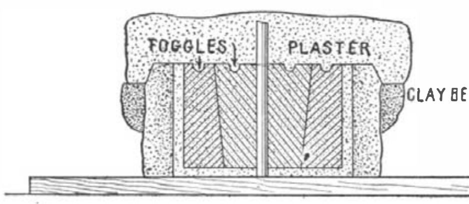


Fig. 21.—PARTS ASSEMBLED FOR CASTING PLASTER CASE.

which we are to cast in cement. Oil the outside of this well, and then proceed to make the outer plaster mold in three pieces, as already explained and as shown in Fig. 15.

After having made the outer mold, proceed to assemble the parts as shown in Fig. 21, and cast the plaster case, as was described in the last article for square objects. Use a clay belt around the outer mold as shown to prevent the plaster from coming down too far. The spindle must be cut flush with bottom of plaster model. Before casting the case be sure to

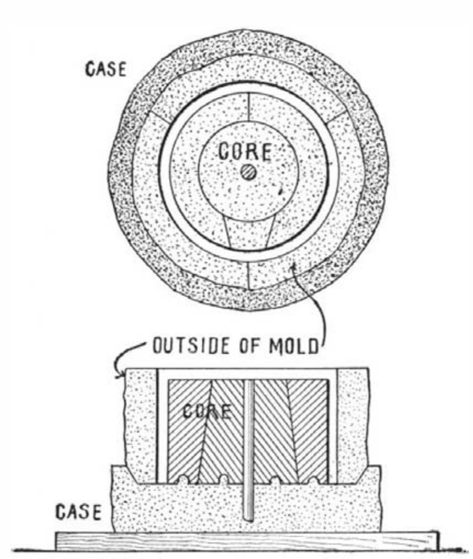


Fig. 22.—PLASTER MOLD READY TO RECEIVE CEMENT MIXTURE.

shellac and oil all parts which will come in contact with the wet plaster used in casting the case. After having removed the case assemble the parts again, using the case as a base as shown in Fig. 22. Cut the spindle flush with the core. The mold set up in this position is ready to receive the liquid cement mixture, which is poured the same way as already explained in the last article.

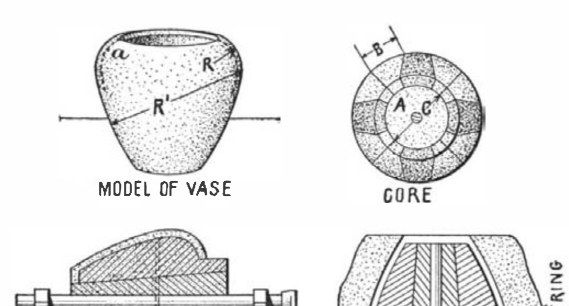


Fig. 23.—STEPS IN MAKING A MOLD FOR A VASE.

One need not confine himself to straight-sided objects as molds, for pieces embodying curved outlines, etc., can also be made by following the general directions given for the mold just described, the only difference being in the shape of the templates used. It will therefore be unnecessary to go into details as to how to make a mold for a vase shaped as shown in Fig. 23, as the illustrations, which show the various steps, will make it clear to one who has followed the previous directions closely. It will be noticed, however, that there is quite an undercut at the point *a* in this vase, owing to the mouth of the vase being of a smaller diameter than the greatest inside diameter of the piece. The main thing to guard against, therefore, in making the mold for this piece is the core. Care must be taken to have the distance *B* shorter than the diameter of the inside core or cone *C*. If this is not done, it will be impossible to get the core out of the finished cast. It might be well to state the progressive operations in the making of this mold. They are as follows: First, make inner core or cone. Second, build up outside part of core. Third, remove outside part of core and cut into pieces as shown. Fourth, reassemble core and place in spinning box. Fifth, build up and turn plaster model of piece to be cast. Sixth, remove all pieces from spinning box and cast outside mold. Seventh, cast case.

