HYDROPLANE BOATS: LATEST TYPE OF HIGH-SPEED CRAFT.

BY WILLIAM M. MEACHAM.

Under normal conditions the resistance which a boat encounters is, in round numbers, proportional to the *cube* of the speed and may be divided into three classes: (1) Skin or frictional resistance. (2) Eddy-making resistance. (3) Wave-making resistance.

The power expended in driving a boat is used largely in overcoming these resistances and is found to vary as the *cube* of the speed.

The only conceivable method of avoiding this condition is to lift the boat from the water by a means having less resistance than that of the boat when supported by displacement. The hydroplane offers this solution, and the following proposition aims to set forth its scientific basis, and to show that the power required to drive a boat on this principle varies in a much smaller ratio than the accepted formula above recited:

Given a flat plate, having weight which is constant under all conditions, deeply submerged in water, drawn edgewise, horizontally through the water, with front edge in direction of motion, raised at a small angle to the horizontal.

The power applied to the plate is divided into two components, one of which furnishes the supporting force, and the other of which overcomes frictional resistance.

I have found that the component of supporting force varies as the square of the speed. The component of frictional resistance also varies as the square of the speed, as demonstrated by experiments of Toëssel and Froude.

It then follows that if the supporting force is kept constant by reducing the width of the plate, across the line of motion, as speed increases, the frictional resistance of the plate, taken as a whole (not as per unit of area), remains constant.

Or, in other words, if the area of the plate is varied (in width across the line of motion) inversely as the square of the speed, the resistance due to skin friction and that due to the inclination of the plate will remain constant, and the supporting force will also remain constant. Since the resistance is constant and the distance through which the force acts varies directly as the speed, the power required will vary directly as the speed instead of as the cube of the speed, as would be the case if weight was supported by displacement.

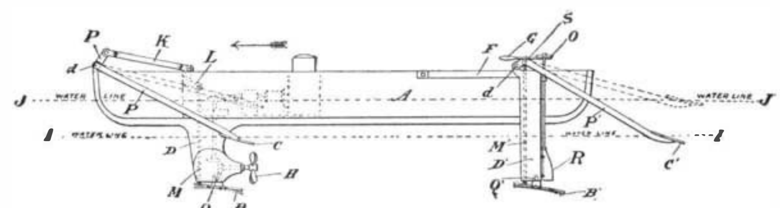
Such would be the result under ideal conditions only. Count de Lambert, and others, with apparatus similar to that herein pictured, succeeded in raising the boat out of the water at high speed, the hydroplanes becoming partially emerged and gliding upon the surface. Such an arrangement, however, of large supporting plates at the surface, serves to produce, in considerable degree, the very resistances to be eliminated and thus, to such extent, to defeat the very purpose for which it has been designed.

With the object of substantiating the principle of the hydroplane, the writer has experimented with *submerged* plates.

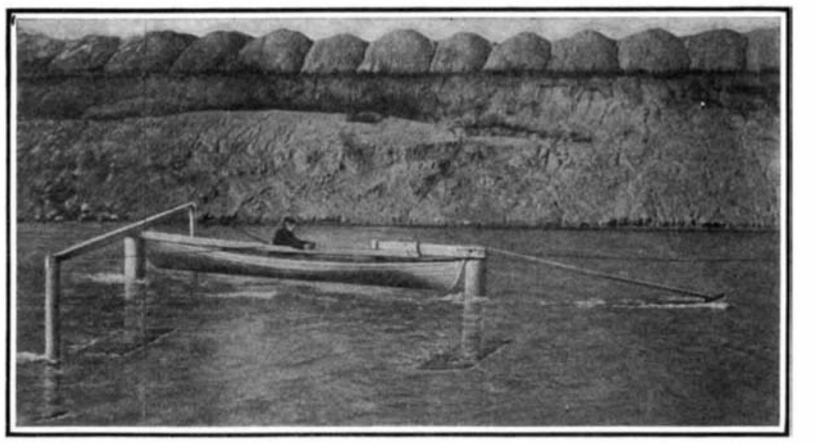
The apparatus used was crude, but it will be seen from the photograph that even at the moderate speeds attained, not over 15 miles per hour, the submerged hydroplanes operated successfully to raise the hull of the boat entirely out of the water.

