TROUVE'S AVIATOR.

At one of the August sessions of the French Academy of Sciences, Mr. Gustave Trouvé presented a memoir, the principal object of which was to show what motor, in order to solve the question of aerial navigation, is best qualified to simultaneously fulfill those two conditions of great power and extreme lightness which are so difficult to reconcile, and which, nevertheless, are strictly exacted by the very nature of the problem.

In the first place, after discussing their value, Mr. Trouvé eliminated steam motors, electric motors, accumulators of energy, such as rubber and steel, and compressed air and gas motors, since none of them completely answered the questions and none of them fulfilled the desired conditions. There does not to-day, added he, exist any motor provided with its accessories, generator and propeller, that we can immediately employ, or at least complete for the object proposed. Now since the generator and propeller are both absolutely necessary, and consequently cannot be done away with, Mr. Trouvé has conceived the idea of merging them into the motor and of thus creating a new organism dependent upon itself, which he has named a "generator-motor-propeller." This organism is constituted through the aid of the well known Bourdon tube, the essential part of the manometer of the same name. Electricity plays merely a secondary although necessary role in it.

We know that if the pressure of the gas that this tube contains increases, the tube bends and tends to spread its branches, but if the pressure decreases, on the contrary, the phenomenon is reversed and the branches approach each other. If, then, through any means whatever, we cause a series of alternately condensed and dilated pressures in the interior of the tube, the latter will undergo a series of oscillations, of powerful vibrations, utilizable as a motive power. For the purpose of still further increasing the energy of the tube, and also for diminishing the volume of the chamber in which the explosions of the detonating mixture take place, Mr. Trouvé has fitted in the interior a second tube similar to the first. This addition increases the elastic force of the gases engendered, and, at the same time, diminishes the consumption of the combustible. To the vibrating extremities of the tube are fixed directly, but with a rotary motion, the wings, A and B, of the apparatus, so as to suppress all intermediate frictional or rotary transmission gearings. The lowering of the wings corresponds to the condensed pressures, and their elevation to the dilated pressures. The chemical combination utilized is the oxidation of hydrogen. This gas is easily and quickly obtained in large quantity, even in a pure state, and oxygen, its combustive, is found already prepared, so to speak, in the atmosphere. The artificial bird (or aviator-generator-motor-propeller as the inventor stylesit), like the genuinebird, thus draws a large part of its aliment from the air. The detonating mixture is regulated at will, but it is of very nearly the following proportions: hydrogen 25 per cent, atmospheric air 75 per cent. The ignition of the mixture is effected by electricity, as in gas motors.

In the small model constructed by the inventor, the generator of the explosions is a revolver magazine loaded with twelve cartridges, the charge of which is determined with care. Two clicks cause it to revolve utomatically, but in order that these may operate and the magazine may revolve, it is indispensable to leave the aviator to itself, for the hammer is kept cocked only by the weight of the apparatus.

The starting is effected in the following manner: The aviator (Fig. 2) is suspended by a thread from the arm of a support, and the pendulum thus formed is moved from the vertical and is held by a second thread against the support. Two candles, one of them (A) movable, and the other (B) fixed, placed in the vertical of the point of attachment, serve to set fire to the two threads. If, with the first flame, A, the first thread be burned, the aviator, like the Foucault pendulum, will begin an oscillation. It will move from the position, 1, to the position, 2, in describing an arc of a circle, but, having reached this point, its acquired velocity is horizontal, and the flame, B, will burn the other thread. The hammer, at liberty, immediately falls, the cartridge explodes, the tube vibrates violently, and consequently the wings strike the air energetically on lowering. At the same time the aviator leaves the original horizontal plane, and, owing to the inclination of the tail, takes an ascensional motion, that is to say, the position, 3. Then the disengaged gases escape into the atmosphere in a direction opposite that of the motion, and exert a force of reaction. The vibrating tube resumes its original form and the wings rise a little more slowly than they descended. The magazine, moved forward by its click work, promptly brings a cartridge to the hammer, which drops and causes a second explosion, and the same phenomena occur again in the same order. During the third, fourth, and following explosions up to the twelfth the aviator travels a horizontal distance comprised between 245 and 260 feet, in struggling against gravity and progressively ascending. Finally, having reached the end of its flight, the aviator does not fall perpendicularly,

