THE MAXIM AIR SHIP.*

AN INTERVIEW WITH THE INVENTOR.

BY H. J. W. DAM, IN MC CLURE'S MAGAZINE.

Very few people are aware of the advanced results which have already been attained, and a visit to Baldwyn's Park, near Bexley, England, would be to them a revelation which can only be described as startling. To see a great air ship, weighing three and a half tons, flying across a park, on wheels, and to know that its engineer could lift it into the air, in a moment, by a turn of his wrist, makes one doubt the evidence of his own senses. It comes upon him with a shock, as if he had just awakened from a long Rip Van Winkle slumber, during which the magic of the world's advancement had left him hopelessly behind. The big white machine is a practical, moving fact, however. It can propel and lift itself. And just as soon as those subordinate experiments, upon which depends the safety of aerial voyages, are completed, one of the greatest mechanical problems of the ages will have been finally and practically solved.

Among all the scientific men whose researches have contributed to this most important result, Mr. Hiram S. Maxim, the inventor of the air ship in question, stands foremost. As the inventor of the Maxim gun, and many other ingenious machines of less importance, he had won a worldwide fame before the navigation of the air became the chief object of his study and investigation. Beginning life fifty-three years ago, with a common school education and a jack-knife, in Sangerville, Maine, he is now the proud possessor of a town house in London, and is lord of the manor at Baldwyn's Park, a stretching domain of hundreds of acres, which he leased five years ago as well adapted to his preliminary experiments. Mr. Maxim is a man of medium height and solid build, his weight being two hundred and ten pounds. His hair, mustache and beard are white, but his mental and physical energy are astonishing, and go far to explain the variety and extent of the results he has achieved. His voice and action show great physical strength, while his eyes, which are a deep brown, full and wide open, have continuously the semi-absorbed, preoccupied look of the student concentrated upon a problem. A courteous host, a jolly, even boisterous story-teller, and a wonderful mechanician, Mr. Maxim is, in his way, as unusual as his machine.

By way of introduction and explanation the inventor said :

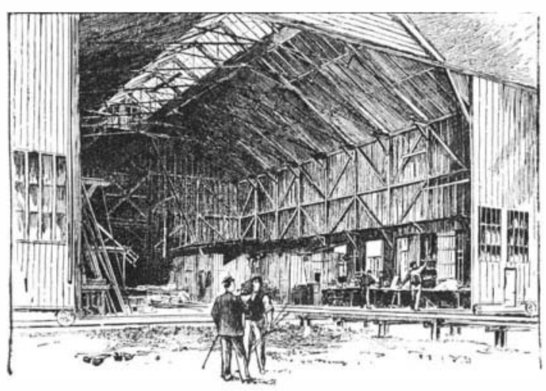
"The principle I have worked on, generally speaking, is that of the kite. That large cloth frame at the top of the model is the aeroplane, or main kite surface. The lesser aeroplane above the platform, or car ; the side aeroplanes, or wings ; and the flat-pointed rudders, fore and aft, are designed to furnish additional kite surface. It is necessary to make it, however, so that we can run it in a calm, against the air, thus making our own wind, as it were ; and for this purpose I have a railway track, and instead of cords to hold the kite against the wind, I employ a pair of powerful screw propellers driven by a steam engine. In this manner I can drive the machine exactly as I please, can ascertain exactly how much the push of the screws is, and at the same time find out exactly how much the machine lifts at different speeds. The machine is, in fact, a big kite. Should I fly it in the air with a cord during a strong gale and then run my engines, I should be able to find out how fast they would have to run in order to take all the pull off the cord. As soon as the cord became slack, the machine would be flying with its own engine power."

To more clearly illustrate his meaning, Mr. Maxim led the way to the workshop in the grounds —a large and substantial bird cage, sixty feet wide and fifty high, in which the mechanical bird had been constructed, and stood perched for one of its daily flights. A railway track, nine feet wide, ran outward from the closed doors, and stretched indefinitely, in a straight line, across the green level of the park to the line of a belt of woods two thousand feet distant. The front of the shop consisted of four large doors, "the largest in the world," their owner remarked ; and when these were rolled back by a dozen workmen the air ship came into view. It was so novel, so unexpected, and so apparently complex at first sight, that it held the eye for a long, silent period ; the beholder's sensation being one of wonder, if not awe, coupled with an indescribable mechanical confusion of ideas.

