But allowance can be made True On the other hand the airship would be moving too, "floating in the moving air," and the navigator of the air "cannot determine the direction of the wind as a sailor can" The only guide for him is some object on the earth. But here there is only water and the moving ship he wants to hit. Will he strike once in forty times of dropping the bombs? The professor doubts it. Assuming, however, that the bomb is miraculous and hits every time, will that not disable the ship or diminish her fighting power? Let the professor answer.

> "A torpedo discharged under water against the side of a ship sinks her, partly from being under water, and partly because the water reacts in the explosion. But the torpedo exploding on the deck has nothing but the air to react against it, and the limit of damage done would probably be a hole or fracture in the deck."

He adds that for one or two hits in this game the airship would require a hundred bombs of a ton weight each on the chance of making one or two holes or fractures in the deck below. Now to take one ton to the height of two miles the airship must have "5000 cubic yards" of gas in the balloon. Therefore on the really off chance of two holes or fractures in the deck there must be 500,000 cubic yards of gas. Truly the fleet below would be able to say as Leonidas did at Thermopylae, that they would have the advantage of fighting in the shade.

Furthermore, what would the fleet's own airships be doing? Of course no fleet would think of putting to sea without an attendant air squadron. Would these ships of the air start out and fight each other? If they did they would both fall into the water, for a hit with the lightest artillery, if it could be used by the combatants, would explode the gas in their respective bags, and down they would fall. "A conflict," says the professor with dry humour, "between two aerial navies composed of balloons belongs only to the realm of poetry." Not so dangerous this, however, as it looks. Many accidents have proved that the balloon's envelope when burst turns into a parachute.

It is clear that the navies of the world are not going to become bad debts by reason of the dirigible. But there is the dreadful series of fatalities to be inflicted on armies and forts and bridges. They at any rate are stationary. They can compel the observance of the two mile limit, however, and perhaps a good deal more. Forts could be protected as well as the turrets of ships, and they would not receive any greater shock from the falling bombs than the ships. Then there is the other side to reckon with. Assume perfect flyers on both sides. What about a line of guard houses, bomb proof, along the frontier, and flying patrols keeping guard between, with squadrons of airships stationed at intervals ready to turn out at any given signal from the patrolling flyers? What about searchlights for night work? What about special heavy ordnance planted at intervals ready to fire at anything up to 16,000 feet? What enemy would fly over the English Channel to get such a warm reception?

The man who said that the airship must destroy the nations must have been weak enough to think that there would be only one airship and that everybody on the other side would be an imbecile as well as a coward. He must also be an adept at taking things for granted. He must also have altogether forgotten the history of the long still unfinished struggle between attack and defence, in plate against gun, etc. It is clear that the dirigible airship has not much of a future either for war or for commerce. As an observer and reconnoiterer there may be something for him to do. but it seems hardly worth considering at the present time. We can afford to wait till the dirigible develops in the direction of the unexpected.

THE AEROPLANE AND ITS CHANCES. We turn to the chances of the heavier-than-air type. This type is following the sound lines of the bird. It is still far from the perfection of bird flight. Nevertheless the main facts of its achievement are not to be despised. It flies independent, it raises itself from the ground, it maintains its equilibrium in the air, it returns to earth when it pleases and as it pleases. One has flown over forty miles, remained in the air one hour, also one hour and a half It has been sold to a shrewd practical aviator for £20,000, and there are fifty examples of him under construction. These are the striking facts with which Wilbur Wright has replied to the critic in Engineering who sneered at his preliminary trials, pointing out that none of them had lasted over a minute and a half, and that, however "majestic" the enthusiastic impressionable French observers had found the machine, it had been the victim of two accidents and had not reappeared. On September 21 and October 11 Wright quietly added the above performances to the record of his machine, and the other facts immediately followed. We presume that the critic has acknowledged that things are better than he thought.

The type has its limits, however. It is dependent wholly on its motor for support in the air, which it cannot maintain except at some speed. We can not forget that a sister machine, flown by Orville Wright, came down during its trials under contract with the American Government, and killed one of its two occupants The explanation given by Orville Wright is that he had three gears instead of the original two on which his brother continued to rely, regarding the use of the third as a dangerous complication. Want of skill then with the third gear caused the misfortune. Still, the position of that type is serious. We shall hear more of it when Orville Wright recovers from his broken leg.