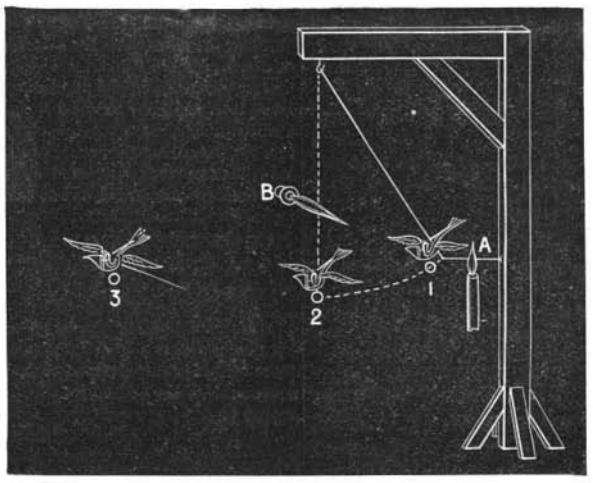

Fig. 2.—METHOD OF STARTING THE AVIATOR.

but the wings, kept raised by the approaching of the branches of the tube and by the silk aeroplane, C (Fig. 1), whose surface is proportional to the weight of the apparatus, act like a parachute, so that the apparatus descends obliquely and slowly to the ground. The aeroplane, represented by dotted lines, connects the rudder with the head, the first joint of the wings and the tail of the aviator. Mr. Trouvé thinks that in the future, whatever be the power of the motor, the use of the aeroplane will remain very serviceable, since its surface, constantly proportionate to the total weight of the apparatus, must prevent any accident in case of a sudden stoppage of the motor.

In an apparatus of large dimensions a reservoir of compressed hydrogen would be substituted for the cartridges of the small model, and the use of aluminum would be indicated, as much by its lightness as by its reasonable price. It should be remarked that the wide cooling surface of the vibrating tube and its contact with the air (which is so much the more intimate in proportion as the velocity is greater) would keep it at a medium temperature.

Upon the whole, Mr. Trouvé considers his apparatus as the lightest aviator that it is at present possible to construct, as its weight does not exceed 7¾ pounds, and as possessing every guarantee of ascensional power and performance.

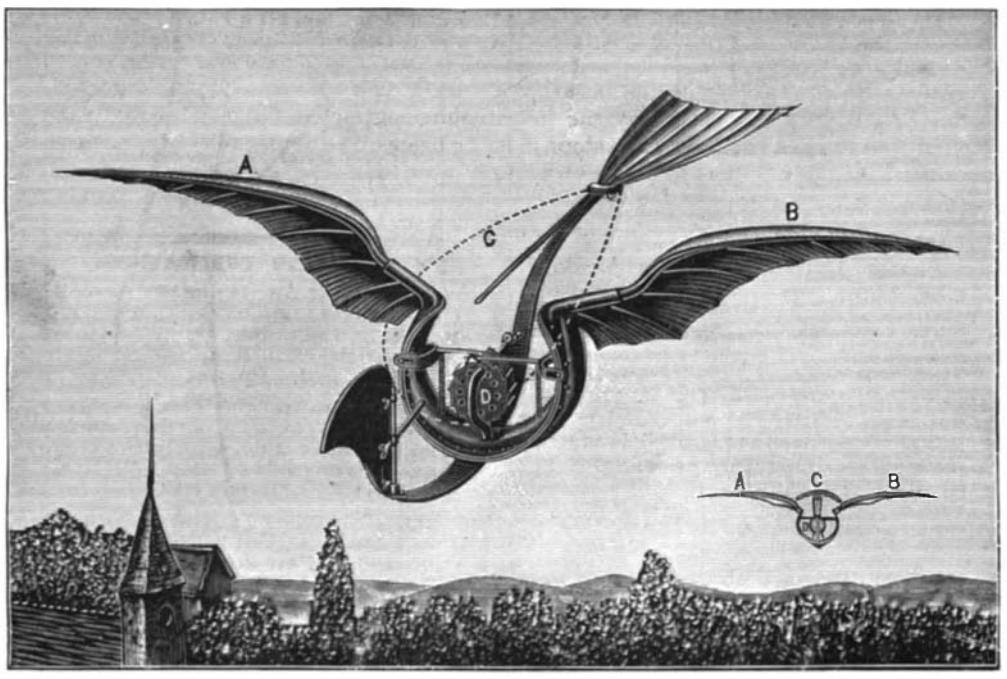

Fig. 1.—TROUVÉ'S AVIATOR.