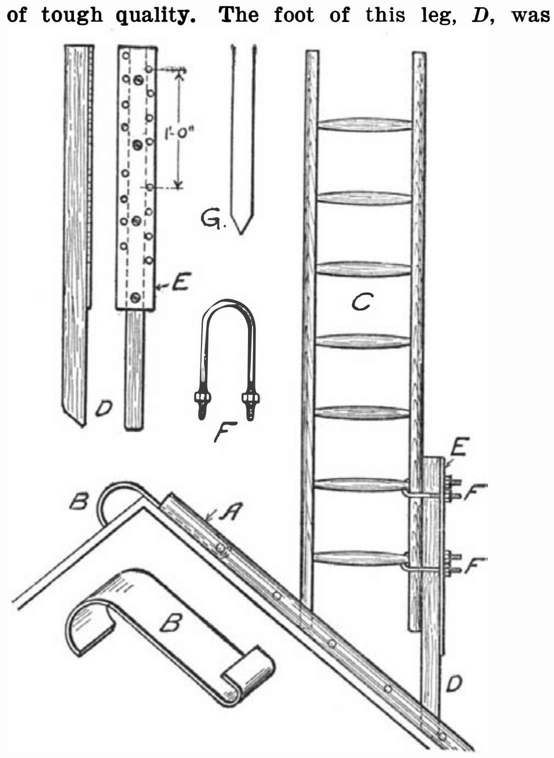
(*To be continued.*)

A LADDER EXTENSION LEG.

BY I. G. BAYLEY.

A painter or any other mechanic is sometimes called upon to paint or repair work which is very unhandy to reach. Perhaps a ladder is to be supported in some manner upon a slanting roof of a shed, or other building. Such a case happened very recently, when the following scheme was adopted by a mechanic with success:

A ladder, *A*, was supported from the peak of the shed roof by means of a plate, *B*, bent in the shape of a hook. Two painter's hooks would do just as well. The plate, *B*, was about 8 or 10 inches wide and 3 feet 6 inches long before being bent. The grip on the roof peak should not be less than 6 or 8 inches. The second or working ladder, *C*, was supported on the first ladder, *A*, by an extension leg, *D*, made of 4 by 3 timber of tough quality. The foot of this leg, *D*, was



HOW TO SUPPORT A LADDER ON A SLANTING ROOF.

shaped as shown in detail to fit against the rounds of the ladder on the roof. A plate, *E*, furnished with a number of holes for a couple of U bolts, *F*, was screwed down to the leg, *D*. The holes were staggered, and spaced 2½ inches apart on each side, allowing adjustment of 1¼ inch each way, to accommodate different pitch of roofs. The distance apart of each group of holes in the plate, *E*, should equal the distance apart of rounds of the ladder, usually 1 foot, so that the rounds of the ladder will bear on the U bolts, which should be drawn up tight when the proper adjustment has been made.

If the extension leg was made of steel, of smaller dimension than the timber one, furnished with a sharp point, *G*, to stick in the shingles of the roof, the ladder, *A*, and hook, *B*, could be dispensed with.

AUTOMATIC LUBRICATING CUP.

BY W. J. C.

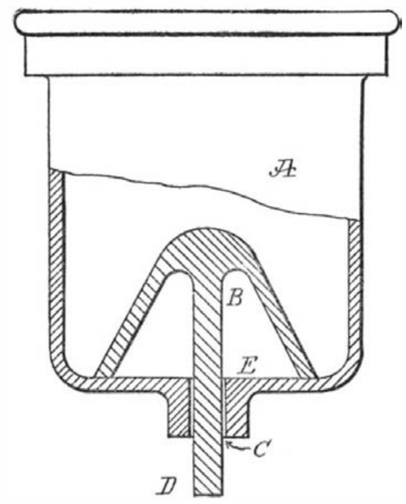
In lubricating the reciprocating parts of vertical engines, there is considerable waste of oil, and the lamp wick dangling from the end of the oil pipe forms a collector of dust and grit, which is carried to the bearings. The waste of oil is principally through the fact that when the engine stops the oil still continues feeding, and drops into the crank pit rather than into the oil cup.

Much of this can be avoided by the use of an oil cup such as shown in the accompanying sketch. It consists of a cup of the usual shape having inside a mushroom-shaped valve *B*, which is ground to a tight seat at *E*. The stem *D* passes through a clearance hole *C*, in the bottom of the cup. When the cup is filled with oil, the mushroom valve prevents its flow as long as the engine is at rest.

The cup is placed directly over the oil cup which is to receive the oil, and which moves in a vertical direction. By means of adjusting screws its height is so arranged that the stem of the valve is raised slightly as the oil cup comes to the top, thus allowing a small amount of oil to pass inside the valve and flow down the stem. The receiving cup should be filled with horsehair, to rub off the necessary oil from the stem.

The oil flows only when the engine runs, and in proportion to the speed of the engine.

