



*The Air Balloon Ascending.*

**T H E**  
**A I R B A L L O O N :**

**Or a T R E A T I S E O N**  
**T H E A E R O S T A T I C G L O B E,**

Lately invented by

The celebrated **Monf. MONTGOLFIER** of Paris.

**S H E W I N G,**

**First**—Those Properties of  
Air, which influence an  
Air Balloon.

**2dly**—The particular Con-  
struction and Methods of  
filling it.

**3dly**—Some of the great  
Variety of probable Uses  
which this important Dis-  
covery may be applied to  
for the Benefit of Man-  
kind.

The Whole rendered familiar to the plainest Capacity.

**T H E F O U R T H E D I T I O N,**  
**With C O N S I D E R A B L E A D D I T I O N S.**

“ To be imprisoned in the viewless winds,  
“ And blown with restless violence round about  
“ The pendent world.”

**SHAKESPEARE'S Measure for Measure.**

**L O N D O N :**

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**M D C C L X X X I V.**

# T H E A I R B A L L O O N.

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**I**T has been amongst the complaints of the present times, that whilst we are travelling the road of Moral Philosophy with some expedition, Natural Philosophy has not alike been the object of our pursuit. And indeed, if we observe the spirit of toleration, which has of late been spreading itself thro' those countries, where fanaticism and bigotry seemed to have taken up their eternal residence, and compare it with the falling off which has taken place of late years in the Philosophical Transactions of Great Britain, this complaint will be found to have some claim. Whether this may be attributed to the superior wisdom of the present times, which is chiefly engaged about what "more immediately comes home to mens bosoms" and occasions, is not so easily determined. The present year, however,

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has furnished us with an experimental improvement in Natural Philosophy, which fully atones for her late repose, and which, if carried to the various uses which probability will warrant us to expect, may prove one of the most novel and serviceable discoveries that this century has produced.

What is here alluded to is *Mons. Montgolfier's* late invention of the *Aerostatic Globe*, or *Air Balloon*—an experiment, which in a very few ages back would have filled the world with amazement and wonder, and perhaps have sent the inventor to his grave with ignominy and disgrace. The times, however, in this respect, are more enlightened; for whilst this phænomenon produces novelty, and opens a wide field for speculation and improvement—it gives due honours and rewards to the Philosopher.

But such is the state of Natural Philosophy, that, except in a very few instances, all discoveries and experiments

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not only lie amongst the learned, but the publications of those discoveries are for the most part written in such a technical style, and presuppose so much scientific knowledge, that the generality of the world cannot readily comprehend them. By this I do not mean to say, that all sciences are not perhaps better explained by terms adapted to that particular science, provided the whole of the public were equally learned. But as this never can be the case—in all great and important discoveries, which may in some respect meet the speculation as well as the general benefit of mankind—treatises adapted to such capacities may have their use, by rousing the attention of strong, but unlettered minds, to add new discoveries out of the catalogue of more scientific researches — as it was a *paper maker* in Paris † that first sent this *Air Balloon* above our atmosphere, who knows

† Mons. Montgolfier.

but



but it might be reserved for an English miller, or wheel-wright, to add wings, or some aerial rudder to guide it through those regions with certainty and precision?

It is upon this principle I offer this little treatise to the Public, not attempting to explain any thing to the learned, who, from their particular studies and experiments in this branch of knowledge, must know much more of the subject—but to satisfy the wishes of unlettered curiosity, by explaining, first, those general properties of air, which influence an *Air Balloon*—second, how an *Air Balloon* is constructed, and the methods of filling it—together with some of the probable uses which such a discovery might ultimately lead to for the benefit of mankind.

*Air*, in Philosophy, signifies that thin and compressible body in which we breathe, and which surrounds the earth to a great height. The air is scarce to be perceived by ourselves, but it sufficiently discovers itself by the resistance it makes

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to bodies moving in it, and by its strong motion against other bodies, which is called *wind*. The laws of our existence and inevitable necessity oblige us to take in, and return this air, be it what it will; infomuch, that all the assistances of art are vain, and all that is done for us in the common course of nature fruitless, if we are deprived of its benefits. Nor is this peculiar to man or animals alone; it is the grand and necessary instrument which Nature universally employs in almost all the operations she is perpetually engaged in. There is scarcely any liquid, as appears by experiments, which has not air intermixed with it, or scarcely any solid out of which it may not be extracted.

But in order to obtain a more particular knowledge of air, it will be necessary to consider distinctly some of its essential properties. The first, therefore, that offers itself to our consideration is *fluidity*. This is so natural to it, that all the various

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rious experiments which have been made, shew it cannot be deprived of it. Indeed, common observation, independent of chemical experiments, will fully prove this: for, in the sharpest frost, where every thing is congealed, the air alone remains *fluid*; nay, even in an artificial cold, forty degrees greater than ever nature has been observed to produce, the air still retains its *fluidity*, notwithstanding it is acted upon by such a prodigious excess of Cold.