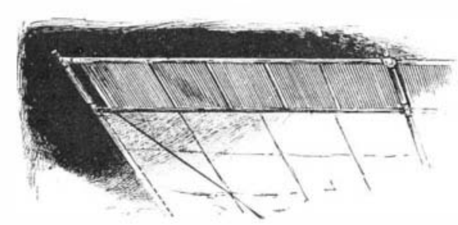
It took many minutes to grasp it ; to form an intelligent idea of it. Then, as the sense of relation between the different parts developed, it became a framework of black steel rods of varying sizes, with a square frame of white cloth, fifty feet by fifty, at the top, and an inclined wooden platform, eight feet wide by forty long, resting on wheels upon the track below. On the platform, near the front end, was a small boiler house in the shape, roughly speaking, of a truncated pyramid, and ten feet behind it was a frame eleven feet high, on which were two sets of compound cylinders, and two big wooden screws above the two sides of the platform and eighteen feet apart. Outside of these fundamental accessories were a water tank, a naphtha tank, and an indefinite number of rods and very small wire ropes, to give strength and compactness to the whole. The many minor elements of the machinery did not at first catch the eye, but all appeared in interesting action when details were entered upon later on. It should be noted that the machine, as it stood and as it appears in the accompanying pictures, was without the side planes, and the big rudders of cloth on steel frames, which are mounted, fore and aft, on the main aeroplane. These are not used in the experimental trials, their utility having been established, as far as is possible without a practical test in the air.

Pushed by the workmen, the machine rolled slowly out of the house, and shortly stood upon the track in the park. It had completely filled the workshop from roof to floor ; but here, with only the sky above it, seemed smaller and lighter. The steam was hissing in the boiler ; the big screws had made one or two preliminary revolutions, and a flight along its track was imminent. "Jump on board," shouted its owner, who stood at the boiler, conning half a dozen different gauges ; and, climbing over an outlying rod like the outrigger of a canoe, I mounted the platform, which was of the lightest matched boards, so thin that they seemed insufficient to bear a man's weight. Prior to the start, a rope running to a dynamometer and post was attached behind to measure the forward impulse, or "push," of the screw. Mr. Maxim turned on the steam and the screw on the port side began to revolve. It is seventeen feet eleven inches in length, five feet wide at the ends, and twenty-two inches at the waist. It is made of the lightest American yellow pine, and painted a pale blue, the paint having been sandpapered to perfect smoothness, reducing the skin friction to a point at which it became negligible. It revolved faster and faster as the steam power was increased, until it was whirling on its seemingly frail framework at a dizzying speed. Then steam was shut off ; it came quickly to a standstill, and its fellow on the other side was tried. All working smoothly, both screws began to turn faster and faster and faster, until the eye began to lose the blades and retain only the sense of two whirling disks. The action of the screws at high speed caused remarkably little shaking of the whole machine. This is one of the surprises of the invention, the tremendous force exerted as compared with the lightness, steadiness, and compactness of the whole.

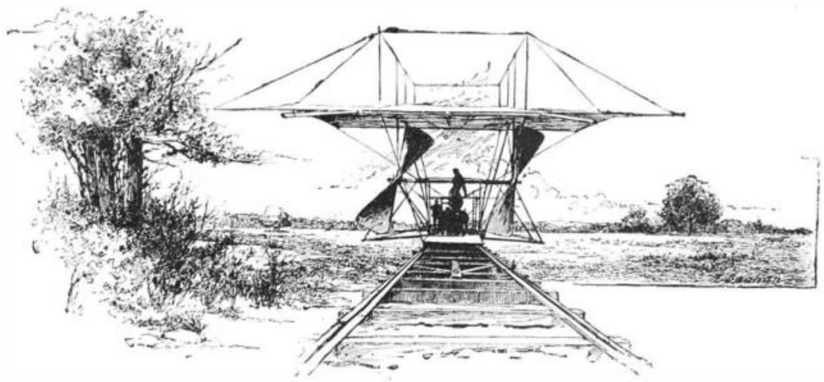
Behind the screws, forty feet away, two men were



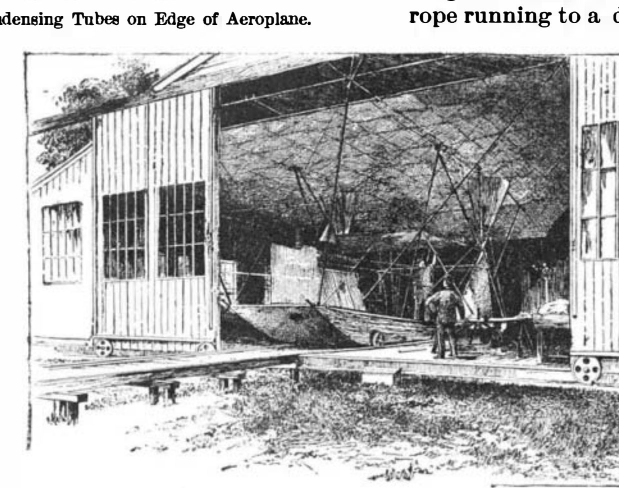
The Workshop.