In the experiment pictured there were but two hydroplanes used, one at the front and one at the stern, in size 15 by 30 inches and 18 by 36 inches respectively. The balance was preserved by a small outrigger on either side. At another time the same apparatus (identically) was tested with a load of two men instead of one with the same result as shown. In the latter instance the total weight, made up of the boat and two men, was exactly 550 pounds. By computation it will be seen that the total supporting hydroplane area was 7⅛ square feet. By careful measurement it was ascertained that the water displacement of all submerged parts was less than three per cent of the total weight.

Special attention is directed to the fact that the surface of the water was scarcely ruffled, except from the regulating plate projected at the front, by means of a rigid bar, for the purpose of regulating or varying the angles of the supporting plates. The plates used in these experiments were excessively large on account of the necessity of working at low speeds with little power.



Longitudinal Section of a Proposed Motor Boat Fitted with Automatically-Adjusted Submerged Hydroplanes.



Experimental Test of Submerged Hydroplanes.

The boat, which is being towed at a comparatively low speed, is shown lifted clear of the water by submerged Hydroplanes at the bow and the stern. This type of Hydroplane is said to be more efficient than the surface type shown below.

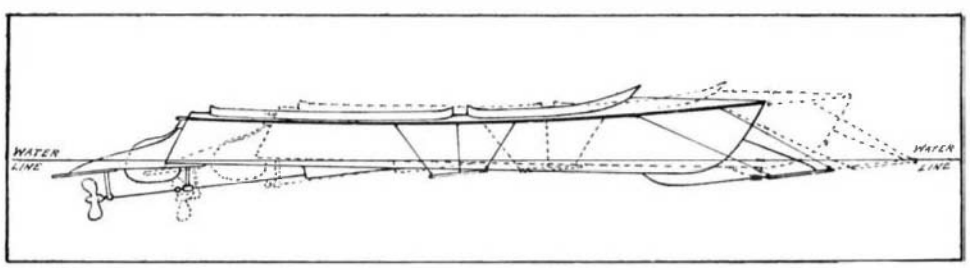
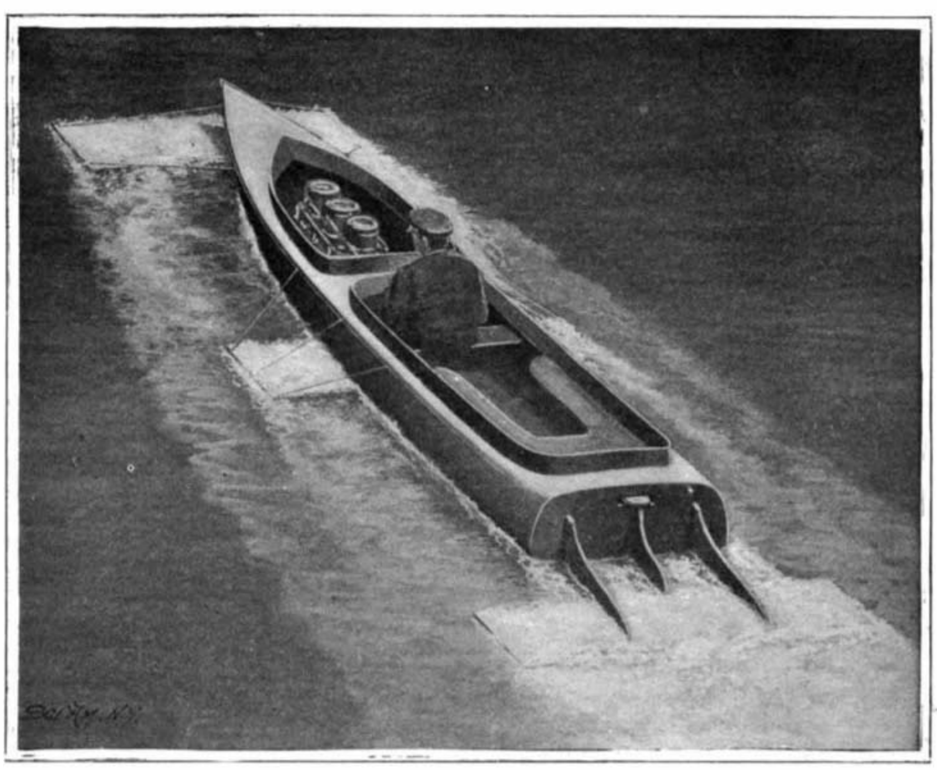


Diagram Showing Positions Assumed at Rest and in Motion by Motor Boat Fitted with Surface Hydroplanes.