If you likewise compress the air with ever so great weight and force into the utmost density or compactness, yet it then does not become solid by concretion, or union of its several particles, but remains equally *fluid* as before, and as soon as ever the compression is removed, it resumes its former degree of liquidity. In the mean time it must be remembered, that the air concretes together, and unites with every species of known bodies, and serves as a kind of element in their composition.



position. This is sufficiently evident from the large quantity of air, which, of its own accord, makes its way out of almost every body, whilst it is analyzing or reducing into its principles; and this is now usually (though perhaps not altogether properly) called factitious or made air. The fact upon examination appears to be thus: air is contained in all known liquors whatsoever, it penetrates together with them into the recesses of compound bodies; thus, at last, after a coalition of the whole, it remains locked up in the pores of those bodies, as it were, in very minute vessels, and afterwards the liquor, into which it was conveyed thither, being dissipated, it is left there alone—Hence then it is evident, that this air was not concreted there, but only lay concealed, being retained by the including body. As soon as ever therefore it can disengage itself from this confinement, it rushes out, not in the least changed, and returns with velocity to its proper nature.

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The second property of air is that of *weight*, or *gravity*, which from numberless experiments (and particularly the following) is found to gravitate upon all inferior bodies.

Take a glass tube hermetically or chymically sealed, fill it with raw mercury, and invert it, immersing the open end of a tube in a basin or other vessel filled with the same fluid, so that the closed end may be perpendicular to the surface of the mercury in the basin. The tube being thus situated, the mercury will run out at the open end of the tube into the basin; till it is about twenty-eight inches above the surface of the fluid contained therein; at which height, notwithstanding the great specific gravity of the mercury, it will remain suspended in the tube. Now, it is certain, that nothing can sustain the weight of the mercury in the tube, but an external pressure on the surface of the fluid, and this can be no other than the weight of the incum-

incumbent atmosphere, which, not being counterbalanced by the air in the tube, raises, or suspends when raised, a quantity of mercury, whose weight is equal to that of a column of air of the same diameter of the tube, in order to maintain an equilibrium.

And this appears evident from hence, that if you open the upper end of the tube, which before was closed up, the air by pressing on the mercury in the tube with the same force as it does on the mercury without it, the former will subside to the level of the latter. This is what is called “The *Torricellian* experiment,” from the Italian philosopher *Torricellius* its inventor.—And on this principle depend the structure and use of the barometer.

The weight of air is continually changing in proportion to the different degrees of heat and cold—but the weight of the common air, near the surface of the earth, at the time of the middle weight

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of the atmosphere, and in the most temperate season of the year, is to that of water, as 1 to 850.

The third property of air is *elasticity*. This is that singular quality by which all known air, possessing a certain space, and being confined there so that it cannot escape, will, if it be pressed with a determined weight, reduce itself into a less space, which will be always in a reciprocal proportion to the quantity of the weight which it acts upon; with this circumstance, however, that it will constantly, by a spontaneous expansion, recover again the space it had lost, in proportion as the compressive force is diminished. This property seems peculiar to AIR, there being no other *elastic* fluid in nature yet discovered.

The elasticity of the air cannot be destroyed: for, upon examination, by every kind of experiment, it has always remained the same; nor are its principles either by long rest, or the greatest pressure,

sure, ever so altered as to lose their *elasticity*. The celebrated Mr. Boyle and Mariotte having, with a particular view to this, kept common air strongly compressed and confined in a wind gun, found upon setting it at liberty, that it was perfectly as *elastic* as before; and Robervallius examining air, which had been confined in the same manner fifteen years, found that it had not lost any of its *elasticity*.

Mr. Boyle has likewise proved, that the *elastic* power, which prevails in any particular portion of the air, without any greater condensation than what is owing to the compressing air itself, can sustain all the force of a whole column of the incumbent atmosphere; and also that this *elastic* power, in such a very small portion of air, can, by expanding itself, repel the bodies which compress it, with as much force as that which is exerted by the whole external body of the air.

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A very small portion of air, therefore, wherever confined, is capable of producing the very same effects as a very large quantity in another place ; for if any portion of common air is contained in a cavity that is easily compressible, it will then sustain the whole pressure, and entirely repel the whole body of the atmosphere. And whenever the air contained in that place is heated by fire, or freed from its external pressure, it immediately, by expanding itself, becomes so rare, as to produce effects equal to those of the greatest body of air.

Another law of the *elasticity* of air is, that when it is condensed to a certain degree, it acquires by the application of heat a greater power to expand itself than it had before ; and this power of rarefaction arising from heat, has the same effect, as if that air had been rendered denser, in proportion to the degree of heat which it before obtained. Unequal masses

masses of air, but of the same density, are always equally expanded by the same degree of fire; so that these expansions in the same degree of density, by a constant law of Nature, are always in proportion to the augmentation of heat applied.—Hence, if the expansion of air of a given density by a certain degree of heat is once discovered, it will constantly hold good in all similar cases.

