GLIDING BOATS.—THE NAVIGATION OF THE FUTURE.

BY PROF. DANIEL BELLET, OF THE PARIS SCHOOL OF POLITICAL SCIENCE.

Every vessel of the ordinary type, even if of very light draft, is partly submerged, for it must displace its own weight of water, whether it be in motion or at rest. To use a figurative but very descriptive expression, it "plows" the water, separating its particles and forming a furrow. This plowing necessitates a continual expenditure of energy, from which, for example, a wheeled vehicle traveling over a smooth road is exempt. It is true that the building of boats has been carried to great perfection, and the forms of bow and stern are such that the water is parted with comparative ease and flows together smoothly astern. In the new auto boats, especially, both the bow and stern waves are nearly eliminated. But the resistance due to partial immersion remains, and forms the greatest impediment to progression, far exceeding the skin friction. It is because of this resistance that the power required to propel a vessel varies as the cube of the velocity.

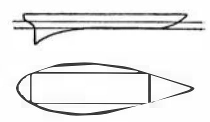
Hence inventors have long sought the realization of a type of vessel which shall not penetrate but glide over the water, thus eliminating all resistance except the skin friction on the bottom. The best method of attaining this result is to give the vessel so great a speed and such a form that the propelling force is resolved into two components, one of which sustains the weight of the vessel. This is the principle of Count de Lambert's remarkable boat, before describing which, however, I will mention some earlier attempts.

The idea of the gliding boat seems to have been suggested by the children's pastime of "skipping" stones on ponds. The stone, like the boat, has weight, which is sustained by the decomposition of its momentum on oblique impact against the water.

In 1872 Froude, at the request of the British Admiralty, experimented with planes sheathed with polished metal, variously grouped and inclined. As light and swift-running motors were not then to be had, the apparatus was towed. At high speeds there was a partial emergence, which sometimes amounted to half the displacement, and the resistance was found to increase less rapidly than the velocity.

M. Pictet also attacked the problem, not with inclined planes, but with constructions somewhat like the modern auto boats, which "glide on their sterns." The sides of his boat were parallel and vertical, while the profile of the bottom was a parabola with its vertex at the bow, and its concavity directed downward. The stern was vertical, and made an acute angle with the bottom. The boat was towed, and showed advantages over ordinary boats at all speeds exceeding 10 miles an hour. It rose perceptibly, the water flowing away in a smooth, connected sheet. Up to 15½ miles an hour the increase of power required was much less than with an ordinary boat, and at higher speeds the power decreased in absolute value. In some cases more than half the normal displacement was out of water.

M. Albert de Puydt has endeavored to make a boat glide over the water without appreciable displacement, by means of inclined planes, which he calls hydroplanes. It is calculated that 13 horsepower suffices to lift out of the water a boat weighing 1,300 pounds, with a hydroplane area of 100 square feet.



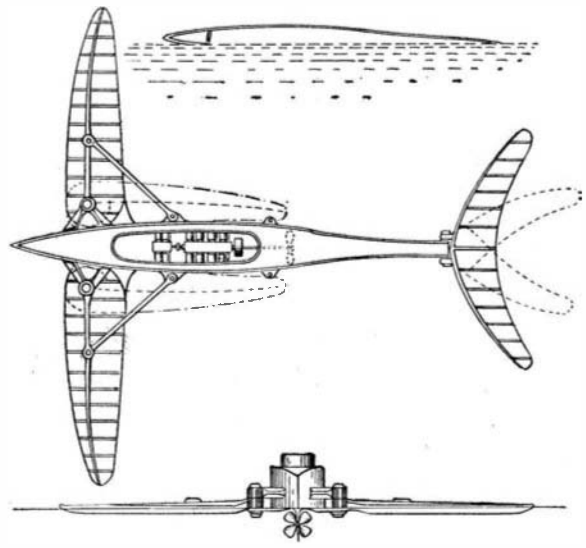
Pictet's Experimental Boat, with Lines of Flotation.

Such a boat easily accommodates a 40-horse-power motor, so that 27 horse-power remains for the forward motion. De Puydt's experiments, I think, have been confined almost entirely to a small model.