No time is lost nor oil wasted in shutting off the



AUTOMATIC LUBRICATING CUP.

supply when the engines are secured, and the stem can be easily wiped clean of all dust if it has remained unused for some time.

This cup could be used on horizontal engines by a slight modification of the stem; but on vertical marine engines, as on tugs, where the engine is run intermittently, the writer has seen it do good service and save many times its cost in oil, labor, and hot bearings.

EXPERIMENTS WITH ALTERNATING CURRENT, USING A SMALL DIRECT-CURRENT MOTOR.

BY F. P. M'DERMOTT, JR.

A small direct-current motor, such as can be purchased for about a dollar, will operate in various ways as an alternating-current motor. These methods of operation are not recommended for regular use, but they serve as excellent experiments with alternating currents.

A series-wound motor with a three-part commutator is suitable. Owing to the variety of such motors on the market, only general directions can be given here, leaving the details to the judgment of the experimenter. If the motor is to be connected to an alternating-current circuit of about 110 volts, it is necessary to have some means of limiting the current passing through the windings. The diagrams show a lamp rheostat used for this purpose. The rated voltage of the lamps should not be less than the voltage of the circuit, for the resistance of the motor may be so low that the lamps will receive almost the full voltage of the supply, and they would then be burned out if made for a lower voltage. A rheostat enabling any number not exceeding ten of 16-candle-power carbon filament lamps to be connected in parallel is large enough. In determining whether the wiring and fuses through which the current is supplied have sufficient carrying capacity, remember that each lamp takes about ½ ampere when supplied with its rated voltage. The current per lamp will be less than this when the motor is in series with the lamp rheostat.

Make the connections to the motor with all of the lamps turned off, and start by turning on the lamps until the motor receives sufficient current. Do not turn on so many lamps that the motor attains an excessive speed or temperature.

Of course, a suitable step-down transformer or a reactance coil may be used instead of a rheostat.

When the motor is in proper condition to operate as a direct-current series motor, it may be operated as an alternating-current series motor. With the exception of inserting the rheostat, the motor is connected to the alternating-current circuit in the same way that it is connected to a battery when run as a direct-current motor. (See Fig. 1.) To reverse the direction of rotation, transpose the wires connected to the brush holders, as would be done to reverse it when operating with direct current.

A repulsion motor consists of a stationary field magnet, through the winding of which alternating current is passed. The armature is similar to a direct-current armature. Instead of the two brushes, or, in larger machines, the two sets of brushes (corresponding to the positive and negative sets of brushes in a direct-current machine) being insulated from one another, they are connected together. To run the motor as a repulsion motor, it will be necessary to shift the brushes until the proper position for operation is found. If the brushes supplied with the machine can be readily shifted, then they may be connected together by connecting a wire to the two brush holders. If they cannot be readily shifted, remove them and bend a piece of copper wire into the shape shown in the diagram (Fig. 2) so that it can embrace the commutator and touch it at diametrically opposite points. This wire acts as two brushes connected to one another, and for experimental purposes may be held in place by hand. After the brushes have been arranged, pass current through the field winding, as shown in Fig. 2, and vary the position of the brushes until the motor runs.

The inverted repulsion motor differs from the repulsion motor in that the alternating current is supplied to the armature, and the field winding is short-circuited. To obtain this motor (Fig. 3) connect together the two ends of the field winding and supply current to the armature. As was the case with the repulsion motor, it is here necessary to shift the brushes until the proper position for operation is found. If the brushes supplied with the motor can be readily shifted, supply current to the armature through them. Otherwise, the current may be supplied to the armature by removing the regular brushes and pressing the wires carrying the current against the commutator at two diametrically opposite points, shifting them until the proper position for operation is found. The repulsion and inverted repulsion motors are reversed by shifting the brushes.

In the single-phase induction motor current is supplied to the stationary winding, and the revolving part consists of a winding having short-circuited coils, or else a squirrel-cage winding.

To obtain the induction motor, wrap a few turns of wire around the commutator, so that each coil of the armature is short-circuited. Run without brushes. supply current to the field winding only, according to Fig. 4. Unlike the other motors here described, the single-phase induction motor is not self-starting unless special devices are provided to make it so. When these devices are absent, as in the case here, the motor will run equally well in either direction when once started. Start by giving the shaft a twist with the fingers or by wrapping a piece of string around the shaft and rapidly pulling it off.

For the theory of these motors, and also the modifications in construction used to secure better operation, consult textbooks on alternating currents.