But with regard to the *great elasticity* of the air, this is likewise constantly observed, that the more it is condensed by pressure, the greater elastic force it will acquire by the same degree of heat, and that nearly in a direct ratio of the densities. Hence it follows, that a portion of air that is exceeding dense may, by means of a very small degree of heat, acquire the greatest resisting force. Also, if you increase the density of the air, and at the same time augment the heat applied to it, the elastic power of the air will always be increased in a compound  
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ratio of both. The last law that is discovered in the elasticity of the air is, that it is contracted into a smaller compass by cold, as it is by an increase of weight. Hence its density is always increased in proportion to the intenseness of the cold.

Having thus described the three leading properties of Air—we now come to explain how this Element is applied in the construction of an *Air Balloon*.

From the nature of air we find, that any factitious air which is lighter than the atmosphere ascends.—We see this by that air which is produced by a fire, called *smoke*, which being specifically lighter than the atmospheric air, is carried up the chimney, and only settles when it gets to that height which is equal to its own levity. This quality of air has been long understood, and various theories have been suggested to what purposes it may be applied. Though *Monf. Montgolfier*, we believe, was the first European

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ropean philosopher who made it a *travelling convenience* for man, and gave to the world an experiment, which is likely to become as useful as it is at present curious.

The methods of making the air which fills this *Aerostatic Globe* are as follow;

Take a certain quantity of oil of vitriol, in the proportion of an ounce to a quart of water, and mix both with filings of iron: these produce a factitious air, supposed to be about ten times lighter than the atmosphere. This air so made is by a tube conducted into the *Air Balloon* so as not to give it all the fullness of a common bladder, but rather loose in some parts, and this keeps it the longer from bursting in its progress through the air. The form of the *Air Balloon* is orbicular, or round—it is generally made of taffeta, or thin silk, on account of its lightness, and gummed on the seams, the better to prevent the air from transpiring. When it is properly filled, it is closely tied at the end, and from this moment

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it becomes so much a lighter body than the circumambient air, that it would immediately ascend, if not restrained by a proportionate balance. When it is let off (which is done by cutting the strings which restrain it) it rises for some time perpendicular, and rather slowly; it then follows the direction of the wind in a progressive ascent, till it reaches that region of air which is lighter than itself. This air repels it with that force, so as either to burst it, or force out by degrees the factitious air; in either case it descends with rapidity to the earth.

From this method of using an *Air Balloon*, the Public will readily see, that the experiment can only gratify curiosity—as very little or no use can be made of it, there being no possibility of restraining its height, or preventing its rapid descension—in either case it must be fatal to any person to ascend with it; as it may travel through regions of air too rarefied for human respiration, and fall  
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with such rapidity as to dash him to pieces.

To remedy this, the same ingenious inventor has adopted another method of filling his *Balloon* by which he has secured its ascent and descent with more certainty and safety; which is, instead of oil of vitriol, water, and filings of iron, to make his air of that smoke which is produced by the burning of wet straw, and by carrying a quantity of this fuel with him (in a little gallery constructed round the Balloon, for the purpose of feeding it) he can ascend or descend at pleasure.

The method of supplying this last *Balloon* with air is, by burning the straw on a grate affixed to the bottom of it — the smoke of which is infused into the Balloon by a tube, to which there is a cock to let it out as occasions may require.

Of this he has made several experiments in the presence of many thousand spectators in Paris; amongst whom were

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some of the first rank in life and letters. —But the greatest experiment which has as yet been made, was that on the 19th of October last by the *Sieur Giroud de Villette* and *Monf. Rozier*. The Balloon constructed for this purpose was sixty feet long and forty broad, which being filled with air made by the smoke of wet straw was capable of taking up these two enterprising Philosophers, together with the weight of the gallery attached to it, and several pounds weight of fuel.

They took the opportunity of a day when the wind blew across the city of Paris, and ascending at one side Port St. Jacques, crossed over to the Fauxbourgh St. Martin, that is, by way of making it more familiar to an English ear, (supposing the experiment was made in London) as if they ascended at St. George's Fields, and traversing across the city, came down in one of the fields near Islington.

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The height they ascended was made by a computation, which was taken as they passed over the church of St. Sulpice, and is said to be 1650 feet, which is more than four times higher than St. Paul's. In this region (contrary to the received opinion of most philosophers, that man could not live in such rarefied air) they could breathe freely; and so supported were they by the enthusiasm of their enterprize, that they had resolution enough to enjoy the birds eye prospect of so stupendous a height, and clearly see Neuilly, St. Cloud, Seve, Issy, Ivry, Charenton, and Choisy—Some of those place 48 miles from the capitol. The gardens about Paris appeared to them like *bouquets*, and the people passing and re-passing (according to the strong expression of Mons. Rozier) “*like so many mites in a cheese.*”—No bad situation to humble the pride of man, and make him feel his individual littleness and insignificancy in the great scale of Creation.