Motor Boat Fitted with Three Surface Hydroplanes of the Type Proposed by Archdeacon.

HYDROPLANE BOATS FOR TRAVELING AT HIGH SPEED ON THE WATER.

The outline drawings will convey a fair understanding of an apparatus designed to reveal this principle

The body of the boat, *A*, when at rest, is supported by displacement at the water-line, *J*. When the boat is put in motion, by the propeller, *H*, the regulating plates, *C C′*, which have hung submerged, are caused by their angle to the line of motion through the water, to rise and remain at the surface.

This lifting of the regulating plate, *C*, at the front end of the boat, causes arm, *P*, to turn on pivot, *d*, which operates the connecting pieces, *K*, *L*, and *M*, and raises the front edge of supporting plate, *B*, which is pivoted at *Q*, causing the angle of plate, *B*, to increase in relation to the horizontal.

The position of plate, *B*, when boat is at rest, and until its position is changed by the regulating effect of plate, *C*, is nearly horizontal, being curved slightly downward from front to back; but as soon as its front edge is raised, by the operation of the regulating plate, *C*, as above explained, a lifting force is produced which, when the speed is sufficient, causes the boat to rise. A like result is simultaneously accomplished by the supporting plates, *B′ B′*, at the rear end of boat, which are regulated by the plates, *C′ C′*, in a similar manner.

The boat is balanced at all times by the automatic and immediate adjustment of this rear mechanism. The level of the boat from front to back is likewise automatically maintained.

When the boat is put in motion, it steadily rises until it has attained the maximum speed, at which time the body of the boat is raised entirely above the surface of the water, and there maintained by the automatic adjustment of supporting plates, *B B′*, which is accomplished by their respective regulating plates, *C C′*, which, still held at the surface of the water, have gradually become lower, relatively to the boat, as the boat has risen in and above the water, with a corresponding lessening of the angle of the supporting plates *B B′*, which have, finally, at maximum speed, come to their position of highest efficiency.

As the speed may thereafter vary, any tendency to sink, because of lessened speed, is immediately overcome by the lifting effect of the automatically increased angle of the supporting plates, *B B′*, the said angle being immediately diminished as the speed is again increased.

This process, repeated, provides for indefinite duration, and when, finally, the speed is slackened, the gradual sinking of the boat is accomplished, automatically, by the reverse operation of the regulating plates, *C C′*, and the supporting plates, *B B′*, by which it is brought to a position of rest, when it is again supported, as at first, by water displacement at water-line, *J*.

The water-line, *I-I*, indicates the relative positions of various parts when the boat is at full speed and maximum height. Letters *D D′* show the hollow, elliptical, supporting frames to which the supporting plates, *B B′*, are attached, and in which the connecting rods, *M M′*, operate. Letters *S S* show the pivotal connections between said rods, *M′ M′*, and the rear regulating arms, *P′ P′*. Letters *R R* show the rudders, which, attached behind the rear supporting frames *D′ D′*, are operated by the lever, *G*, and cross-pieces, *O O*, by means of a chain. Letter *F* indicates the necessary wood or metal framework for rigidly connecting and supporting the rear portion of mechanism.

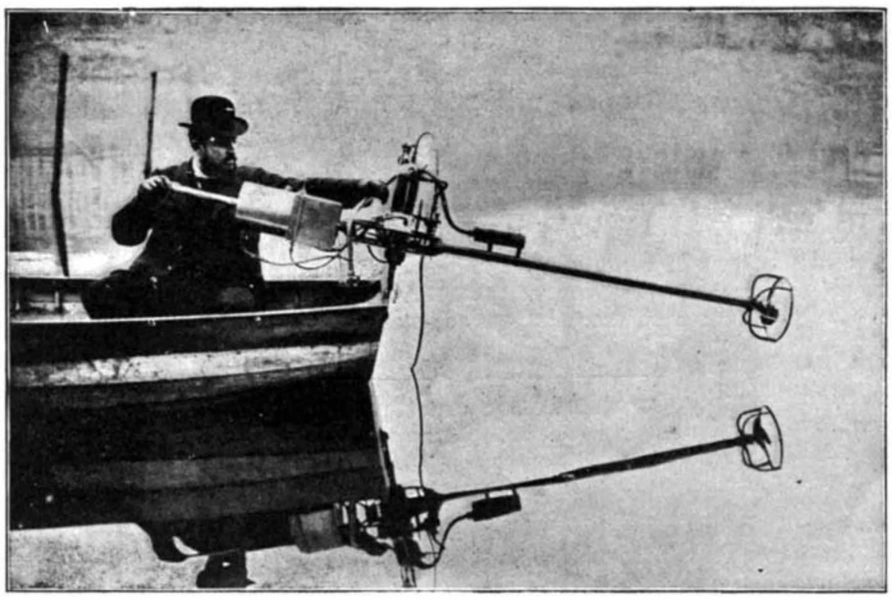
The supporting frame, *D*, at the front end, contains, in addition to the rod, *M*, the necessary shaft, gearings, etc., for the operation of propeller, *H*.