M. de Lambert, on the contrary, has built a series of practicable gliding boats. I have tried one of them, which carries two persons, and there would seem to be no difficulty in constructing much larger vessels. For years De Lambert has studied the application of the skipping-stone principle to navigation. He towed inclined planes with increasing speed until they suddenly rose to the surface, the power consumed falling as suddenly and remaining very small as long as the speed required for such gliding was maintained. The improvement of light-weight motors led him to equip his boat with one, which enabled it to move independently. In 1897 he mounted a compound Field motor with tubular boiler on a catamaran formed of two narrow hulls joined by a frame of metal tubes. The motor made 800 revolutions a minute. To the frame were attached, under the hulls, four transverse planes whose inclination to the horizon could be varied from 1 in 20 to 1 in 30. The boat weighed 600 pounds, and the combined area of the planes was 55 square feet. At speeds above 10 miles an hour the boat glided on the planes with the hulls entirely out of water. The maximum speed, 20 miles an hour, was remarkable for a grate surface of 74 square inches and a screw diameter of 18½ inches.

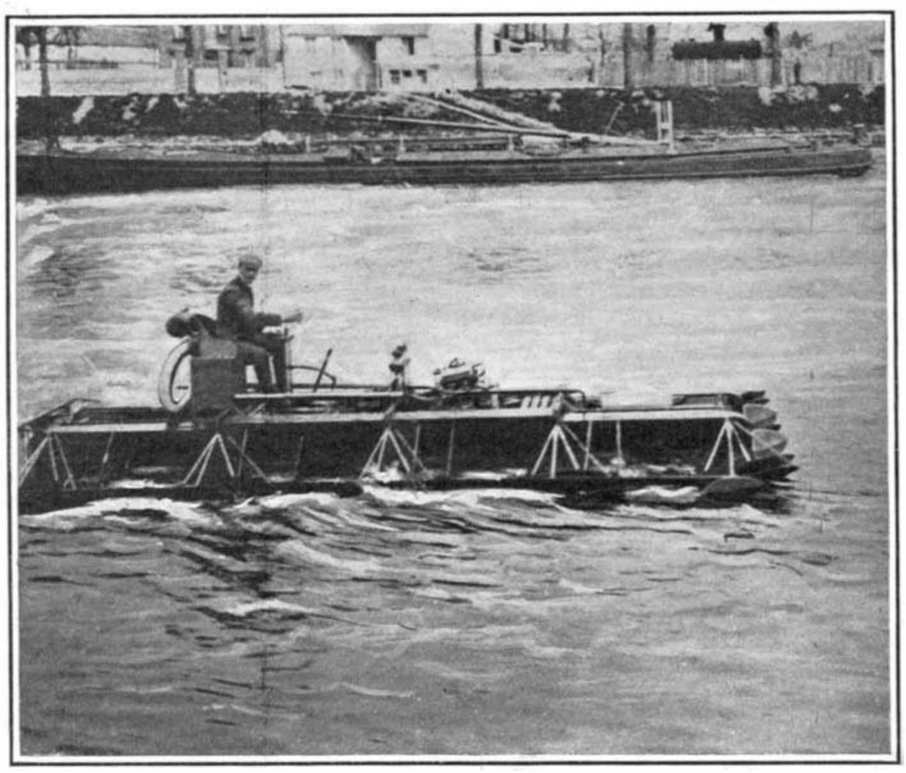
But a steam engine is not suited for a one-man boat, so an easily-managed petroleum automobile motor was used in subsequent experiments, in which increased speed was attained by modifying the arrangement and inclination of the planes. Count de Lambert's latest boat is 20 feet long and 10 feet wide between the ends of the planes, which are five in number. They are made of mahogany, I believe, and the inventor has built the entire boat of ordinary materials, to prove that the essential thing is not the material, but the arrangement of the planes. The two hulls are long and narrow, but this is merely to economize space, for they play no part in navigation at normal speed, when they are entirely out of water. The construction is very light, the frame consisting, in part, of aluminium tubes. The power is furnished by an ordinary automobile motor (Dion Bouton) of only 12 horse-power. The boat will carry two persons, but may be managed perfectly by one.

When the motor is started, the vessel moves forward a few yards, supported by the floating hulls, and the submerged planes plow the water. If this state of affairs should continue, great power would be required; but, from the beginning, the inclined planes tend to rise, and they emerge partially after a few yards' run. This causes a great diminution of resistance and, therefore, a sudden increase in speed, and the boat rises quickly until only the after parts of the planes dip in the water. This is the normal position. Indeed, as may be seen when the boat passes the observer, and, less clearly, in the photographs, the two forward planes seem not to touch the water, so that the boat glides partly on a layer of air or foam. It almost "skips" over the surface, with amazing speed, and without forming a bow or stern wave or the classical "furrow." The speed may well be called amazing, for it has risen to 25 miles an hour. This is the speed of the most perfectly designed auto boats with 80-horse-power motors, but De Lambert's boat, of equal weight, uses only 12



Designed to run on films of air forced out under the gliding runners.