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In respect to the weight an *Air Balloon* can carry, it must depend on the size. That constructed by Mr. Biaggini, and lately let off in the Artillery Ground, Moorfields, was ten feet diameter, and could have carried about sixteen pounds\*—so that by a computation of this kind, on a more enlarged scale, the exact weight can be readily ascertained—that lately sent up in Paris, which we have been just describing, was sixty feet long, and forty broad—and must have carried up (computing the weight of the two men, the gallery, and straw) not less than between three and four hundred weight.

In respect to its rate of travelling in the air, we may very well suppose it at least fifteen miles an hour from the average calculation of experiments which

\* Mr. Biaggini has just now prepared another *Air Balloon*, which he is exhibiting at the Pantheon, and which he shortly intends to let off in the Artillery Ground, 16 feet diameter, and of force sufficient to carry up a child of eight years old.

have

have been made, without allowing for the loss of time in the perpendicular ascent; and the obstructions it is subject to meet with from the shiftings of the wind; and if in any future discovery we should be able to direct its course, there is no doubt it will travel with still more velocity.

Such is a brief and plain description of an *Air Balloon*, which has with so much justice roused the curiosity and attention of all Europe—a discovery, we must confess, hitherto merely curious, but which bids fair, from the probable improvements which may be made in it, to be highly serviceable to society.

At present however, by this invention, we can only ascend and descend, and the latter, perhaps, not always with the most perfect security: it is besides at the mercy of the wind, “*to be blown with restless violence round about this pendent world.*” The first object of improvement therefore  
will



will be to direct its motion in the air by the means of *wings*, or *feathered oars*. This may appear visionary to some; but we have authority to assure the Public, that not only the original inventor of the *Air Balloon* is busied in this project, but something of a similar nature is now in great forwardness amongst ourselves, under the direction of a Scotch artist, who is already supported by a subscription of seven hundred guineas to complete it.

The machine is to be in the form of a bird; the body is to contain the inflammable air; the shaft of the wings to be nine feet long, and nine inches wide; both to be made of the purest elastic steel ever wrought in this country, and the whole is to be worked and directed by a person who is to go up in a basket attached to the machine.

This once obtained, the uses which might arise from it are many and various.

On the first report of a country being invaded, an *Air Balloon* would save the expences

expences of messengers, posts, &c. from the coasts to the main army, as at the height it ascends, with the assistance of glasses, the number of the enemy, together with their place of landing, might be communicated with great dispatch.

A general likewise in the day of battle would derive singular advantage by going up in one of these machines; he would have a bird's eye view not only of every thing that was doing in his own, but the enemy's army, and by sending down his orders occasionally (which may be done by the means of a plummet) he may literally be said

*'To ride in the whirlwind, and direct the storm.'*

Observations at Sea may likewise be made at a greater distance, and with a greater certainty than at present, which would not only be useful in time of war, and preventive of accidents at all times, but add perhaps extensive discoveries to our terrestrial globe.

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During sieges they may be rendered particularly useful, by observing the works of the enemy, and of course rendering them ineffectual. Had this discovery been known even so late as the siege of Gibraltar, it would have saved that brave garrison some lives, and great labour, as occasional turrets were obliged to be built the better to observe the operations of the enemy—all which an *Air Balloon* would have saved. In cases of fires in capitals or large towns, an *Air Balloon* let off would instantly ascertain where the fire was, and of course occasion a more direct and speedy assistance.

To maintain a war of posts, as was pretty much the case in the late war in America, an *Air Balloon* would be of the most singular advantage. For instance, had the troops in that unfortunate expedition to Albany been provided with this celebrated discovery, to give necessary signals and intelligence to the detachment who were to support them; the effects  
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of that unfortunate day would not be recorded, as they now are, in the debilitated and humiliating state of Great Britain.

In Natural Philosophy it bids fair to make many great and considerable improvements. It is well known, that our great philosopher Dr. Franklyn, by means of an artificial Kite, has already drawn down lightning from the clouds: Why may not this experiment be improved by means of an *Air Balloon*? When the appearance and approach of clouds prognosticate immediate thunder, an *Air Balloon* carrying up conductors might draw it down, and separate that force, which oft has proved fatal to the lives of many. In the West and East Indies, where thunder storms are infinitely more frequent and mischievous than in these countries, it would be a discovery of the most salutary kind, and as its objects would be of such material advantage to the natives, there is little doubt but such fur-

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ther improvements may be made, as the very bad effects of thunder may in a great measure be prevented.

