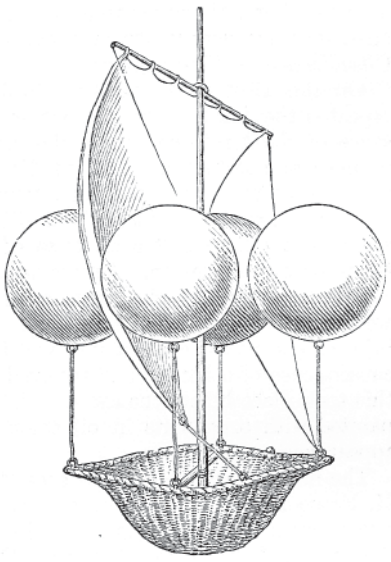
filled with the morning's dew; the heat of the sun, by its attractive power on the dew, raised him up to the middle region of the atmosphere, whence, some of the flasks being broken, the adventurer sank again to the ground. Other aeronautical ideas occur in the romance.

Cardan proposed that ascensional power might be applied in a rocket; and one Honoratus Fabry has described a huge apparatus, consisting of long tin pipes, worked by air compressed by the action of fire.



Lana's Aeronautical Machine.

The most noted scheme for navigating the air promulgated previously to the successful experiments of the Montgolfiers, is due to a Jesuit, Francis Lana, and was proposed by him in a work entitled *Prodromo dell'arte Maestra*, Brescia, 1670. His idea, though useless and unpractical in so far that it could never be carried out, is yet deserving of notice, as the principles involved are sound; and this can be said of no earlier attempt. His project was to procure four copper balls of very large dimensions, yet so extremely thin that after the air was exhausted from them they would be lighter than the air displaced, and so would rise; and to those four balls he proposed to attach a boat, with sails, &c, and which would carry up a man. He submitted the whole matter to calculation, and proposed that the globes should be about 25 feet in diameter and 1/225th of an inch in thickness ; this would give from all four balls a total ascensional force of about 1200 lb, which would be quite enough to raise the boat, sails, passengers, &c. But the obvious objection to the whole scheme is, that it would be quite impossible to construct a globe of so large a size and of such small thickness which would even support its own weight without falling to pieces if placed on the ground, much less bear the external atmospheric pressure when the internal air was removed. Lana himself noticed the latter objection, but he thought that the spherical form of the copper shell would, notwithstanding its extreme thinness, enable it, after the exhaustion was effected, to sustain the enormous pressure, which, acting equally on every point of the surface, would tend to consolidate rather than to break the metal. Of course this assumed the ball to be absolutely spherical, a state of affairs as impossible as indifferent equilibrium actually is. He proposed to exhaust the air from the globes by attaching each to a tube 36 feet long, fitted with a stopcock, and so produce a Torricellian vacuum. He was thus apparently ignorant of the invention of the air-pump by Otto Guericka about 1650 ; and though his project is noteworthy as the hydrostatics of it is correct, still Lana displays his ignorance of philosophical facts known in his day, quite as much as his originality ; and his proposition has, since Montgolfier's discovery, received a greater share of notice than it deserves.

So late as 1755, and not long before the invention of balloons, a very fanciful scheme was proposed by Joseph Galien, a Dominican friar, and professor of philosophy and theology in the papal university of Avignon. This visionary proposed to collect the diffuse air of the upper regions, and to enclose it in a huge vessel extending more than a mile every way, and intended to carry fifty-four times as much weight as did Noah's ark. It is unnecessary to notice at greater length this absurd chimera, which is merely mentioned here at all because it is sometimes referred to, though only on account of the magnitude of the fantastic scheme.

It is proper here to remark, that nearly all the early projectors imagined that the atmosphere was of no great height, and that it covered the earth like a shallow ocean, having a well-defined boundary ; and the aerial vessels which they proposed were intended to float on the surface of this ocean, exactly as ships do on the sea, with their upper portions in the ether or diffuse air, or whatever the fluid might be, that lay above. And these ideas were, of course, not dispelled till after the invention of the barometer and the discovery of the law of the decrease of atmospheric pressure with elevation.

Some writers have stated that Francis Bacon first published the true principles of aeronautics. This assertion we cannot help noticing, because it has really no foundation: except in the propensity, fostered by indolence, which would gladly refer all the discoveries ever made to a few great names. They mistake, indeed, the character of Bacon who seek to represent him as an inventor. His claim to immortality rests chiefly on the profound and comprehensive views which he took of the bearings of the different parts of human knowledge ; for it would be difficult to point out a single fact or observation with which he enriched the store of physical science. On the contrary, being very deficient in mathematical learning, he disregarded or rejected some of the noblest discoveries made in his own time.

We can find only two passages in Bacon's works which can be considered as referring to aeronautics, and they both occur in that collection of loose facts and inconclusive reasonings which he has entitled *Natural History.* The first is styled *Experiment Solitary, touching Flying in the Air, and* runs thus---" Certainly many birds of good wing (as kites and the like) would bear up a good weight as they fly; and spreading feathers thin and close, and in great breadth, will likewise bear up a great weight, being even laid, without tilting up on the sides. *The farther extension of this experiment might be thought upon."* The second passage is more diffuse, but less intelligible ; it is styled *Experiment Solitary, touching the Flying of unequal Bodies in the Air:---"* Let there be a body of unequal weight (as of wool and lead or bone and lead) ; if you throw it from you with the light end forward, it will turn, and the weightier end will recover to be forwards, unless the body be over long. The cause is, for that the more dense body hath a more violent pressure of the parts from the first impulsion, which is the cause (though heretofore not found out, as hath been often said) of all violent motions; and when the hinder part moveth swifter (for that it less endureth pressure of parts) than the forward part can make way for it, it must needs be that the body turn over ; for (turned) it can more easily draw forward the lighter part." The fact here alluded to is the resistance that bodies experience in moving through the air, which, depending on the quantity of surface merely, must exert a proportionally greater effect on rare substances. The passage itself, however, after making every allowance for the period in which it was written, must be deemed confused, obscure, and unphilosophical.

We now come to the discovery of the balloon, which was due to Stephen and Joseph Montgolfier, sons of Peter Montgolfier, a large and celebrated papermaker at Annonay,