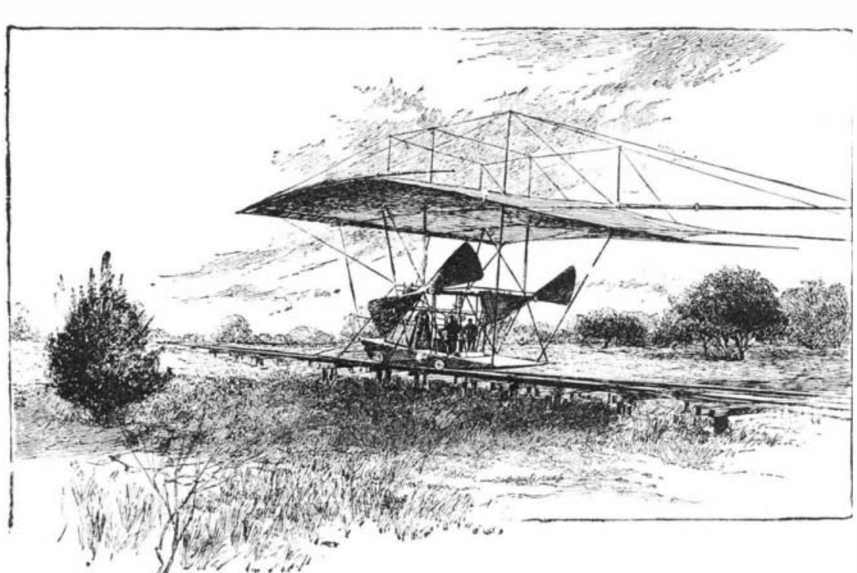
Condensing Tubes on Edge of Aeroplane.



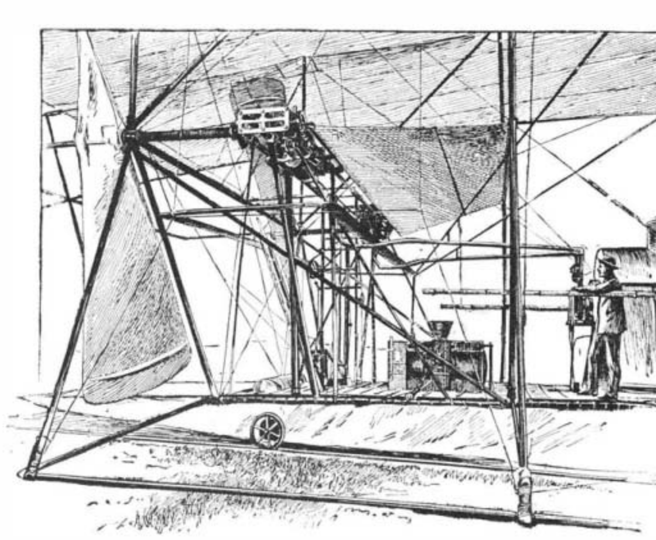
The Maxim Air Ship.



The Air Ship in the Workshop.



The Air Ship on the Track.



Details of Maxim Air Ship.

HIRAM MAXIM'S AIR SHIP.

* The illustrations for this article are from copyrighted photographs taken under the supervision of the author and Mr. Maxim, by Pradelle & Young, of Regent Street, London.

squatting over the dynamometer, and indicating the degree of "push" on a large index board for the engineer to read. The index marked four hundred, five hundred, six hundred, seven hundred, and, finally, twelve hundred pounds of "push." The pressure was then diminished below five hundred, and the commander yelled: "Let go." A rope was pulled, the machine shot forward like a railway train, and, with the big wheels whirling, the steam hissing, and the waste pipes puffing and gurgling, flew over the eighteen hundred feet of track in much less time than it takes to tell it. It was stopped by a couple of ropes stretched across the track, working on capstans fitted with revolving fans. The stoppage was gentle, and the passenger breathed freely again, looking now upon the machine with more friendly and less fearful eye, as if it were a dangerous bulldog with which amicable relations had been established and fear of injury was over. The machine was then pushed back over the track, it not being built, any more than a bird, to fly backward. In a quarter of an hour it is again at its starting place, and ready for another flight. Having seen it in action and had evidence of its power, the details were more than ever interesting, and were furnished by the inventor in succinct and practical terms.

