ON

AËRIAL LOCOMOTION.

BY

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THE construction of a machine by which man might be enabled to move at pleasure through the air has long been looked forward to as a possible triumph of mechanics. Darwin, after predicting that the power of steam will be applied to purposes of locomotion both by land and water, anticipates also that it will

> " bear
> The flying chariot through the fields of air :"

and Tennyson, depicting a vision of the future, represents the heavens as traversed by commercial fleets, and " the nations' airy navies grappling in the central blue."

It is impossible to accomplish the desired object by the guidance of balloons, on account of the vast surface presented by them to the action of the wind. Greater power would be needed to overcome this action, than to lift into the air a powerful engine. If therefore the problem is to be solved, the encum-

brance of balloons must be dispensed with, and an engine must be devised capable of lifting its own weight and that of an aëronaut into the air ; and of continuing to exert the power requisite for this purpose for a considerable time.

There is no difficulty in devising mechanical instruments for aërial propulsion and guidance. Earlier projectors principally aimed at imitating the wings of birds ; but since the use of the screw for the propulsion of steamboats, the employment of a similar propeller for aërial locomotion naturally suggests itself. The action of such a contrivance is illustrated by a small toy, sold for the amusement of children : where a string pulled by the hand, giving a rapid rotation to a miniature propeller, causes it to rise in the air. It is also illustrated by the firework called the Chinese turbine ; which rises similarly in the air when caused rapidly to revolve by the combustion of the explosive mixture.

There is no reason to apprehend any peculiar difficulty in the mechanical adaptation of this principle to the purpose under consideration. The real difficulty lies in obtaining a suitable motive power ; *i.e.*, one capable of furnishing sufficiency of power without excess of weight.

The steam-engine first occurs to the mind as the possible agent of propulsion. In this case the chief obstacle is the weight of the boiler, coals, and water ; that of the cylinder, piston, and moving parts being comparatively trifling. It might be possible to

reduce considerably the weight of locomotive steam-engines, by contracting the size of the boiler, and increasing the pressure of the steam and velocity of movement of the piston : still, whatever reduction might thus be effected, the total weight must always remain formidable.

A caloric engine, though dispensing with the weight of water, does not on the whole offer prospect of advantage.

Another source of motive power is afforded by the combustion of gas. An engine moved by this power has been constructed (by Mr. Hall), and is stated to have been worked with efficiency ; though, as inferior to the steam-engine for ordinary purposes, it did not come into use.

In such an engine the weight of the boiler, coals, and water, necessary to the steam engine, is altogether dispensed with : the place of these being supplied by a receptacle of gas, a source not of weight, but of lightness. If the power derived from this source could be efficiently applied, an engine worked by it would be quite capable of lifting its own weight and that of a load attached, into the air. But if the receptacle of gas were large, without which long journeys would be impossible, difficulty of guidance, as in the case of a balloon, would be created.

Another source of power is afforded by the combustion of explosive compounds, such as gunpowder, gun-cotton, &c. In this case the weight of boiler,

coals, and water is replaced by that of the supply of explosive material, whereby, for short journeys, a great reduction of weight is effected.

Sir G. Cayley made experiments to ascertain the capabilities of gunpowder as a source of motive power. But two great disadvantages attend the employment of this substance as a mover of engines: *viz.*, the violence of its explosion, and its tendency to foul the vessels in which it is burnt. On both these accounts gun-cotton is a greatly preferable material; as the velocity of its combustion can be regulated, while on ignition it is wholly converted into gaseous fluids. It has also the advantage in respect of lightness; a given weight of it producing a greater power than an equal weight of gunpowder.

An engine worked by gun-cotton might closely resemble the steam-engine. A suitable quantity of the gun-cotton (or other similar substance) being introduced into a chamber near the cylinder, and there ignited, the gas thus generated would rush into the cylinder, and work the piston, just as is now done by steam. A very powerful engine could thus be constructed of very small weight, which might be employed to communicate a rapid rotation to an aërial propeller (or to any desired number of these).

This rotation however might be produced far more directly, by employing the gaseous products of combustion to work a turbine; as is done in the fire-works called the Chinese turbine and Catharine wheel; and on a more important scale by water in

the Barker's mill and water turbine. If the turbine thus worked by gas revolved very rapidly, a good proportion of the total power expended might be rendered available.* And the simplicity of such a mode of action, reducing friction and getting rid of the weight of machinery, would evidently offer important advantages.

Until some new source of power is discovered, the combustion of gun-cotton (or similar substances) seems to promise more than any other that combination of power with lightness and compactness which is requisite for the purpose of aërial locomotion. Nor can I see that there is anything to prevent the construction of an engine worked by such a power, that should be capable of lifting itself and a considerable load attached into the air, and of moving through the air with great velocity.

The utility of such an engine would be diminished by its restricted range of flight; as the weight of combustible material, of which it would consume a large quantity, would limit its powers in this respect. Nevertheless in certain circumstances it would be of great service, especially in warfare; and would afford a means of achieving results now altogether beyond our reach.

* In the case of the water-turbine, a larger proportion of the whole power is made useful than in most other machines worked by water.

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THE properties of gun-cotton are not at present thoroughly understood; and it is possible that they may not be found suitable to the purpose above indicated, *i.e.*, the working of an engine. But there can be little doubt that if the attention of chemists were specially directed to the investigation of explosive compounds, it would be found possible to form a number of these, of very various properties. For the purpose in question the object would be to devise one which, on ignition, should generate a large volume of gaseous products without excessive velocity of combustion. For the purpose of working a turbine, there would be no difficulty in obtaining a suitable material: the mixture now used for propelling Congreve rockets would answer very well for this purpose, though it is by no means unlikely that others still better might be devised.