have held the giant. The crown and sword and the rest have still to be accounted for. But it is recorded that when the Danes were advancing on Aix in 880 the treasures of the church were removed to Stablo. It seems more than likely that any valuables in Charlemagne's grave would be sent away with them.—London Standard.

THE AIRSHIP SYSTEM OF M. FREDERICK L'HOSTE.*

By DR. T. BYARD COLLINS.

IN the airship system proposed by M. L'Hoste the balloon itself is of novel construction. It is of cylindrical conical shape and encircled by three hoops which support a tubular steel axis running through the center of the balloon from end to end. The hoops are

FIG. 2.—A MODEL OF THE AIRSHIP.

of wood and are joined to the center pieces by wire stays, much as the rim of a bicycle wheel is joined to its hub. It therefore possesses very considerable rigidity, and is held in shape, not as other dirigible balloons, by the internal pressure of the contained gas, but by the nature and form of the framework.

Two pulleys are attached to the axis, one on either side of the center, and upon these, by means of ropes, are hung two small compensating balloons, each independently in contact with the outside air and capable of being raised or lowered as demanded by the balloon's exigencies at any moment.

By this form of structure M. L'Hoste hopes greatly to augment the elements of economy and safety. First, the absence of interior pressure thus secured reduces the leakage of gas through the pores of the envelope to a minimum—a leakage which has hitherto been a source both of waste and danger. Second, the absence of internal pressure precludes the possibility of the balloon's bursting from this cause, as was the case of Severo's "La Paix," dropping him to a horrible death two thousand feet below. And finally, in case of accidental deflation, the balloon, maintaining its form, would in its descent present an immense surface to the opposition of the atmosphere, thus acting as a parachute and effectually breaking the force of the fall.

The forward end of the balloon is covered by a kind of pneumatic cap formed of silk and sewed on the cone. This cover, which when distended gives the prow a favorable form for the reduction of atmospheric resistance to forward propulsion, and also increases the rigidity of that portion of the aerostat most needing such a character, is filled with gas to a point of pressure superior to that of the atmosphere; but this is the only part of the balloon in which such pressure obtains, and if this inflated end cover should burst, the balloon would suffer no vital damage.

The inventor has also given the question of equilibrium and stability careful attention. Aft of the balloon is a silken rudder hinged to the end of the axis, and spread out like a bird's tail. To this rudder is attached a rigid rod which runs beneath the body of the balloon and terminates in a weight directly beneath the center of the long axis. This weight, acting as a pendulum, automatically raises and lowers the

FIG. 1.

1.—a, plane horizontal surface; b, rod; c c, cranks.
2.—Diagram of L'Hoste's Airship System. b b', two small compensating balloons; c c', pneumatic cap; R, horizontal rudder giving stability and equilibrium; the pendulum attachment is shown at P.
3.—Diagram of one of Hargrave's Flying Models, showing the trochoidal movement of the wings.

rudder relative to the angle which the balloon may tend to assume at any moment, thus keeping the craft constantly on an even keel. There is also a vertical sail aft which is operated in the usual way.

Below the balloon is suspended the car, a photograph of which is presented herewith. It will be seen that

M. L'Hoste seeks to utilize not only the lifting power of a gas bag, but also the advantages both of the aeroplane and of beating wings.

The framework of the structure is of Mannesmann steel tubing of small diameter. The top and bottom support concavo-convex aluminium aeroplanes. In the machine now building these planes are 12 meters long by 4 meters wide and 9 meters long by 3 meters wide respectively, the upper one being the larger.

To the fore and midway between the planes is a horizontal rudder, and aft a vertical one, both plainly appearing in the photograph. But the most remarkable part of M. L'Hoste's invention consists in the propellers.

In 1893 the late Mr. Hastings argued learnedly before the International Conference on Aerial Navigation that the screw was vastly more efficient as a propeller than anything else could possibly be. But Mr.

Hargrave, who had had large experience in the construction of flying models, had found that beating wings for both vertical and horizontal propulsion were quite as efficient as the screw. Several years before Mr. Hargrave read a paper before the Royal Society of N. S. W., in which he defined the trochoidal plane as "a flat surface, the center of which moves at a uniform speed in a circle; the plane being kept normal to the surface of a trochoidal wave, etc." A trochoidal plane is illustrated in Diagram 1, where a plane horizontal surface a is rigidly attached to the rod b connecting the crank c c'. By imagining these cranks to revolve, carrying the connecting rod with its attachment around with them, one may get a very clear conception of a trochoidal plane. Mr. Hargrave, in the paper above referred to, then proceeded to show that "the trochoidal plane is the mechanical power almost universally used by nature for the transmission of force." And then, after giving many illustrations, he continued: "The trochoidal action of fins, muscles, and legs seemed so plain that I could not help theorizing on the action of wings in flight; . . . the chain of evidence seemed so complete that I have no doubt it will soon be accomplished without the aid of the screw or gas bag. . . . There is a distinction between the ver-