The first question was its supporting power in the air. He said:

"The area of the main aeroplane is two thousand eight hundred and ninety-four square feet; of the small one, one hundred and twenty-six; and of the bottom of the car, one hundred and forty. With the rudders and wings added, the total area is about six thousand square feet. The wings are ten in number, and superposed, five on each side, and are each five feet wide and from twenty-five to thirty-five feet in length, according to their positions. The forward rudder, projecting in front from the main aeroplane, is eighteen feet wide and thirty feet long, and the aft one, eighteen by twenty-three. Rudders and wings, like all the other aeroplanes, are made of a specially woven cotton cloth, so fine that you cannot blow through it, and mounted on a framework of hollow steel tubes. All these aeroplanes are inclined at a small angle to the air, the angle which gives the most support combined with the least resistance to its forward motion."

"What speed is necessary to support the machine in air?"

"A minimum, under present conditions, of twenty-five miles an hour. At that speed with wings and rudders adjusted, it will leave the track. It lifted in one of the earlier trials, and caused us some trouble, as we were not ready."

"What will happen in the air if anything goes wrong, and the engine stops?"

"The machine will settle to the earth, and land with the same velocity as if it had fallen a distance of three feet."

"Only three feet?"

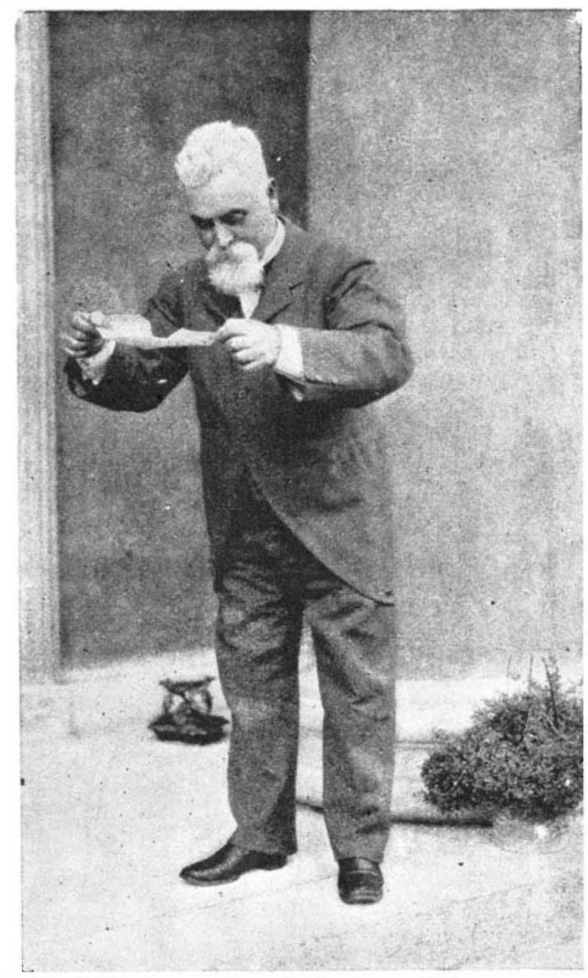
"Yes. When the propulsion ceases, the machine will fall three feet. At this point the resistance to the atmosphere afforded by the aeroplanes will become nearly equal to the force of gravity, and it will settle without any increase of velocity."

"How about its steadiness in the air? You know a kite sometimes indulges in extraordinary rolling, to say nothing of darts and dives."

The explanation of this point was given ocularly, and much more clearly than words would have made it. Mr. Maxim tore a sheet of paper from his note book, held it up, and let it fall to the ground. It darted, dived, and fell in irregular lines, shooting out behind him. He then took the same sheet of paper, tore a square out of each corner, and bent back the four sides from the corners of the squares at an angle of forty-five degrees. He then held this up and let it fall. It sank to the earth gently, without a tremor, its surface remaining perfectly even throughout. "That," said he, "is the principle of the wings. They are so adjusted that as any side is depressed it presents a greater lifting surface to the air below. There's no trouble keeping her on an even keel," he added with a smile.