Phyics may keep equal pace with the other improvements in Natural Philofophy: for as the great organs of our senses, tafting, feeling, hearing, and smelling, are communicated to us thro' the medium of the air, who can fay what improvements the constitution might receive from fuch quick and elevated changes? We all know, that fome invalids are only kept alive by what phyficians call the *change of air*, that is, by travelling from one country or town to another—but as the air is always allowed to be purer in its *afcent*, and as an *Air Balloon* can regulate that afcent to precision, the benefits may be of the moft valuable kind. In *asthmas* and *decays* it may turn out a fpecific, and in other difeafes, though not fo powerful, yet highly ferviceable.

In fhort, as the various properties of air are at prefent fo well known to contribute to the prefervation of our exiftence,



ence, what are we not led to hope from a knowledge of using it, and living in it in a purer and more extensive degree than ever? The present period seems to be a favourable omen for the extension and encouragement of this discovery— as PEACE, the parent and patron of all knowledge, has happily once more revisited Europe, and calls upon its philosophers and artists to erase the ravages of war, by the cultivation of useful and ornamental science.

SINCE writing the above, the Editor is favoured with a letter from a respectable correspondent in Paris, dated the 3d of December, acquainting him of a late experiment made of the *Air Balloon*, which he is happy in laying before the public, as it in a great measure justifies the sanguine hopes he entertains of its further improvement.

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“ On Monday the 1st of December an *Air Balloon*, under the direction of Messrs. Charles and Roberts, was let off from the Thuilleries. It had suspended to it a basket, covered with blue silk and paper finely gilt, in the shape of a triumphal car, in which Mr. Charles and Mr. Roberts embarked, and mounted up into the air, amidst many thousands of people of all ranks and conditions, perhaps three or four hundred thousand. Beside the Duke de Chartres and a great part of the French nobility, there were the Duke and Duchefs of Cumberland, the Duke and Duchefs of Manchester, and many other foreign princes and nobility. The philosophers had flags with them of different colours, with which, as they mounted aloft, they saluted the admiring world below. When they came to the height at which they meant to sail (which was computed to be about twice the height of St. Paul's) they threw down a flag as agreed. They then glided along a steady horizontal track over the Fauxbourg St. Honore, saluting the people as they went along, with their flags; and landed at about 20 miles distance  
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from the place they set out from, being accompanied (*sur la terre*) by the Duke de Chartres, and several of the French and English nobility and gentry, who came in almost at their landing. Mr. Roberts then got out, when Mr. Charles, after throwing out some ballast to lighten the machine, ascended alone in the *Balloon* to the almost incredible height of 15026 toises, or 3052 yards perpendicular, in about ten minutes.

“ The account Mr. Charles gives of his observations during this time (which is published in the *Journal* of to-day) is, that he lost sight of every thing below upon earth, and saw nothing but a wide expanse of fine æther—that the Barometer fell from 28 to 18, and the Thermometer from 7 above freezing to 5 below it. He descended about four or five miles from the spot he got up, near the house of a Mr. Farrar, an English gentleman, where he slept that night, and was brought to town by a nobleman in his own carriage the next day, amidst the general acclamations of the Public.

“ The Balloon was composed of red and straw-coloured taffeta, which were  
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pieced alternately, so as to appear like meridional lines upon a terrestrial globe. The upper hemisphere was covered with a netting, surrounded at the bottom by a hoop, to which the car was suspended; so that the elastic pressure of the inflammable air was equally repressed by all the meshes of the net above. *Monf. Montgolfier* attended during the whole of the experiment."

We are sorry to add to this account, that on the arrival of *Mess. Charles* and *Roberts* in Paris, they were arrested by order of the King, who, as *father of his people*, was advised by some bigotted Ecclesiastics to prevent the farther endangering the lives of his subjects.—But as great interest is making for them by the princes of the blood, together with all the philosophers in Paris, it is thought they will speedily be discharged. Public curiosity is much damped by this circumstance, as the next experiment *Mr. Charles* meant to make of the *Air Balloon* was to take a trip in it from Calais to Dover, in which he was to be accompanied by the celebrated *Monf. Bougainville*.

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## P O S T S C R I P T.

**T**HE very rapid and extensive sale of this little Treatise, which the Editor sent into the world with no other view, than to make familiar to ordinary capacities, an invention which may be further improved for the benefit of mankind, induces him, in this Edition, to report what further trials and improvements the *Air Balloon* has suggested to the philosophers of this country.

When the Editor stated the great variety of probable uses which this discovery might be applied to, he was aware that he ran some risque of obtaining credit with the indolent, the sceptical, and unlettered part of mankind; for such is the nature of man, that from pride, and a variety of other causes, equally unphilosophic, few will be brought to acknowledge the possibility of effecting what they do not comprehend, particularly if the object is much out of the latitude of common understanding. It was upon the errors of this principle that Columbus had nearly abandoned the project of discovering America, that the famous Gallileo was imprisoned six years in the Inquisition; and to come more immediately to the point, that our modern philosopher, Montgolfier, had not totally given up this his discovery; as on his first expedition, the *Air Balloon* not rising proportionably to public expectation, (owing to too small a quantity of inflammable air) the populace were growing clamorous, and had he not at last succeeded, would not only have prevented him a second trial, but perhaps have made him pay dear for the first.