Will this type ever carry anything? Assuming that it ultimately does become a carrier, and manages to attain to soaring power arriving at the perfection of bird flight—at present it has not risen higher than 100 feet—its use in war will be liable to the disabilities we have been considering in the case of the dirigible. In war, then, beyond reconnoitering, the aeroplane has not a future. As to commerce, we return to the question "will this type ever be a carrier?" Professor Newcomb raises an objection which appears to be fatal.

> "Being as it were supported upon the air, it must present to the latter a horizontal surface proportioned to the entire weight to be carried. If one yard of surface can be made to carry a certain weight at a certain speed, one thousand yards will be required to carry one thousand times that weight. Any enlargement of the machine must therefore be in a horizontal direction The estimate of weight must be so much per square yard of horizontal surface: an addition of weight in the vertical direction can never be possible Hence if any enlargement of the flyers is ever made—for example, if they are to carry two men instead of one as at present—it must be through enlarging their superficial extent in the same proportion. Reflecting on the present extent of the successful flyers, it will readily be seen that a practically unmanageable area of supporting surface and a consequent weakening of the machine will be required for any important enlargement. Whether the limit be one, two, or three men, every extension of it must, to secure the necessary strength involve increased weight per square yard, which will be less and less compatible with its performance."

To begin with, this criticism refers to the type as at present developed—the type of machine dependent on motion for support in the air The conditions will be different when—if ever—the machine is perfected into a soarer independent of motion for support in the air. Moreover, this objection was raised against the first proposals to fly, and was seen to be to some extent futile after the measurements of the wings of birds and insects had shown that the heavier the flyer the less the spread of wing did he require in proportion.

Furthermore the Wrights have advanced so far as to carry the second man without any enlargement of their machine. Both brothers have carried their passenger—it was one of the conditions of their enterprise that they should. One of these passengers was killed, it is true, but that was due to an accident with the gear, not to the fact that the machine was carrying more weight than it was entitled to carry.

It will be said that there is some confusing element here: inasmuch as in the beginning everything depended on the agility of the aeronaut who had to learn the gymnastics of his balance, and very difficult they were. These difficulties of gymnastic effort have now given way to simple methods of mechanical control. and two men can now sit up comfortably where one had to lie flat and wriggle, with the certainty of death if he stopped an instant

However, after all is said that can be said it must be admitted that the prospect of the aeroplane ever becoming a carrier of any importance is doubtful, if improvement is to be confined to the present lines of effort for a machine so extremely light and frail. It may be a consolation to know that the ocean liner, formed on the fish model, was in the beginning very light, and frail too. If that type advanced to forty thousand tons and twenty-six knots there may be hope for the frail basket known as an aeroplane. One can only shrug the shoulder and look askance at Wells and the rest of the company of jumpers at conclusion.

There is a prospect of another kind for the flyer, however. Military men are sure to be struck some day not distant with the possibilities of using the machine as a mount for one or two men, even in its present state of development—not for going into the fighting line, but for rapidly transporting corps d'elite from one part of the field to another. For example, if during the war with Russia the Japanese had been able to fly over the mountain country they tackled so pluckily for their great turning movements their success might have been invariable instead of partial. A thousand machines supplying 1000 men every hour to some point twenty or thirty miles away would be a formidable factor in a battle. Musketry fire would not be fatal to them, and artillery they could discount as infantry do by scattered formations. It is an idea for the military expert to consider and develop. But if it comes to the front the aeroplane will but add to the existing method of waging war with effect. It will revolutionise nothing but tactics.

THE UNKNOWN.—Along new lines of effort will there be a chance? Who shall say? Professor Newcomb says all that can be said on that subject and says it well. "Should some way of controlling or reversing gravitation be discovered: should it be possible to make the ether react upon matter: should radium be hereafter produced by the ton instead of by the milligramme: should some metallic alloy be found having ten times the tenacity and rigidity of steel—all our forecasts relating to the future possibilities in the application of power would have to be revised." Of radium let it be understood in this connection that it is a substance which has been scientifically described as emitting energy in seeming defiance of all laws of energy.

It comes to this then, that before we can feel justified in looking forward to the tremendous changes predicted by the dreamers and the tellers of fables as the consequence of advance in the art of flying, there must be some new startling and unexpected discoveries. For the present men must be contented to fly in a way. The main thing is that they are flying in a way truly wonderful; but with vague longings for something that does not appear too clearly.

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The Royal yacht Osborne is to be sold. She is out of date, but still a very valuable boat, having cost £133,083 to build, in 1874, and having had large sums spent on her since.