Ader's Gliding Boat and Its Pneumatic Runners.



An Experimental Trip with Lambert's Boat.

Length, 20 feet. Breadth, 10 feet. Five gliding planes. Speed, 25 miles per hour. 12-horse-power motor.

Lambert's Steam Glider, Model of 1897. Made 20 Miles per Hour.

Lambert's Gliding Boat at Speed. Hulls Lifted Clear of the Water.

GLIDING BOATS.—THE NAVIGATION OF THE FUTURE.

horse-power! This very remarkable result, I think, practically solves the problem of navigation by gliding. All that remains to do is to apply the principle on a larger scale.

M. Ader, also, has invented a very ingenious boat, which is now in the Paris Conservatoire des Arts et Métiers. It has, at the bow, two large wings and, at the stern, two small ones which form a sort of tail. The wings fold together lengthwise when not in use. To facilitate gliding, M. Ader conceived the idea (more ingenious than practical) of forcing compressed air into chambers formed between the concave wings and the surface of the water. There must be in this device a large consumption of power in the continual compression of air, to replace that which escapes as the boat advances.

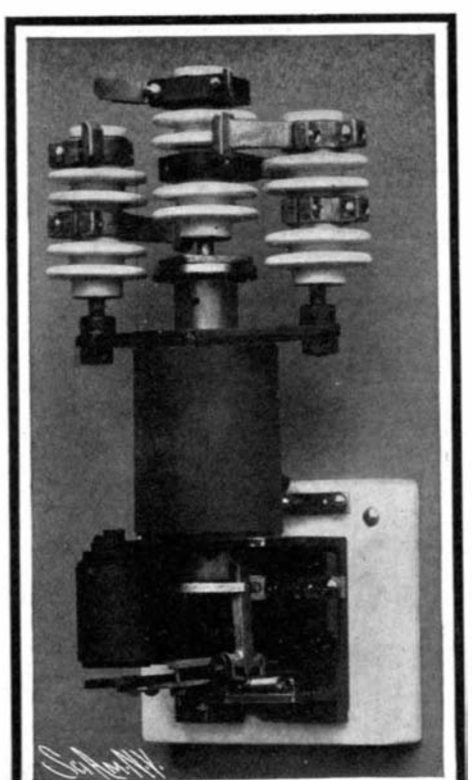
Count de Lambert's boat has stood the test of practice. In defiance of theoretical objections, it steers perfectly, and it can be stopped with the greatest facility, because, when the motor stops, the hulls fall back into the water and act as brakes. Pleasure boats of this type are sure to come into use quickly, and I cannot see why further study should not lead to the construction of larger vessels on the same principle.

AN AUTOMATIC SWITCH FOR MAKING AND BREAKING THE PRIMARY CIRCUIT OF TRANSFORMERS.

With transformers, it is important that, when the secondary current is started or interrupted, the primary circuit shall be simultaneously closed or opened. In fact, whatever may be the importance of the efficiency of a transformer, the annual efficiency of a transforming installation always leaves something to be desired if the periods of operation are interspersed with long periods of rest. This is due to the fact that the primary circuit always remains closed, and the current necessary for the magnetization continues to pass through it. It is in order to remedy this inconvenience that the Siemens-Schückert Company has for some time been employing the arrangement that we are about to describe with the aid of the accompanying diagram.

If, in the secondary circuit, the switch, A_2, is closed, a circuit is formed for the current from the batteries, *B*. This circuit includes the contact spring, k_4, and the electro-magnet, *s*. The latter becomes energized and attracts the armature, *a*. At the same time, the lever, *h*, which forms part of *a*, and the end of which sufficiently supports the sleeve, *H*, containing the iron core, *E*, will turn upon its axis, *O*, to move away from under the sleeve and allow it to drop and close the switch, A_1, of the primary high-tension circuit.

When the switch, A_2, is again thrown off, the contact, k_3, is closed, and the solenoid, *S*, will then be violently excited by the secondary alternating circuit. As a result of this, the core, *E*, is quickly drawn back into the coil, *S*. Hence, the sleeve, *H*, will be carried along and the high-tension switch, A_1, will be again opened. The interrupting arrangement cannot possibly fall back because the supporting lever, *h*, again moves into place beneath the sleeve, *H*. In the inoperative position, the electro-magnetic tele-interrupter is devoid of current, and therefore consumes no energy, besides being silent.



THE SIEMENS-SCHÜCKERT AUTOMATIC SWITCH FOR TRANSFORMERS.
The switch is shown in the open, or "off," position.