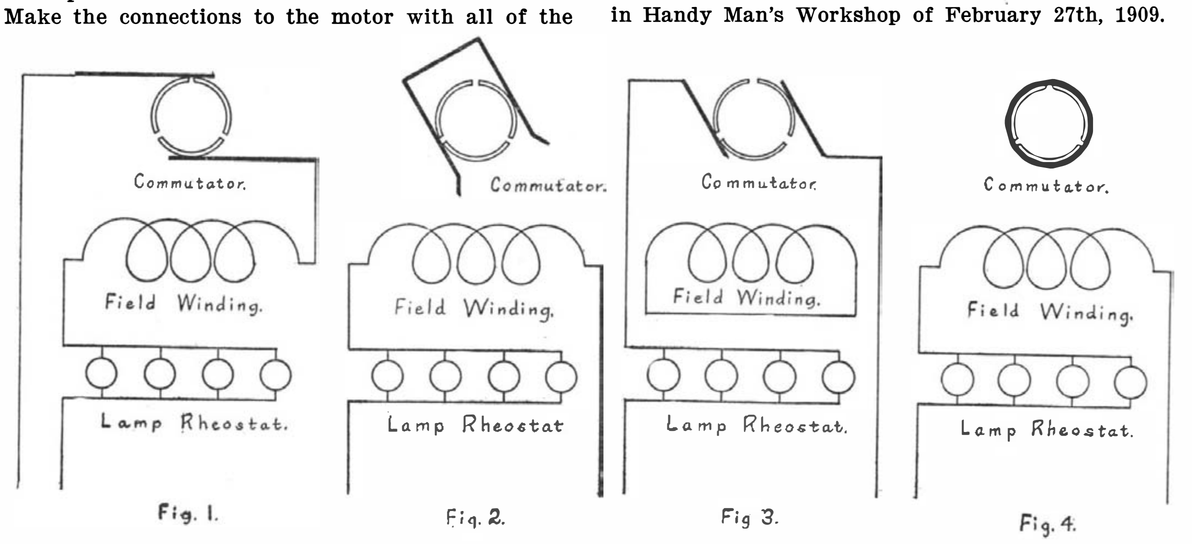


DIAGRAM OF CONNECTIONS FOR THE EXPERIMENTS.

DEVICE FOR REMOVING BROKEN WOOD SCREWS.

BY G. H. SINCLAIR.

For the past fifteen years I have successfully used a tool for the removal of broken wood screws made on the same lines as the soft brick pipe drill shown in Handy Man's Workshop of February 27th, 1909.

The size of the pipe needed can be obtained from the shank of the broken screw, though it is desirable that the pipe should be a trifle larger, to allow for clearance and in case the screw should not have been run straight. Any piece of brass or steel tubing can be used; while steel is better, brass is more readily obtained. After the teeth are filed, bend every alternate tooth out a trifle for clearance. Use this pipe bit, and bore out the broken off screw. Glue in a plug, and you can run in a new screw, never knowing the old one had been broken.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

COLLAR.—B. S. ELLS, Troy, N. Y. The purpose of this invention is to provide a collar having improved means of attaching the same to the collar button at the back of the neck band, and which will operate to prevent the button at this point from coming in contact with the cravat or necktie which may be worn with the collar.

EAR-JEWEL FASTENING.—C. WELLER, Newark, N. J. The improvement refers to jewelry and its object is to provide a jewel fastening arranged to securely hold the jewel in place on the lobe of the ear without requiring piercing thereof, and to allow convenient manipulation of the fastening when applying or removing the jewel.

Of Interest to Farmers.

TROUGH.—J. S. WEAVER and J. B. WEAVER, New Oxford, Pa. This invention is an improvement in troughs such as are generally used for feeding and watering stock, and has in view a trough such that the ends may be easily applied to and detached from the body and from water-tight connection therewith, whereby the parts when disassembled can be closely packed, convenient for shipment and stowage.

DESICCATING APPARATUS.—J. ROEH, Spokane, Wash. This apparatus may be used for carrying out the process disclosed in a divisional application formerly filed by Mr. Roeh. The invention relates more particularly to an apparatus especially designed for use in the treatment of milk to remove the water therefrom and produce a powdered product.