"But can't it tip over in a wind?"

"No. It is quite possible to make a plane remain right side up in the air, even if the center of gravity is considerably above the center of lifting effort. Stability in the air depends very largely upon the shape of the aeroplane, but nevertheless with this machine the center of gravity is very much below the center of lift;



Mr. Maxim Illustrating the Principle of the Wings of the Air Ship.

and this, together with the form of the aeroplane, makes it quite impossible that the machine should tip over in the air. The center of gravity in this machine is here," and he held up his hand at an imaginary point about five feet back of the boiler and seven feet above the center of the platform. It may be here mentioned that the main aeroplane is twenty-five feet above the platform. The total height of the machine to the tops of the rods above the aeroplane is thirty-five feet, and its greatest length seventy feet.

"Are the cotton aeroplanes strong enough to bear the weight in falling, without fracture?"

"They are twenty-five times stronger than is necessary. The greatest weight which can bear on them is a little over a pound to the square foot, and they are tested for twenty-five pounds. The pressure on the cloth is practically the same at all speeds, whether the machine is falling to the earth or sailing through the air; the cloth in any case has to sustain the weight of the machine."

"How is it steered?"

"For steering to the right or left I expect to use the screws. If I have any difficulty I can easily use rudders. For steering upward or downward the fore and aft rudders will be used. The aft one is pivoted on the extension of the two center poles and the forward one hung on their ends. Both will be worked from the center of the platform, and will at first require a man to each, though I shall greatly simplify the working of them later on."

"What is your estimate of the speed?"

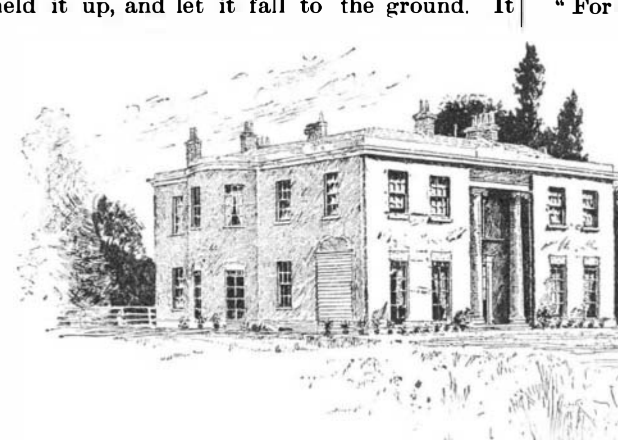
"I don't expect, with this machine, to get over thirty-five miles per hour. The next one, which will be smaller, and will be worked with a hundred horse power, will give me, I expect, from fifty to sixty miles per hour. The highest speed I look for, as the art is perfected, is ninety miles per hour. I believe that any speed which is attained by a railway train can be reached by a machine moving through the air."

"How about the duration of the flight?"

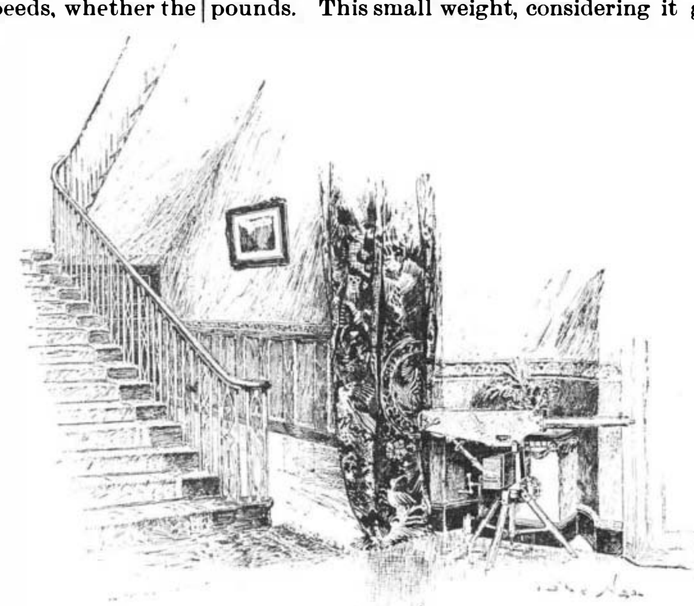
"That is merely a matter of water and naphtha. The margin of weight carrying is so large that, once the machine is successful, any amount of time and distance within reason can be looked for."

