Aerial Navigation

Perhaps the greatest mechanical problem of the present day is that of successfully navigating the air.

Ever since the earliest times man has had a desire to fly. There was the Darius of old with his wings of wax, which worked very successfully, until the sun became angry with him, and shining forth melted them, and caused his disastrous fall. Then we have our modern "Darius Green and his flying machine", but even he did not reach the Forth of July celebration.

Until but very recent time those who have even dared to think of aerial flight as being possible have been treated with scorn and ridicule and denounced as cranks.

In 1879 Mr. Edmand C. Stedman, a poet, at the risk of being denounced as a crank of high order, published an article in the Century magazine. Though not attempting to treat the subject from a scientific standpoint he suggested many possibilities of a practical character.

Mr Lorellus Metcalf who was for many years editor of the Forum also took an active part in helping the good cause along, and raising it above ridicule.

He propesied the setting forth of an air ship from the coast of Spain Aug 14th 1892 to sail over the old route of Colombus, to the new world. Though his dream has not been realized, he together with Mr Stedman, have opened the way to the subject, which has been quickly recieved by some of the best engineers and scientists of the country, among whom may be mentioned Prof Langley of the Smithsonian Institute, Mr H.S. Maxim an engineer, and Mr. Chanute President of the American Institute of Civil Engineers. These three have probably in the last five or six years done more than has ever been done upon the subject before. They have practically solved the problem.

There are two plans upon which scientists have been working; the one proposes to navigate with machines lighter than the air, the other with machines heavier than the air.

The first proposes to use balloons which are to be propelled through the air in some manner. The French government, has without lack of money or brains experimented very extensively in this line, but their attempts have been very unsatisfactory. The highest speed attained, has been four miles an hour and as the wind usually blows ten miles an hour or more, this slow speed would be of little use. Mr Maxim has proved that a much greater speed cannot be attained. As a balloon in order to lift its load must be made so light and fragile, that the resistance which the air offers to its cross section diminished by the decrease of resistance obtained by being pointed and having sloping sides, will be sufficient to collapse it.

This plan has been nearly abandoned by engineers and scientists

The other class, who propose to navigate with machines heavier than the air, may be devided into three subclasses. First those proposing

to imitate birds by flapping wings; Small models have met with moderate success, but it is usually considered as impracticable. Second those who propose to ascend by horizontal screws or fans, driven at a high velocity. Though this might and would succeed with sufficiently light motor it would be a rather dangerous position for the operator, should something get wrong with the machin while in mid-air. as there would be no parichutal support. Third those who propose to drive a nearly horizontal plane through the air with a sufficient velocity to sustain the load it is intended to carry. This is founded upon the principle that the plane will have passed on to a new body of air before that upon which it rests has had time to give away; just as a flat stone is "skipped" upon a pond.

A branch of this class may be considered separately before treating of the method which will be probably first successful.

