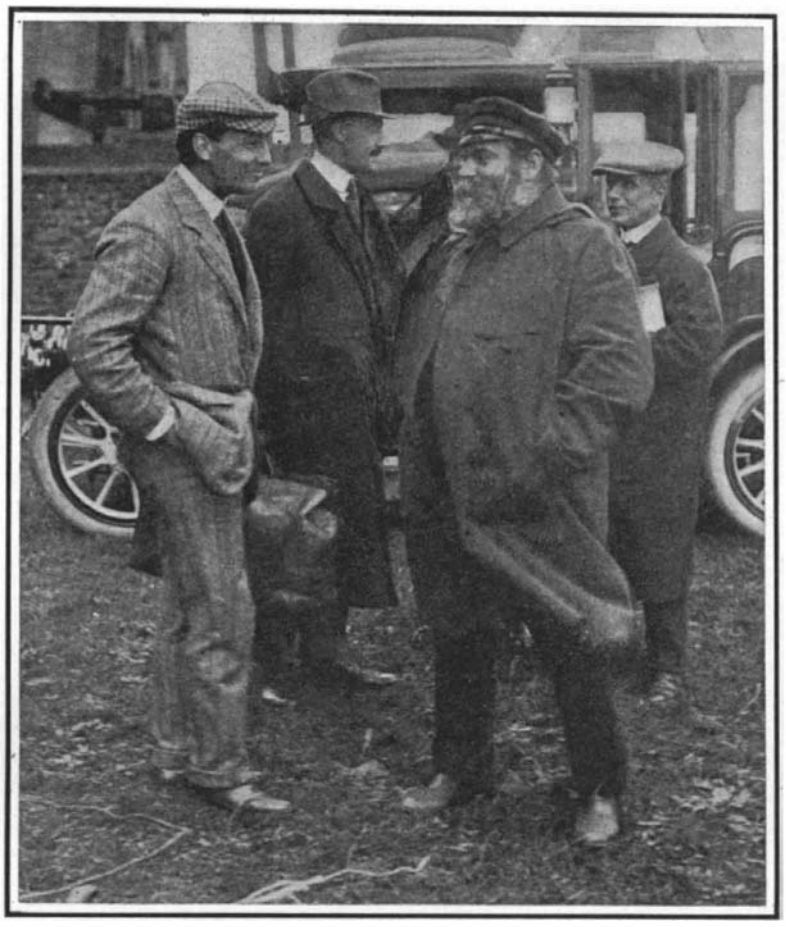
THE FIRST ATTEMPT AT A CROSS-CHANNEL FLIGHT AND NEW FRENCH CROSS-COUNTRY RECORDS.

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.

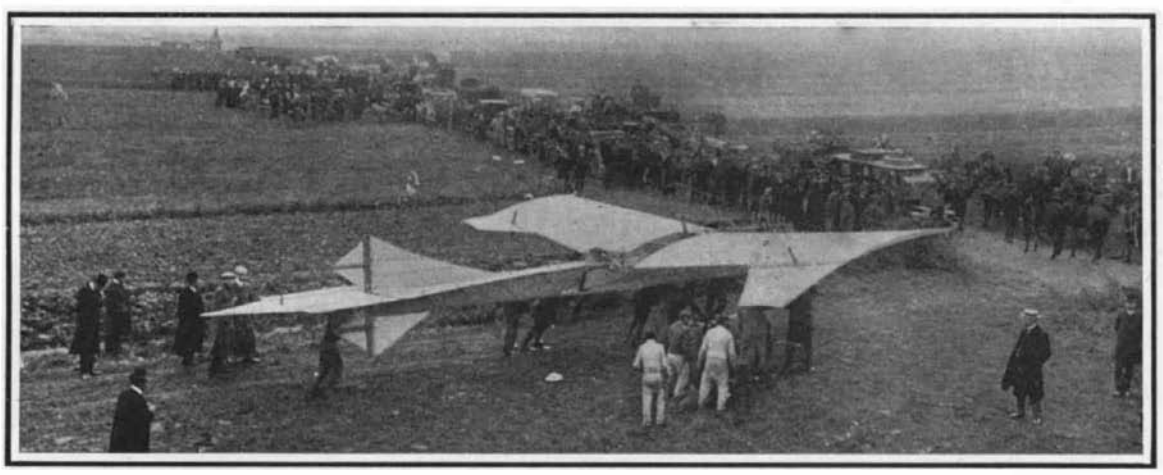


Hubert Latham, aviator, and M. Levavasseur, designer and builder of the "Antoinette" monoplane and motor.

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.

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.



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

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

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.

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.