As far as support and action in the air were concerned, there seemed nothing more to be said, and yet it was difficult to realize that the facts as stated were simply and undeniably true; to realize that the navigation of the air is the traversing of an entirely new medium, whose conditions are so foreign to those of water, for instance, that they are difficult to quickly conceive.

The next question was that of weight, and here came some object lessons in the weight of metal that were astonishing. "Lift that tube," said Mr. Maxim. The tube was of copper, four feet long, and elliptical in shape, its greatest diameter being one and a half inches. It looked heavy. Lifted up, its lightness was surprising. It weighed no more than thin paper, and actually seemed, for the moment, like paper colored in imitation of copper. "That is one of the condensing tubes," said Mr. Maxim. "There are five hundred of them up there." and he pointed to a section of what had appeared to be thin laths running across the entire front of the main aeroplane. "Of course," said he, "we can't waste any water up in the air, because we have no means of replenishing. The used steam runs up by those large pipes, and the water runs back through those small ones to the tank in the center of the platform. The framework is constructed," he continued, "not of rods, but tubes, and tubes of the least possible weight. They are all of steel, a steel with considerable carbon in it and not tempered, and they vary from one inch to three inches in diameter. I tried aluminum, but found that steel was stronger, weight for weight. In addition to this, steel tubes can be united with great facility, and the coefficient of the joint is fully ninety-five. There is no convenient way of uniting aluminum tubes, however, and if they were united the coefficient of the joint would be very low. The heaviest tubes in the machine are the shafts of the screws, which are five inches in diameter, five feet long, and an eighth of an inch thick. The next size, used in the car, are three inches in diameter, and one-twelfth of an inch thick. I have a few more, one-fourteenth of an inch thick, of the same size. I need not say that at every point I have used the lightest tube possible for the strain which comes upon it, perfect safety being at all times considered, as I purpose to take my first machine up into the air myself, and I don't intend to run any risks. The bulk of the machine is constructed of hard steel tubes one twenty-fifth of an inch in thickness. The total weight of the machine, with its full complement of water, naphtha, and three men, is something over seven thousand one hundred pounds Without the wings it is six thousand eight hundred and eighty. The boiler complete weighs one thousand pounds. This small weight, considering it gives me a force of three hundred horse power, is perhaps the most valuable portion of the work, since it has always been known that we could fly if we could get a motive power of adequate strength with sufficient lightness. I use a compound engine, the high pressure cylinders being five inches in diameter, with a twelve inch stroke, and the low pressure eight inches in diameter, with a twelve inch stroke. The piston speed is eight hundred feet per minute. Nearly everything connected with the machinery had to be newly designed, with a



Mr. Maxim's House at Baldwyn's Park.



The Hall in Mr. Maxim's House.

HIRAM MAXIM'S AIR SHIP.

special view to lightness, none of the known appliances being of use in this case. It was necessary, in the first place, to develop a system of making a very large quantity of carbureted air from naphtha, with very little weight." Pointing out a large hole where the air was drawn in, he said that, as the velocity with which the combined air and gases entered was at the rate of two miles a minute, he found it very difficult to deal with these gases at this high velocity, and had spent a great deal of time in devising a system by which the gas was equally spread out over the whole furnace, and not influenced by the inductive action of the incoming gas at this very high velocity. "I had," he resumed, "to devise a system for regulating the product of the gas; for pumping the liquid into the gas generator; a new kind of boiler and feed water heaters; a system for burning a very large quantity of carbureted air in a small space, without smoking or blowing out; a system for regulating the steam, and pumps for filling the boiler and regulating the supply. None of the existing types of engines seemed well fitted to the purpose. I had to design one expressly with a view to great lightness, and notwithstanding there were some hundreds of types of connecting rods already in existence, I found it necessary to design an absolutely new form of connecting rods. I had to invent a new dynamometer to meet the necessities, and new dynagraphs for measuring the lift of the machine at different speeds, as well as another to measure its rate of speed through the air." He paused, looking over at the machine which represented so many hours of concentrated brain work in a puzzled, absorbed way. "And there is more to do yet," he added impressively. "I don't call this an air ship or a flying machine or anything else. To me it is merely a machine for making experiments in aerial navigation. In my next one, I shall make a number of changes which it is not worth while to make in this. It is slow work, but there is no doubt of the result. Propulsion and lifting are solved problems, and it is merely a matter of time."

"How much time?"