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.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending July 13, 1909,

AND EACH BEARING THAT DATE

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

Acceleration controlling device, W. A. Wolcott 928,013
Adding machine, A. R. Jennings, reissue... 12,987
Adjustable clamp, Buswell & Cascaden..... 927,942
Advertising device, R. Hagen.... 927,966
Aerial device, L. Ruppin.... 927,815
Aeroplane, J. Seiler.... 927,605
Air brake systems, angle cock support and lock for, W. E. Sharp.... 927,686
Air liquefier, J. F. Place.... 927,594
Alloys of zinc with copper, making, S. Elliott 927,843
Antisiphon trap, G. O. Miller.... 927,667
Arc shade for gas illumination and other uses, M. Herskovitz.... 927,726
Atomizing, etc., method of and apparatus for, A. Sala.... 927,881
Automatic switch, I. Dyer.... 927,512
Automobile curved road illuminator, D. W. Wells 927,619
Automobile fender or life guard, J. A. Harris, Jr. 927,530
Automobile frame suspension, E. C. Shumard 927,886
Automobiles, reclining seat for, J. S. Lord.. 927,566
Axle device, differential, L. R. Hibbard.... 928,198
Baker's peel, H. B. Jones.... 927,547
Balance wheel staff, C. M. Joye.... 927,859
Bailing press, W. S. Livengood.... 927,807
Band saw knife for trimming shoes, W. B. Keighley, et al.... 928,133
Basket, work, F. D. Miller.... 928,207
Bath apparatus, vapor, B. Anderson.... 927,629
Battery grid, J. K. Pumpelly.... 927,812
Beam, pilot, C. C. Hogen.... 928,200
Bearing, ball, H. Borchardt.... 927,937
Bearing for rotary journals, counterbalanced, G. P. Herrick.... 928,126
Bearing, shaft, R. F. Halliwell.... 927,791
Bed bottom, spring, T. Klipfel.... 927,982
Bed, settee, J. Phillipson.... 927,811
Belt, safety, G. L. Dennerline.... 927,839
Belt with standing sides, endless traveling, G. Gates 927,648
Bicycle, G. H. Meiser.... 927,989
Bicycle prop, Williams & Patterson.... 927,620
Binder sheaf carrier, J. G. Pillow.... 928,067
Binder, temporary, W. S. Mendenhall.... 927,741
Blind, awning, W. D. Williams.... 928,012
Blind operator, window, W. J. Sterling.... 927,894
Block. See Toy block.
Boat construction, W. H. Cole.... 927,640
Boiler furnace, steam, O. D. Orvis.... 927,672
Boiler plug, collapsible, Shonefelt & Vaughan 927,688
Boiler stand, P. F. Murphy.... 927,746
Boilers, forming openings for washout plugs for, H. B. Ayers.... 927,473
Bottle blowing machine, S. E. Winder.... 927,913
Bottle cleaning machine, O. Eick.... 927,646
Bottle closure and stopper extractor, combined, C. J. Korndorfer.... 927,732
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Heating by aid of vacuum, system of, C. C. Peck 927,591
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Knitted fabric, ribbed, R. W. Scott.... 928,222
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Knitting machine, Wilson & Paquette, 928,165, 928,166
Knitting machines, fashioning device for straight, C. H. Usher.... 928,229
Lacing hook setting machines, spacing mechanism for, W. F. Fraser.... 927,647
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Manure scraper, Dieleman & Rietveld.... 928,186
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Oiler, windmill, H. A. Mowrey 927,669
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Planter, corn, D. F. Shular 927,607
Planting machine, R. R. Langley.... 927,555
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Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

SEALED PROPOSALS.

SEALED PROPOSALS will be received at the office of the Director of the Census, Washington, D. C., until 2 o'clock, P. M., August 9, 1909, and then publicly opened for furnishing all the labor, materials and work necessary for the construction in lots of 60, 75, 100, or 125 tabulating machines and delivering the same complete, free of all charges for transportation, at the Census Building, Washington, D. C. The right is reserved to accept or reject any or all bids in whole or part, to strike out any item or items in the specifications, and to waive any defects. For specifications, blue print drawings, blank proposals, and full information address E. DANA DURAND, Director of the Census, Department of Commerce and Labor, Washington, D. C.

WANTED.—DRAFTSMAN FOR DESIGN OF HEATING SYSTEMS at $5.25 per diem, Bureau of Yards and Docks, Navy Department. An examination will be held at the Navy Yard, Washington, D. C., July 30, 1909, to fill the above position. For application and further information address "COMMANDANT," Navy Yard, Washington, D. C.