Time, however, the settler of most things on their true basis, has given to this philosopher the full credit of his invention. The public no longer doubt, because they see that an *Air Balloon*, filled with inflammable air, ascends, and that it carries up a weight proportionate to its magnitude. This fact so oft repeated, they likewise begin to think it possible some further discoveries may be made, to

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render it useful as well as curious; and the philosophers of Europe, seeing this propensity of the public, and feeling the ardour of science, are now bending their minds to a subject where they are sure of meeting encouragement and approbation.

In this list, we are happy to acquaint the public, that two of our own countrymen are now busily employed on different projects, which if they can bring to perfection, it is impossible to describe the number of useful purposes this invention will give birth to.

The first philosopher seeing that an *Air Balloon* is at present entirely governed by the wind, and subject to all its changes and shiftings, has added a pair of artificial wings to the body of the Balloon, to be worked by the person who goes up in the basket. This we hinted, in the first edition of this pamphlet, to be in some forwardness; it is now compleated, and the artist, very early in the Spring, will begin the first journey that perhaps was ever undertaken by man — *a journey through the air*, where, in the language of our divine Bard, he may be literally said “to ride upon the flightless couriers of the wind.”

The second artist demands our wonder more, as he scorns the auxiliary of an *Air Balloon*, and means to traverse the air in what direction he thinks proper, by the assistance of a machine in the form of a canoe, to which are to be attached a pair of artificial wings and tail. This apparatus is now nearly compleated, the wings are nine feet by nine inches, the tail about a yard and a half long, both made of the purest elastic steel, and to be worked at discretion by the artist as he sits in his canoe.

This wonderful attempt the Editor has seen and examined, through the courtesy of the Inventor, who adds urbanity to a love of science. The wings are said to be constructed on the model of those of the West India crow; and the tail, though not so long, has somewhat of the plumage of a peacock. These the artist works with great facility, spreading and contracting both at pleasure, and he now only waits to commit them to the air till a second pair of wings are ready for him to use in case of any accident happening to the first.

However strange this last project might appear, and however impracticable it may be thought for a man to support his own weight with that of his apparatus, merely by the aid of artificial wings, the idea is not new in this country; the celebrated Bishop Wilkins, a very grave and learned prelate

late of the last century, was so possessed of the certainty of effecting this, that he wrote a book upon it, explaining its practicability upon philosophical principles. The age he lived in was not, however, ripe enough for his theory; had it been preceded by the success of *Air Balloons*, there is no doubt but the public would have given him a patient trial, when perhaps he, who in this instance was treated as a visionary, would be considered a great experimental philosopher.

Leaving those two very extraordinary attempts to the success which bids fair to await them, the Editor cannot close this postscript without laying before the public an account of the last experiment which has been made of the *Air Balloon*.

On Thursday, the 18th of December last, an *Air Balloon* was launched by a Mr. Dinwiddie from the Bowling Green Tavern, near Buckingham Gate; its size was much less than that let off by Mr. Biaggini at the Artillery Ground. Its form longitudinal, very much resembling that of a pocket of hops; it was about three yards long, and four feet circular. Previous to its launching, the artist found there was not air enough to ensure its ascent, he therefore, in the presence of the spectators, filled it exactly after the manner prescribed in this treatise,\* by a mixture of oil of vitriol, filings of iron, and water, placing one end of the tube through a hole in a small cask, where the fumigation was made, and the other in the neck of the Balloon.

On its first being let off, it rose with so much difficulty, that it was for some time doubtful whether it would succeed or not; at length getting rid of the houses which surrounded it, and consequently arriving at more expanded air, it gradually ascended, and took its course south west for about seven minutes, when it was entirely out of sight.

We could discover from the manner of this Balloon getting up, and irregular motion when up, that its best form should be circular, as it not only ascends the higher but the steadier; the atmospheric air surrounding it with more force and impelling it with greater certainty.

A desire to gratify, as early as possible, the public curiosity concerning the experiments of Messieurs Charles and Robert with the *Air Balloon*, Dec. 1, 1783, has induced us to lay before them the following abstract of so much of the discourse delivered by the first of these gentlemen at the opening

• See Page 17.

opening of his course of lectures on Natural Philosophy, as published in the Journal de Paris, No. 347 and 348, Dec. 13 and 14, 1783, as relates to his aërial voyage.