"Well, if I had nothing else to occupy me, unlimited money, and plenty of space for experimenting, I should expect to be up in the air within eighteen months. I am very busy, however, have a very limited space here, and am proceeding as economically as possible. In my opinion, however, under the most unfavorable conditions, aerial navigation will be an accomplished fact inside of ten years."

This was a digression. We now came back to the most remarkable boiler that ever was seen. It was inclosed in a house eight feet long, five feet wide at the base, and about six feet high. The sides of the house were of thick cloth, woven from pure asbestos, and the frame and top of the thinnest iron. Within, viewed through a peephole, the entire floor was a mass of small flames from seven thousand six hundred gas burners. The boiler has about six hundred tubes which are eight feet long, and about one hundred which are four feet ten inches long. These tubes are about half an inch external diameter, and half a millimeter, or one-fiftieth of an inch, in thickness. They are curved and joined into a steam drum, ten inches in diameter and eight feet long, where the water and steam are separated, the water again passing through the boiler, and the steam passing to the engine. There are also some three or four hundred much smaller tubes, which are used for heating the water by the products of combustion before it enters the main boiler at all. In order to prevent the tubes from being injured by the great heat of the fire, a forced circulation of the water is employed. It is therefore possible to use a very small and thin tube and a very hot fire without any danger. A single spare boiler tube in the shop served to exhibit the peculiar lightness of the boiler, which is perhaps the most ingenious as well as the most important part of the machine. The tube, like the condensing tube before mentioned, was as light as so much paper. It was made of pure copper, any impurities, in view of the thinness of the tubes, causing them to become "hot short" and break. "With only a moderate fire," said Mr. Maxim, "I have been able to get a horse power out of four of these tubes; with a hotter fire I have got a horse power out of three of them. Their bursting pressure under steam is sixteen hundred and fifty pounds to the square inch. The boiler itself has been fired to give a steam pressure of four hundred and ten pounds to the square inch, but I have never run the engine above three hundred pounds, thereby developing three hundred brake horse power, which is all that I need for this weight, and which leaves a very wide margin of safety. To run the boiler the machine carries six hundred pounds of water, and two hundred pounds of seventy degree Baume naphtha. The consumption of naphtha is about one pound per horse power per hour."

Last of all, in the way of general description, came the questions of propulsion and lifting power. To give all the details under this heading, into which the inventor entered, would alone make an article quite as long as this, if not a small volume. Concerning specific results, however, he said:

"The lifting of an aeroplane by a screw or screws has been the subject of many series of experiments by myself and others. The number of pounds lifted by one pound of 'push' in the screw varies greatly with conditions. In my early experiments with a merry-go-round, or whirling table, I succeeded in lifting fourteen times the 'push' of the screw, or fourteen pounds of weight for every pound of 'push' forward. In this large machine, however, with a large number of wires and a good deal of framework, where the aeroplane is so large, where it is difficult to make it remain uniform or rigid when there is a pressure on it, and where I have an engine, boiler, platform, men, tanks, wires and tubes to force through the air, I have not been able to lift more than six pounds for each pound of 'push.' This, however, is much more than is absolutely necessary. The engine is able to give, and has often given, a 'push' of nineteen hundred and sixty pounds, which would mean a lifting power of nearly twelve thousand pounds. With a 'push' of one thousand pounds from the screws, using one hundred and twenty horse power, the lift, as shown by the dynagraphs, was over six thousand pounds. This left only a weight of one thousand pounds on the track, and this was not sufficient to keep us there. The speed along the track with this 'push' was twenty-seven miles per hour."

"When do you expect to take your first flight?"

A TWO SEATED TRICYCLE.

"I have not set any time, and shall not. Haste in an enterprise of this kind is the worst possible policy. At every trial of a machine which is mechanically new in so many particulars, weak points develop and require attention, while new improvements constantly suggest themselves. To-day it is a leaking valve, to-morrow something else. Rising into the air with a new machine, when all the experiments in the way of maneuvering, which can only take place in the air, are yet untried, would be unwise until everything which can be completely tested on the track has been so tested. The possibilities of accident must be as nearly as possible exhausted beforehand. More than this, I have not at Baldwyn's Park the necessary room and privileges. It may be that I shall not attempt to rise until I have more room, and I am now looking for a suitable location—something difficult to find in England. In fact," he added, with one of his ready New England comparisons, "I am like a boy with a pair of skates which he has never tried, and only a little piece of ice to try them on."