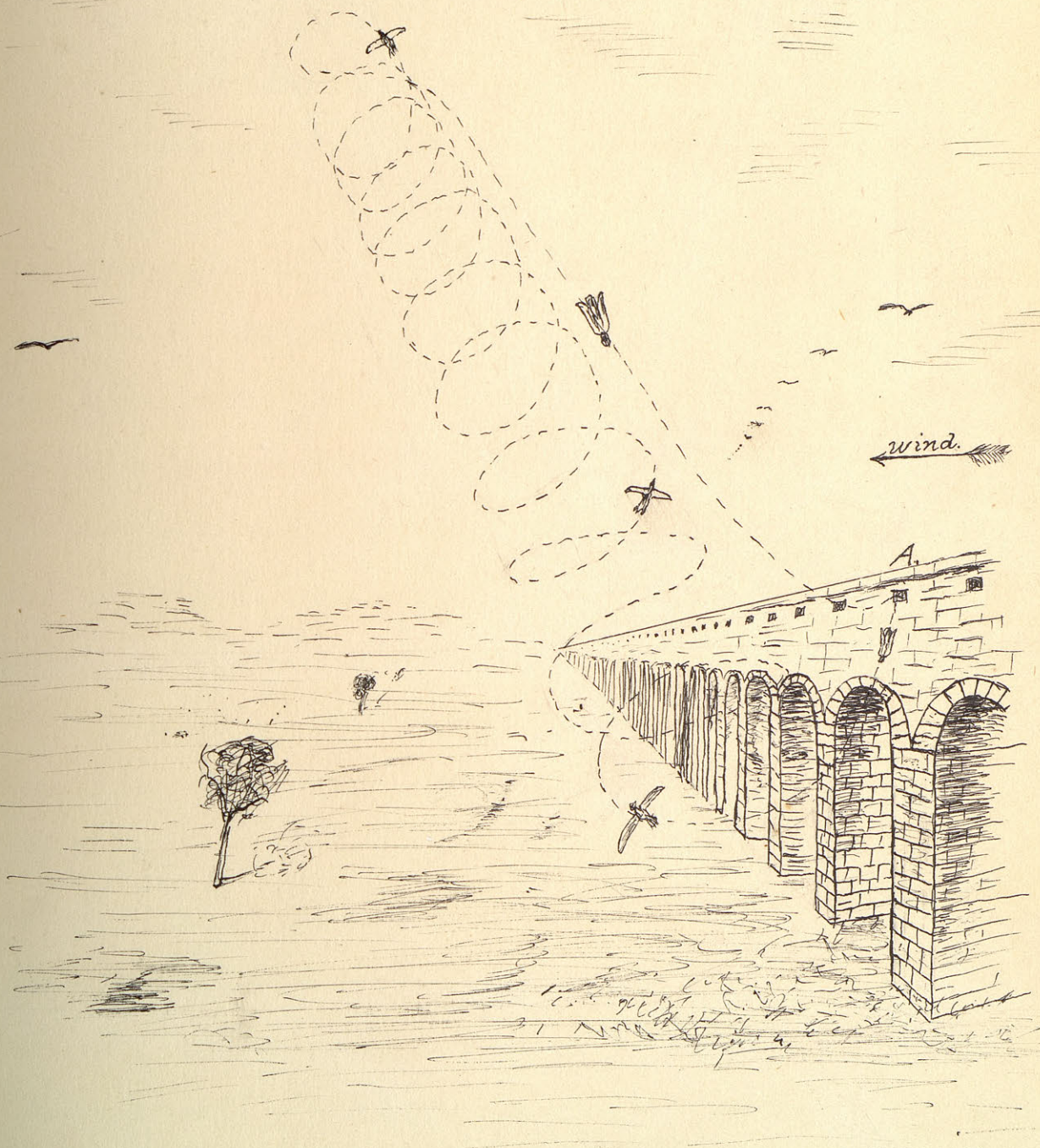

Fig. II. Aqueduct of Bec.

This is illustrated by our soaring birds, which by taking advantage of the wind are able to sustain themselves for hours in the air, and even raise to a higher level, without even a flutter of a fether, or any muscular exertion whatever, save that in keeping the wings spread. This is doubted by some who say there must be some unpreceived motion of the wings or tail. but those who have been favorabley situated to observe are unanimously convinced of the fact. Mr Chanute makes the following strong statement, "Ascension is the result of the skillful use of the power of the wind, and no other force is required." He ilustrates by a kite which he claims if its equilibrium could be perseived it would fly without string or tail. He also quotes the following from Mr. Weylen. "One day while I was close to the Aqueduct of Buc, and the wind was blowing strongly down the valley and at right angles to the aqueduct, I saw a sparrow hawk come out of a hole near point