“ Previous to our ascension,” says Mr. Charles, “ we had sent up a globe of 5 feet 8 inches to discover the course of wind, and mark out our intended route. The compliment of cutting the string was paid to Mr. Montgolfier, and it instantly rose. Meanwhile we prepared to follow it with impatience; but the perplexing circumstances\* we were in prevented our putting into execution every minute particular that we had intended the night before. The globe and the chariot were in exact equilibrium on the ground. At three quarters after one, we threw out 19 pounds of ballast, and rose in the midst of a profound silence, occasioned by the emotion and astonishment of both parties. Our first pleasing reflections on our escape from the persecution and calumny which had attacked us, were heightened by the majestic scene which presented itself to our view; on every side a most serene sky, without a cloud, and a most charming distant prospect. As we ascended by an accelerated progressive motion, we waved our banner in token of joy, and, in order the better to insure our safety, I was particularly attentive to the barometer. M. Robert examined the cargo with which our friends had ballasted our chariot, as for a long voyage, of champaign, &c. blankets, and furs.—Having enough, and to spare, he began with throwing out one of the blankets, which spread itself in the air, and fell near the dome of the Assumption.—The barometer then sunk 66 inches, and we had ceased to ascend, or, more properly speaking, were arrived at the height of about 300 toises. This was the height to which I had undertaken to stop, and from this moment, to that of our first getting out of sight of the observers at the different stations, our horizontal course was between 26 inches and 26 inches 8 lines of the mercury, which agrees with the observations made at Paris. We took care to throw out our ballast in proportion as we descended by the insensible loss of inflammable air, and we raised ourselves sensibly to the same height. Had circumstances permitted us to regulate this ballast with more exactness, our course would have been almost absolutely horizontal and voluntary.

Having reached the height of Mousseaux, which we left a little to the left, we remained for a moment stationary. Our chariot turned about, and we then filed off, as the wind directed.

\* *Les circonstances orageuses qui nous pressoient.*



directed. We soon after passed the Seine, between St. Ouen and Asnieres, and leaving Colombe on the left, passed almost over Gennevilliers. We had crossed the river a second time; leaving Argenteuil on the left, we past at Sanols, Franconville, Eaubonne, St. Leu-Taverny, Villiers, cross L'Isle Adam, and afterwards Nesle, where we descended. Such were nearly the places over which we must have passed almost perpendicularly. This passage makes about 9 Paris leagues, which we ran over in two hours, with scarcely any sensible agitation in the air. During the whole of this delightful journey we felt not the least uneasiness about our own fate or that of the machine. The globe suffered no other alteration than the successive modifications of dilatation and compression, of which we availed ourselves, to rise or descend at pleasure, in any quantity. The thermometer was, for above an hour, between 10 and 12 deg. above 0, owing to the inside of our chariot having been warmed by the rays of the sun. Its heat soon communicated itself to our globe, and contributed, by the dilatation of the inflammable air within, to keep us at the same height, without being obliged to lighten our ballast; but we suffered a greater loss: the inflammable air dilated by the sun's heat, escaped by the appendage to the globe, which we held in our hands, and loosened, as circumstances required, to let out the air too much dilated. By this easy method we avoided the expansions and explosions which persons unacquainted with these matters apprehended. The inflammable air could not break its prison, since it had always a vent, and the atmospheric air could not get into the globe, since its pressure made the appendage serve as a valve to oppose its entrance.

After 56 minutes progress we heard the gun which was the signal of our disappearing from the observers at Paris. Not being obliged to confine our course to an horizontal direction, as we had till then done, we gave ourselves up to the contemplation of the varied scenes in the open country beneath us. We shouted *Vive le Roi*, and heard our shouts re-echoed. We heard, very distinctly, voices saying, 'Are not you afraid, my friends? Are not you sick? What a clever thing it is! God preserve you! Farewel, my friends!'—We continued waving our banners, and we saw that these signals redoubled the joy and security of those below. We several times came down low enough to be heard: people asked us whence we came, and what time we set out; and we ascended bidding them farewel.—As circumstances required, we threw out, successively, great coats, muffs,