Tho foregoing was the substance of the "few safe particulars" which Mr. Maxim was willing to give. The improvements upon his first machine, which will appear in his second, and the eventualities and possibilities of aerial navigation, were subjects upon which he was not inclined to talk very much. He confessed, however, that an air voyage of three or four thousand miles seemed to him eventually probable. "I don't want to speak of things before I am ready to do them. I don't imagine that flying machines will be used very soon to carry bricks from Haverstraw to New York, or coals from Newcastle. The first machines are certain to be used for military purposes, whatever their cost or whatever the expense of running them, and the nation which first employs them will have every other at its mercy. I shall be quite content with my results when I can go a distance of twenty miles and back. That will suffice for all present purposes."

A Great Coal Vein in Tonquin.

The French are actively working a coal mine in Tonquin which promises to produce excellent coal in large quantities. The mine is situated about eight miles from Port Hongay, in the Bay d'Along, and a railway has been laid down for the whole of that distance. The offices and huts of the miners are all situated at Hongay, and the workpeople are conveyed to the mine every day by train. The mine itself is called Hatou. The length of the seam is given as 16 miles, and it is, according to the *Times*, nearly 200 feet thick. The supply is, therefore, practically inexhaustible. At present about 500 tons a day are extracted by the simple process of quarrying, the mass of coal having only a very thin layer of soil on the top. The miners are exclusively Annamites, of whom about 200 are employed, but the higher officials are all Frenchmen, although the capital of the company, strange as it may seem, is chiefly held by English merchants at Hong Kong.

A TWO SEATED TRICYCLE.

The tricycle which we illustrate is built to accommodate two riders side by side. The ordinary tandem bicycle is open to the objection that the rider appears to be accompanied by a groom. In the present machine, which is of French origin, each rider actuates a pair of pedals which are connected with the wheels as in bicycles, so that each of the rear wheels is driven independently. Each rider helps to steer with one hand, while the other rests on a special support attached to the head of the tricycle. This tricycle is 5 feet 10 inches long, 25 inches wide at the level of the axles of the rear wheels, and weighs 55 pounds.

The advantages claimed by M. Matière, the inventor, and M. Laverne, the builder, of 177 Rue des Boulets, Paris, are ease of management, especially as regards turning, speed and great stability, which is insured by the position of the riders. For our illustration we are indebted to the *Revue Universelle.*

Brown-Sequard.

Dr. Charles Edouard Brown-Séquard, the eminent physiologist and physician, died in Paris, April 2, of congestion of the brain. He was born at Port Louis, in the island of Mauritius, April 7, 1817. His father was a native of Philadelphia and his mother was born in France. Dr. Brown-Séquard began his study of medicine in America. In 1838 he removed to Paris, where he graduated as M.D. in 1840. His researches on the vital properties and functions of the spinal cord were of the utmost value. He was made professor of experimental and comparative pathology in the *Ecole de Médecine* of Paris in 1869. At different times Dr. Brown-Séquard visited the United States, delivering lectures and practicing his profession. By a desire to investigate the contents of his own stomach, he was led to try experiments on himself, which at last brought on a most rare and peculiar affection known as merycism or rumination, which required him to masticate his food for a second time during the remainder of his life.

The brilliancy of his discoveries obtained for him a world-wide reputation, so that scientists were greatly shocked when he formally announced in 1890 the discovery of a fortifying fluid, which immediately became famous under the title, "Elixir of Life." For this discovery Dr. Brown-Séquard was pilloried in the eyes of the world as a charlatan. The subcutaneous injections of the secretions of certain glands of dogs and other animals proved efficacious in a number of cases, and this discovery was of equal value with those of his early life. It is perhaps unfortunate that the great physiologist should have discovered the "Elixir of Life" at the advanced age of seventy-two, when he could not spend the requisite amount of time and energy to perfect his discovery; but it is very safe to say that half the stories relating to the new remedy are untrue, and that Dr. Brown-Séquard never claimed half as much for it as his enemies, who took malicious delight in likening the aged doctor to Ponce de Leon and others of the same class.

Gas from Wood.

A western genius has invented a machine for making gas for illuminating purposes out of wood, instead of coal. The machinery is very simple, consisting merely of a retort and purifying chamber, with a tank for holding the gas. He claims that the machine can be used for domestic purposes, and that by attaching it to an ordinary cooking stove enough gas to last a day can be made by the fire necessary to do the cooking.