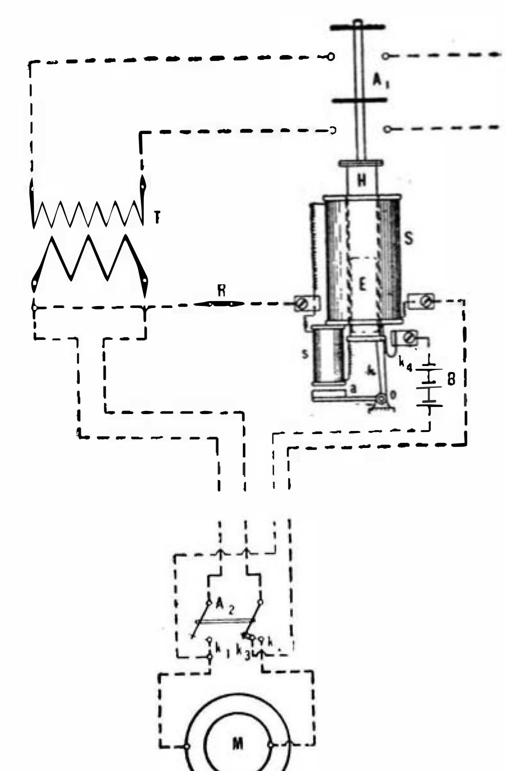


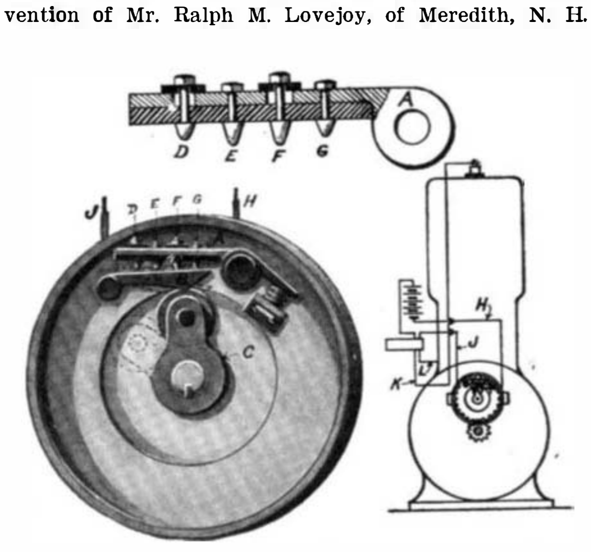
DIAGRAM OF WIRING OF SIEMENS-SCHÜCKERT AUTOMATIC SWITCH FOR TRANSFORMERS.

"Calcium Steel."

A novel material, likely to assume a high importance for the ceramical industries in case the statements made in regard to its properties are borne out even partially, is called "calcium steel." This product is obtained from feldspar sand and a lime flux and is a compact, homogeneous and plastic mass of great hardness, resisting oxidation and not affected by the influence of the atmosphere or of acids; it also is a poor conductor of heat and electricity. Its specific weight is 3.2, and its crushing strength about 2,500 kilogrammes per square centimeter. "Calcium steel" can be worked like a metal, and can be filed, bored, chiseled, polished, enameled, painted on, or otherwise decorated like glass and porcelain. For the manufacture of articles from this product two processes are available. After mixing the two components, viz., feldspar sand and lime, in the proper ratio and in a finely powdered condition, the mass can either be molded cold and compressed like bricks and the articles thus obtained heated up to the temperature required for the sintering of the components, or else the mass may be simply melted together and poured out like metal in molds after having become liquid. The cast articles would have to be carefully annealed and cooled slowly. "Calcium steel" is of a white color, but can be colored by the addition of metal oxides or the like. Its extremely favorable physical properties make it an extremely favorable material for water conduits, gas pipes, and other underground piping.

CIRCUIT-BREAKER FOR EXPLOSIVE ENGINES.

Something quite new in the line of circuit-breakers for explosive engines is provided by the recent invention of Mr. Ralph M. Lovejoy, of Meredith, N. H.



CIRCUIT-BREAKER FOR EXPLOSIVE ENGINES.