muffs, clothes. As we sailed over L'Isle Adam, we flourished our banners, and asked after the Prince of Conti; but had the mortification to be told, by a speaking trumpet, that he was at Paris. At length, re-ascending, we reached the plains of Nessel about half-after three, when, as I intended a second expedition, and wished to avail myself of the advantage of situation, as well as of the day-light, I proposed to Mr. Robert to descend. Seeing a troop of country people running before us over the fields, we descended towards a spacious meadow, inclosed with some trees and bushes. Our chariot advanced majestically over a long inclined plane. As it approached the trees, fearing it might be entangled among them, I threw out two pounds of ballast, and it sprung upwards over them. We ran over above 20 toises within one or two feet of the land, and looked like travellers in a sledge. The country people pursued us as children do a butterfly, without being able to overtake us. At length we came to the ground. As soon as the curate and syndics could be brought to the spot, I drew up a verbal process, which they immediately signed. Presently galloped up the Duke de Chartres, the Duke de Fitz-James, Mr. Farrer, an English gentleman, and a number of horsemen, who had followed us from Paris. Fortunately we alighted near a hunting-seat of the latter, who immediately mounted his horse, and riding up to us, exclaimed, "Mr. Charles, I am first." The Prince embraced us both in our chariot, and signed the process. So did the Duke de Fitz-James. Mr. Farrer signed it 3 times. His signature was omitted in the Journal, for he was so transported with joy, that he could not write legibly. Of above 200 horsemen who followed us from Paris, only these could overtake us; the rest had knocked up their horses, or given out. After relating a few particulars to the Duke de Chartres, I told him I was going off again, when would he have me return? He replied, in half an hour. Mr. Robert quitted the chariot, as we had agreed. Thirty peasants held down the machine. I asked for some earth to ballast it, having not above 4 or 5 pounds left. A spade was not at hand, nor were there any stones in the meadow. The sun was near setting. I made a hasty calculation of the time requisite for the alteration of weight, and giving a signal to the peasants to quit their hold, I sprung up like a bird. In 20 minutes I was 1500 toises high, out of sight of all terrestrial objects. I had taken the necessary precautions against the explosion of the globe,



globe, and prepared to make the observations which I had promised myself. In order to observe the barometer and thermometer placed at the ends of the chariot, without altering the center of gravity, I knelt down in the middle, stretching forwards my body and one leg, holding my watch and paper in my left, and my pen and the string of the valve in my right, waiting for the event. The globe, which, at my setting out, was rather flaccid, swelled insensibly. The air escaped in great quantities at the valve. I drew the valve from time to time, to give it two vents; and I continued to ascend, still losing air, which issued out hissing, and became visible, like a warm vapour in a cold atmosphere. The reason of this phenomenon is obvious. On earth the thermometer was 7 degrees above the freezing point; after 10 minutes ascent it was 5 degrees below. The inflammable air had not had time to recover the equilibrium of its temperature. Its elastic equilibrium being quicker than that of the heat, there must escape a greater quantity than that which the external dilatation of the air could determine by its least pressure. For myself, though exposed to the open air, I passed, in 10 minutes, from the warmth of spring to the cold of winter, a sharp dry cold, but not too much to be borne. I declare, that in the first moment I felt nothing disagreeable in the sudden change. When the barometer ceased to rise, I marked exactly 18 inches 10 lines, the mercury suffering no sensible oscillation. From this oscillation I deduct a height of 1524 toises, or thereabouts, till I can be more exact in my calculation. In a few minutes more my fingers were benumbed by the cold, so that I could not hold my pen. I was now stationary, and moved only in an horizontal direction. I rose up in the middle of the chariot, to contemplate the scene around me. At my setting out the sun was set on the valleys; he soon rose for me alone, who was the only luminous body in the horizon, and all the rest of nature in shade. The sun himself presently disappeared, and I had the pleasure of seeing him set twice in the same day. I beheld, for a few seconds, the circumambient air and the vapours rising from the vallies and rivers. The clouds seemed to rise from the earth, and collect one upon another, still preserving their usual form, only their colour was grey and monotonous from the want of light in the atmosphere. The moon alone enlightened them, and shewed me that I was tacking about twice, and I observed certain currents that brought me back again. I had several sensible deviations, and observed, with surprise, the effects of the wind, and saw  
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the streamers of my banners point upwards. This phenomenon was not the effect of the ascent or descent, for I then moved horizontally. At that instant I conceived, perhaps a little too hastily, the idea of being able to steer one's own course. In the midst of my transports I felt a violent pain in my right ear and jaw, which I ascribed to the dilatation of the air in the cellular construction of those organs, as much as to that of the external air. I was in a waistcoat, and bareheaded. I immediately put on a woollen cap, yet the pain did not go off but as I gradually descended. For 7 or 8 minutes I had ceased to ascend; the condensation of the internal inflammable air rather made me descend. I now recollected my promise to return in half an hour, and, pulling the upper valve, I came down. The globe was now so much emptied, that it appeared only an half-globe. I perceived a fine ploughed field near the wood of Tour du Lay, and hastened my descent. When I was between 20 and 30 toises from the earth, I threw out hastily 2 or 3 pounds of ballast, and became, for a moment, stationary, till I descended gently on the field, above a league from the place whence I set out. The frequent deviations and turnings about make me imagine this voyage was about 3 leagues, and I was gone about 35 minutes. Such is the certainty of the combinations of our aërostatic machine, that I can at pleasure complete 130 specific lightness, the preservation of which, equally voluntary, might have kept me in the air at least for 24 hours longer. When the two Dukes saw me at a distance coming down, they and the rest left M. Robert to meet me, and hastened to Paris; and the Prince himself most kindly undertook to give the publick an account of us, and to quiet their apprehensions for us."

F I N I S.