The supporting plates, *B B′*, it should be noted, are connected at pivots, *Q Q′*, at a point in front of the center, so that the upward pressure on these plates while the boat is in motion, tends to press them to a more nearly horizontal position and thereby operates as an unfailing spring against the pressure exerted by the regulating plates, *C C'*. It will be understood that in this construction no attempt is made to adjust the plates in width as speed increases; but the advantage of the application of this principle is secured by designing the plates for each particular boat for one speed only (which is its maximum speed), and the lifting force required at other speeds (between starting and maximum) is obtained by the automatic regulating device which gives the plates at all times such an angle as is necessary.

Strange as it may seem, the chief obstacle encountered in early experiments was not to make the hydroplanes rise, but to prevent them from rising too far, and it was as a means to this end that the surface follower, as a regulating device, was adopted. By its use the boat becomes practically a soaring machine and bears the same relation to an ordinary boat, in the water, as does a soaring bird to a balloon, in the air; and this relation holds, also, in respect to their skin friction areas. It also possesses the following advantages over a soaring machine in the air, i. e., it soars in, and its propelling force is exerted upon water, which is seven hundred times as dense as air, while the displacement of the hull, with its necessarily large frictional surface, is all carried in the rarer medium, air, and above the water, the surface of which can be used to effect the regulation of the inclination of the supporting hydroplanes.

Another special advantage of a submerged hydroplane construction is that it will operate without hindrance in water sufficiently rough to totally unfit a gliding boat.

The strength of development and success will depend, not upon disproving or defying any established law, but upon strict application of rational laws and careful attention to details.



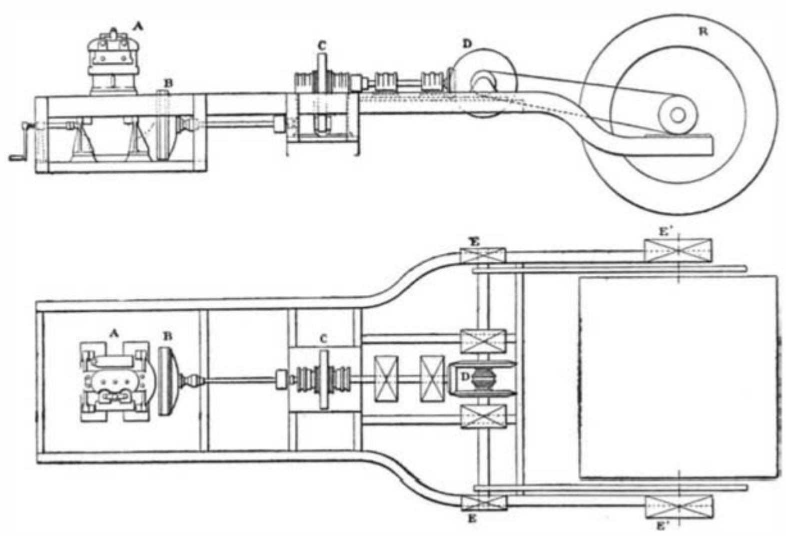
THE MOTOGODILLE, OR MOTOR SCULL, APPLIED TO A SMALL BOAT.

A MOTOR PADDLE WHEEL FOR SMALL BOATS.

In the accompanying engravings we give a side elevation and plan view of a detachable stern paddle wheel designed for the propulsion of small boats, and perspective views of the apparatus mounted upon a boat.