The improved mechanism avoids the uncertainties of a vibrator, insuring positive interruptions, and instead of a single, sudden break, a series of interruptions of high frequency are afforded. Furthermore, the arrangement is such as to keep the contact surfaces clean. The action of the mechanism and the course of the currents may be traced in the accompanying engraving. The contact lever, *A*, is provided with a number of contact posts adapted to make contact with the cam lever, *B*. The latter is formed with a cam swell, which is engaged by a roller on the crank arm, *C*. The posts, *D*, *E*, *F*, and *G*, on lever, *A*, are arranged to consecutively make contact with the lever, *B*, as will be presently explained. The primary circuit may be traced from the battery, through the primary winding of the induction coil and by way of wire *J*, direct to the lever, *B*, without passing through a vibrator. Thence it is conducted through lever, *A*, and wire, *H*, back to the negative pole of the battery. The secondary wires, *K* and *L*, lead respectively to the spark plug and the engine base. The crank arm, *C*, is revolved by suitable gearing with the main shaft of the engine. At each revolution of the crank arm the lever, *B*, will rock upward, raising the lever, *A*. The dotted lines show the normal positions of these two levers, with the post, *D*, resting on lever, *B*. By reference to the detail view of lever, *A*, it will be observed that the posts, *D* and *F*, are insulated from the lever, also that the posts, *E* and *F*, are longer than *D* and *G*, so that the posts terminate in an arc instead of a straight line. By reason of this arrangement, as the levers rise out of normal position the post, *E*, will first make contact with the lever, *B*, completing the primary circuit of the induction coil; then as the levers continue to rise this contact will be broken when post, *F*, engages the lever. Finally, when the levers are in their highest position, the primary circuit will be completed again through post, *G*. Then as the lever drops the circuit will be broken when *F* engages the lever, completed when *E* engages the lever, and finally broken when normal position is reached with post, *D*, engaging lever, *B*. A spring acting on the arm, *A*, insures perfect contact of the posts with this lever. Thus, every time the crank shaft operates the cam lever, three positive interruptions of the circuit are made. For the sake of simplicity, we have shown but four posts on the contact lever. However, it will be obvious that any desired number may be provided to increase the frequency of the interruptions. Owing to the fact that the two levers swing on opposite axes, there will evidently be some friction between the contact posts and the cam lever. This friction, while not enough to be objectionable, will serve to keep the contact points clean, insuring perfect electrical contacts.

Do We Require Teeth?

In a highly diverting discussion that followed the reading of a paper (published in full in a recent issue of the Journal of the American Medical Association) on "To What Extent are Teeth Necessary to Civilized Man?" Dr. Eugene L. Talbot made the startling assertion that dentistry, owing to uncleanliness in the insertion of bridges, etc., has as much to do with disease as any other one thing. He claims that the collection of germs about an ill-fitting crown is more detrimental to man than no teeth. For years Dr. Talbot has believed that man can get along without teeth. Men have lived to 90 to 100 years of age and have been without teeth for fifty or sixty years.

One assertion of the doctor is well calculated to arouse the apprehension of the reader. "Methods of preparing food to-day," says he, "do not require mastication and the jaws show in the evolution of man a shortening up, decay and loss of the teeth due to disease, and as evolution advances it will be seen that man can get along without teeth. Loss of the teeth due to interstitial gingivitis is a marked illustration of the fact that the teeth are passing."

"In regard to bacteria in the mouth," Dr. Talbot concluded, "there is no question that modern dentistry is doing more to injure the teeth and the alimentary canal than any one thing. The filthy condition of the mouth under bridges and crowns is certainly not conducive to health."

Dr. Frank L. Platt said that although it is possible for man to live without teeth, he did not think it a good plan for him to do so. He expressed himself as heartily opposed to the eating of prepared food that is easily digested, and opposed to vegetable food and health food because patients who have taken up this mode of living are all losing their teeth, show evidence of malnutrition, are anemic and miserable specimens of humanity. Teeth, Dr. Platt averred, were given us for a definite purpose; they should be maintained as long as possible, and if they are lost, they should be replaced.

Dr. G. V. I. Brown said that the animal economy gets along better with a good, full complement of teeth than it does without them. He declared that the mere fact that the chemist has prepared artificial food that can be digested without mastication is no argument against the use of teeth for masticating purposes. "They have been obliged to do this to help out the people without teeth or the people who are too lazy to use their teeth." Dr. Brown expressed his opposition to the idea that we can get along without teeth. "We can do it, but only with the greatest of care in the preparation of food."

Dr. M. I. Schamberg supported Dr. Talbot in the view that the time may come when people will be able to get along without teeth.

An interesting application of thermite (oxide of iron and alum) occurs in the production of castings free from air holes. For this purpose a mixture of thermite and titanium oxide is introduced in the melted mass. This causes an elevation of the temperature, and the titanium combines with the nitrogen of the air contained in the mixture, forming cyanides of titanium, which float on the surface as slag; at the same time oxygen combines with the iron, also forming slag. In this way the gases contained in the casting, and liable to form air holes, are eliminated.—Rev. des Prod. Chim.