A Fig. 1.) near the top on the leward side. The bird left the hole and dove downward like a dart, his wings scarcely opened, and thus reached a point almost the center of the opening of the arch. At this point he stretched his wings wide open and began circling, his orbit drifting with the wind, until he attained an elevation of eight hundrid or onethousand feet. At this point he folded his wings almost completely and dove downward again upon a steep incline, making use of the highth gained to recover his hole, into which he entered gently by simply opening his wings wide when within eight or ten feet of the wall. In all this journey the bird exerted no muscular work whatever save that in opening and closing his wings twice."[51]

It is of the Aeria plane, driven by some mechanical contrivance such as a screw that I wish mostly to speek. The most extensive experiments of the present day, with perhaps the

exception of those conducted with ballons by the French government, have been conducted by Prof Langley and Mr Maxim in this line. Though working separately there experiments have been along the same line. They have been very thurough and exact and have arrived at almost exactly the same results. So there can be little fear of going astray in taking them as authority.

In ascertaining the sustaining power of planes they both employed long arms (one 30 the other 81 ft long) revolving upon a vertical pivot and supporting a plane at their extremity They found that a plane was capable of sustaining two hundred and forty pounds per horse-power. It was also found the best results were obtained at a speed of sixty miles per hour.

Mr Maxim is authority for the following statment. If a pine board two feet wide and twenty feet long, with the edges well sharpened, with bottom slightly concave and top convex

be susported in the air with the
font edge one inch higher than rear
edge, and driven by a two bladed pro-
peller twenty eight inches in diameter
at a speed of fifty miles an hour,
it will support a weight of two-
hundrid and forty pounds including
its own iveight. or that equal to
a moderately larg balloon. It will
require alowing twenty five per-cent
for slip of screw one and six tenth
horse power to propel it.

The lack of a light and yet power-
ful enough motor has long been the
hinderance in the way of succesful
aerial navigation. Scientists have
long said give us a sufficiently light
motor and we will give you a suc-
cesful flying machine.

Much has and is being expected
of electricity, but there is no electric
motor yet invented which with
accumulators weighs less than eighty
pounds per horse power, for one hours
run.

Nor has a light gass motor been

found, so that engineers have been obliged to turn there attention to there old friend steam. Mr Nasin has calculated that if one pound of pure copper be drawn into small thin tubes it will give sufficient heating surface for one horse power and if another pound be alowed for casing and supports and a pound for connections, steam separater and burner we shall have three pounds of metal per horse power and a boiler strong enough to stand an internal presure of five hundred pounds per squair inch, and allow a large fraction of safety. Allowing the engine to weigh six pounds and the water in the boiler one pound we have a motor of ten pounds per horse power. Supposing it does not require more than two pounds of petroleum per hour, for five hours run fuel and water need not weigh over twenty-five pounds, and the distance travelled over would be two hundrid and fifty miles

Though this is the lightest motor perhaps ever built, there are others almost as light. Prof. Langley claims that one can be built weighing ten pounds per horse power, and a quarter of a centuary ago there was a steam motor built weighing but thirteen pounds per horse power, Putting the above motor upon the pine board before spoken of it would give sufficent supporting power to alow a one hundrid and thirty pound man to ride.

From the above statement it would appear that the day of aerial flight is at hand. But it takes time and money to carry forward such an enterprise, People must be educated, and as it takes time to educate, we shall be obliged to wait a little longer before our ideal is realized

Mr Maxim in his article in the Cosmopolitan of June 1892, diseribes a machine which he proposes to build; he states how it is to be