On examining the diagrams from left to right, we observe, at *A*, a two-cylinder de Dion-Bouton motor of 16 effective horse-power; at *B*, a clutch; at *C*, a speed reducer; at *D*, a reversing gear; and at *E* and *E'* sprocket chains connected with the paddle wheel *R*. This wheel consists of paddles inclined at an angle of 50 deg., small spaces being left, so that the stress is exerted upon a wider surface than if the paddle consisted of a single bow, as is usually the case. As the water is easily discharged, it creates no passive resistance, and thus a high efficiency is obtained. As this propeller is designed for Oceanica and has to be actuated by kerosene, the only fuel practical in that country, a special carbureter has been applied.

With this paddle wheel it is possible to carry from 18 to 20 tons of merchandise at a commercial speed of from 5 to 6 miles an hour with an output of fuel not exceeding 40 ounces per horse hour.—Translated from L'Automobile for SCIENTIFIC AMERICAN.



ELEVATION AND PLAN OF THE BUCHET MOTOR PADDLE WHEEL.

THE "MOTOGODILLE," A MOTOR DEVICE FOR PROPELLING SMALL BOATS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting device in the way of applying a motor to small craft has been brought out in France. The apparatus has been designed to afford a very simple as well as inexpensive method of applying a small gasoline motor to boats. It is nothing more or less than a power oar and consists of a motor-driven propeller which is adapted to be placed on the boat; but contrary to other apparatus and motors which require to be specially built and installed in the boat so as to form part of the latter, it forms an entirely separate mechanism which is fitted to the stern of the craft in a few minutes, and which permits the immediate conversion of any ordinary boat into a motor-driven craft without any change whatever in the boat itself. By applying a simple socket-piece to the stern with four screws or bolts, the propelling apparatus, which fits in the socket by means of a pin in about the same way as a steering oar, can be immediately installed. The new propeller device, which is known as the "Motogodille," is of extra light, simple, and strong construction, and forms a single rigid piece having but a single contact with the boat. It serves to propel and steer the craft at the same time and also to change the speed. The socket and the support of the apparatus form a kind of universal joint which allows the pilot to raise the propeller or to plunge it to the required depth so as to vary the speed of the boat, or else to displace it to the right or left for steering. These movements are all carried out with one hand and without any more fatigue than is felt when using a rudder. As the propeller is mounted on a long shaft and works at a distance of 4 feet 6 inches from the stern, it runs in comparatively still water and gives a much better propelling effect than usual. The variable immersion of the propeller shows it to work with a flat-bottomed boat in very shallow water. A speed varying from 5 to 10 miles an hour is obtained (according to the size of motor which is used) with an ordinary boat containing 5 or 6 persons, with a consumption of 0.3 gallon per hour of gasoline. Two sizes are made, one of 1¼ horse-power weighing 35 pounds, and a second giving 2½ horse-power and weighing 90 pounds. A very practical application of the device is upon sailboats, as it will bring the boat into port in case of a calm, and it can easily be stowed in the hold. As will be noticed the motor is mounted upright just over the main pivot which works in the boat. Back of the motor and fixed on the steering bar is a box with sliding cover for the battery and spark coil. Above it is a cylindrical gasoline tank.

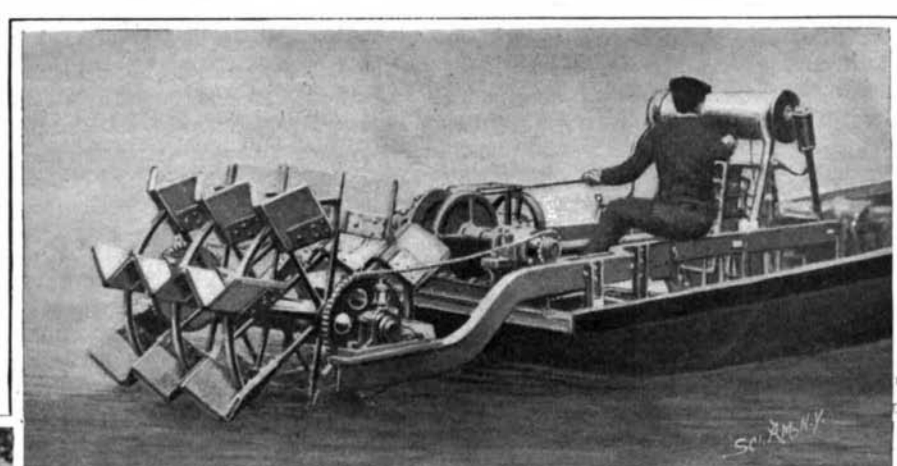
The Destruction of Flies.