The Art of Drawing.

To be able to draw well imparts to a person accuracy and correctness of observation; it is a valuable adjunct to an education; it conduces to make us more correct and certain as to what we do; it is a great helpmeet to the memory. How frequently it happens that in making an explanation of a new idea or object, if immediately placed on paper in the shape of a rough sketch or diagram, the whole thing appears clearer to the mind than if described without anything to give an idea of the shape of the object. To the young we say employ all your spare time in learning to draw. Allow no idle minutes.

Scientific Hydraulic Gold Mining.

In 1856 I was chosen as one of a committee of three to witness a test of hydraulic mining, for the purpose of deciding a dispute which had arisen between different manufacturers of hose nozzles. One of the parties had more than a half dozen made, in order to satisfy himself which was the best. The nozzleman generally stood from 20 to 30 feet from the gravel bank. On this occasion the water came down through wrought iron pipe about 8 inches in diameter, which ran down a steep hillside; to this was attached a canvas hose of eight thicknesses, and this was wound solid with about a ¾ inch manila rope, the lower end being tapered for say 50 feet to about 4 inches at the lower end; to this the strong rubber-lined woven hose of eight or ten thicknesses, and to the end of this the brass hose. The hoseman on this occasion was a short-set, very strongly built man, with a strap of leather over his shoulders and attached to the hose. The perpendicular fall of the water on this occasion was 196 feet, this being the most powerful pressure ever used for the purpose to that date. The gravel was what we called cement gravel, so hard that it could scarcely be picked up. The extreme end of each nozzle was from 1¼ to 1½ inches in diameter, varying in order to determine which would do the best work, or rather the most of it. In addition to the gravel the ground contained large bowlders of various sizes. One of the contesting parties claimed that the best results would be obtained by having the brass hose tapering from the canvas to within about 6 inches of the end, and that 6 inches to be of exact size; but the other party contended that the best results would be produced by having the nozzle tapered from the butt to the point as a true radial from 20 to 30 feet from butt to point; and that, if the radius was shorter than this, that the water would scatter after it reached the radial point. The man holding or operating the nozzle would quiver and tremble as the water poured from the nozzle and be compelled to stand with his feet braced apart to keep from being thrown down. On the bank stood a knurly white oak, about 18 inches through. Some gravel had been washed from under the roots of it. I suggested to the nozzleman to try each nozzle at 25 feet distant on the bark of the oak. This he did. The first nozzle with the 6 inch parallel point took off some of the coarse outside bark. We then took the nozzle tapered to a radius of 25 feet, and it peeled the tree wherever it struck it, even cutting into the wood and tearing out small splinters. This nozzle we decided to be the best for hard gravel washings. The victor published our decision all over the State and sent out circulars. He offered each of us $100 in gold, which we, of course, declined, we only allowing him to pay our expenses and $10.

I lost $5 of that $10 on a bet with a gentleman who knew more than I did. I bet him $5 that I could split the stream at the end of the nozzle with my penknife blade. So I went into the blacksmith shop and on an oilstone whet my knife as sharp as it could be. I scratched the end of the nozzle across the center so as to have a channel for my knife to run in, but after working for over half an hour and getting as wet as a drowned rat, and rather a laughing stock, I gave it up and handed him his $5 gold piece. It was singular to put one's hand against the stream at the very end of the nozzle, for it seemed as smooth as oil, and the end of one's finger merely made an apparent dent in it.

Many miners were badly hurt, and some of them killed, by being careless in using hose, by being knocked down, by stumbling over rock, and getting caught in front of the stream and driven against the banks or into the gravel. On this trial I saw immense bowlders turned over by the water from the nozzle of the hose that I do not think five men could roll over by hand.

J. E. EMERSON.

THE Compagnie des Hauts-Fourneaux, Forges et Acieries de la Marine et des Chemins de Fer, are experimenting with a new alloy for armor plates, projectiles, and guns, viz., a steel containing 1 per cent of chromium, 2 per cent of nickel, and not more than 0·4 per cent of carbon. The steel is first melted in an open hearth, and in the ordinary way. When the silicon and manganese in the metal have attained their proper proportions, the nickel and chromium are added successively in the form of ferro-nickels and ferro-chromes, or in the shape of a double ferro-chrome and nickel.

THE average annual rainfall in the United States is 29·6 in., the variations ranging from 0 to about 125 in.