SINGLE MOTOR CONTROLLER.

tical lift we see when a bird rises straight up, as exemplified by skylarks, hawks, and partridges, and the horizontal flight of ducks, pelicans, and albatrosses. In the first place, the wing, which is in effect a plane, is rotated in a cone and kept normal to a trochoid during each revolution. . . . In horizontal flight the conical movement is the same, but the connecting rod is at right angles to the plane of the wings, and flight is the resultant of gravity and the waves of air being thrust downward and backward by the wings."

Now this is the principle sought to be utilized by M. L'Hoste in his propellers, of which there are five pairs, as shown in the photograph of the model presented herewith. They are made of aluminium on a light steel framework, and so constructed that the forward edge is rigid while the posterior portion is flexible. Each wing terminates at its inner end in a kind of handle which passes through the ball socketed in the framework, the ball acting as a fulcrum upon which the wing may be moved in any direction. The inner ends of the handles are then joined to a series of connecting rods, thus revolving the wings in a cone and causing them to act as modified trochoidal planes;

the alternate pairs having a reciprocating motion, and, being rigid only on their forward edges, change their angle of incidence at each vibration. On the down stroke the angle is such that a forward thrust results; on the up stroke the inclination is reversed, so that a forward thrust again results. It is thus that M. L'Hoste would obviate the necessity for the use of the time-honored screw.

The machinery is to be actuated by two forty horse power petroleum motors of exceptional lightness and placed in the hold of the vessel, as shown in the photograph.

With the French, the weight of powerful motors for aeronautical purposes is no longer so serious a consideration as formerly, since having made such progress of late they are now dreaming of inclosing a horse power within the compass of a watch case.

SOME ELECTRICAL SWITCHES.

A NUMBER of improvements in electrical switches have been introduced by Messrs. Dorman & Smith, of Manchester. We recently had an opportunity of inspecting a number of these at the firm's Ordsal Station Electrical Works, Salford. One is a liquid motor-controller specially designed for working the motors on overhead electrical cranes. The accompanying illustrations, one of a switch for controlling three motors, and the other for controlling a single motor, show clearly the effective, but at the same time simple, arrangement of this switch. A solution of caustic potash is used for the liquid. The contact between the source of supply and the motor is made by lowering a cast iron plate into the solution. When this plate only just touches the solution the resistance is naturally considerable, but it is of course reduced as the area of the immersed part of the plate increases. These switches are each fitted with a reversing switch. In order to simplify the gearing, two plates are used in each switch, one for the go-ahead and one for the go-astern, or lower and lift, as the case may be. By this method, as will be seen from the illustrations, a simple form of gearing, which lends itself neatly to the reversing switch arrangement, is all that is required. The whole of the electrical connections are insulated from the iron framework, and the tank itself is generally unearthed.

Another switch we saw was an edgewise grip contact switch. In this switch the blades are gripped on to the contacts by means of a toggle arrangement, which is operated by a continued motion of the switch handle after the switch blades have reached their position on the contacts. On opening the circuit the first movement operates the toggle, and so reduces the pressure on the contacts; at the same time a trigger is lifted and the switch arm flies off, moving over the contacts with a light rubbing pressure.

The main circuit-breaking switch is combined with an auxiliary switch interlocked so that the main switch is closed first, then the circuit is completed through the auxiliary switch, leaving the main switch quite free to be opened by any automatic device. This auxiliary switch cannot be opened until after the main

THREE MOTOR CONTROLLER.

switch has been opened. The automatic device on the overhead or maximum switches presents several novel features. It is claimed to insure absence of friction immediately the armature has started to move.—The Engineer.

To Clean a Panama Hat which has become stained by perspiration, the National Druggist recommends the following process: Apply first sodium hypophosphite in strong solution, liberally. The best plan is to immerse the hat in the solution, and shortly afterward immerse it in one of oxalic acid. After the stain has disappeared, which it will do in the course of an hour or two, rinse the hat in clear water first, and afterward in water carrying a little glycerin. Then let it dry, and send it to the hatter to be blocked. The object of the second rinsing is simply to make the hat supple. The writer hereof has treated his own hat, which he has worn for several years, in this manner several times, and it is yet a passable one. Of course, it was a good one in the first place or it would not have stood the treatment.

* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.