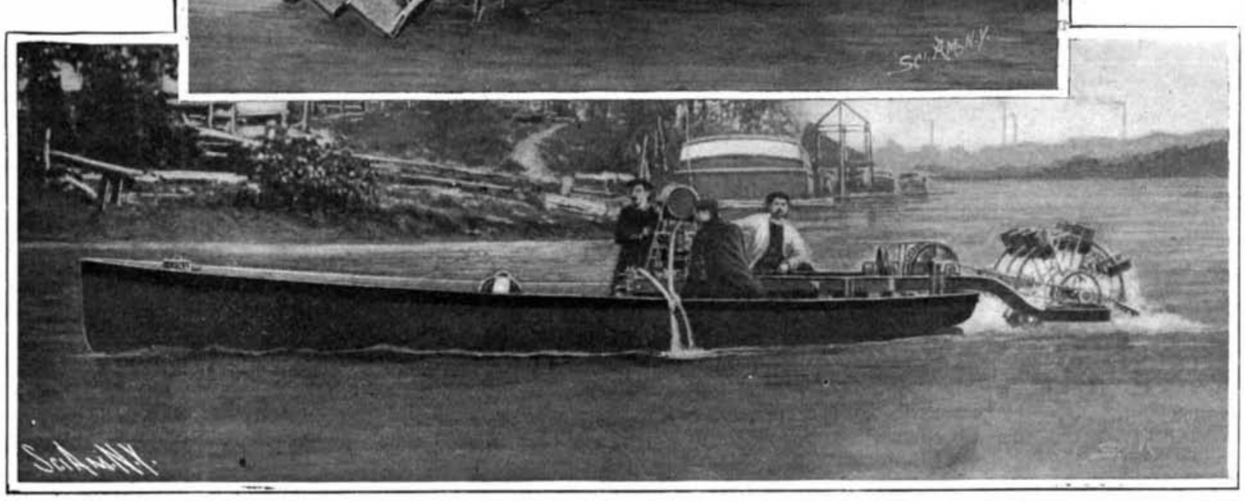
The fly is doomed; the fiat has gone forth, and its days are numbered. Doctors have recognized the fact that the house fly is not only a nuisance, but also a real danger, because it is the bearer of microbes and nastiness of all kinds. Fired with the spirit of enterprise, and wishing to do good to humanity at large, the Matin, of Paris, recently offered a prize to the discoverer of the most practical and efficacious means of destroying these insect pests, and thus eliminating one great source of the spread of epidemics.

A pamphlet entitled "Delenda Musca" has carried off the prize.

According to the writer of this essay, very few people are aware that the domestic fly lays its eggs in cesspools, drains, liquid manure, and dung heaps of all kinds. In these delectable media the *Musca domestica* deposits its oblong eggs, which are opened by the detachment of a narrow longitudinal band or strip—much in the same way as the blade of a knife is opened. The larvæ grow with surprising rapidity, attaining their full size, in summer, in eight days' time. One fly may give birth to millions of others, as it breeds continuously for several consecutive months (usually from May to October). Assuming that one specimen lays 200 eggs (containing an equal number of males and females) then, as will be seen from an easy calculation, in six months' time one hundred thousand million flies will be brought into the world to tease bald-headed men and the helpless in general. After showing that it is useless to attack the full-grown insect, the author seeks some means of destroying it while it is in the period covered by the laying of the egg to the formation of the pupa—just when the insect is most vulnerable, and is found collected together in more or less considerable quantities. The greatest points of attention to this end are cesspools, muck heaps, drains, manure heaps, and the like. Arsenic and arsenical compounds should not be used for the destruction of flies' eggs and larvæ in open cesspools in country districts, where—too often, unfortunately—they are in underground or other communication with wells, watercourses, and springs, which might thus get poisoned. Recourse should be taken to some substance which not only dissolves in the liquid contained in the drain, but which will penetrate right into the heart of solid matter. This substance must be of a nature to withstand fermentations and all transformations experienced by the solids contained

THE BUCHET MOTOR PADDLE WHEEL SEEN FROM THE REAR.





SMALL BOAT ACTUATED BY THE BUCHET MOTOR PADDLE WHEEL.