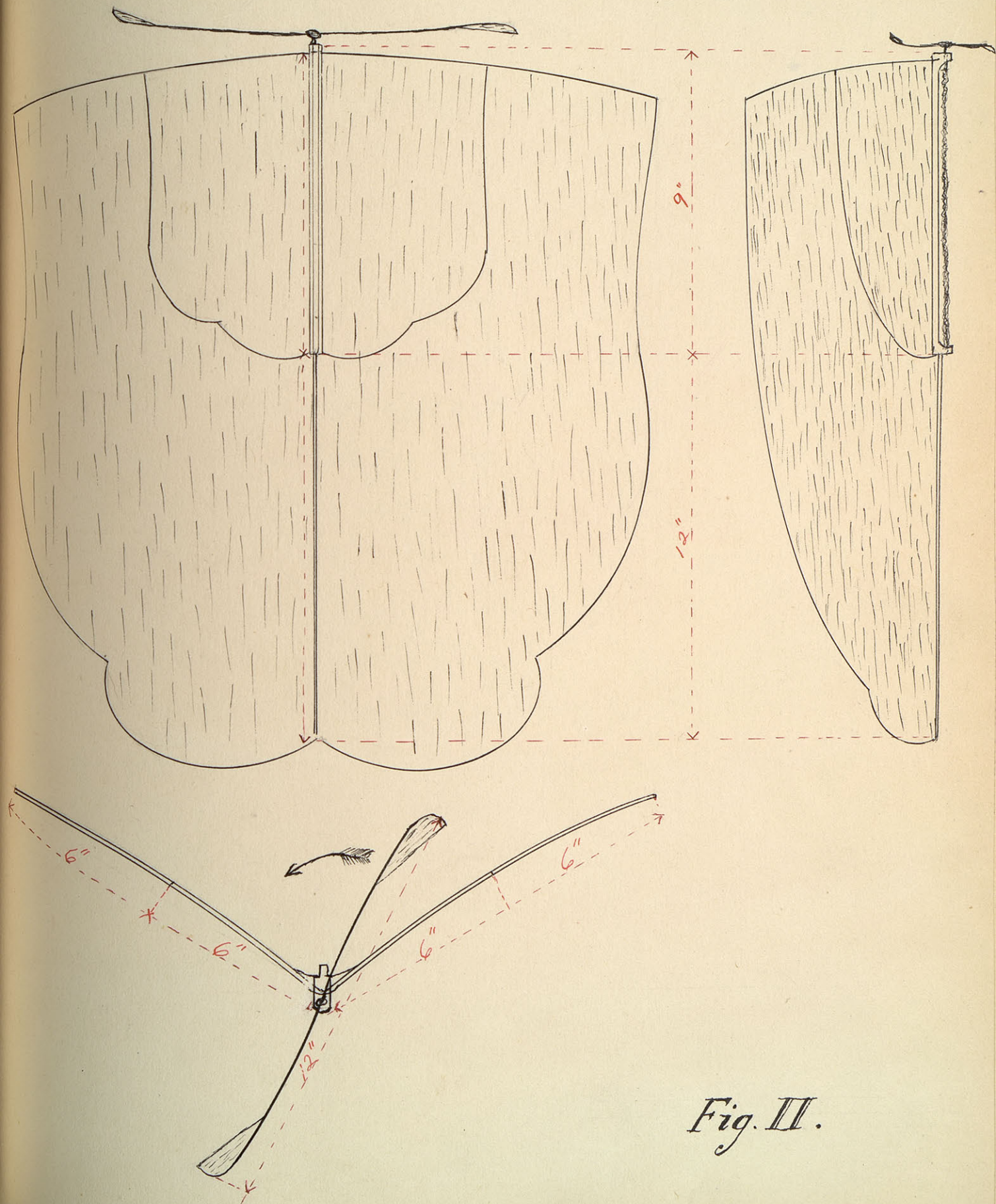

Fig. III.

tested and operated by running it upon a circular track. the machine being held down by heavy wheels untill properly adjusted, then the heavy wheels to be replaced by light ones, the machin to be run around the track untill it faces the wind, when the speed is is to be increased and the flight begun. When they wish to alight they will select a level piece of ground, and desend facing the wind. He concludes his article by saing "The cost of these experiments will be from $50000 to $100,000 and the time required will be two years".

There is a rumor afloat that Prof. Langley has perfected at the Smithsonian institute a working model and that it is soon to be tested down the Potomic. It is discribed as consisting of a body the shape of a mackerel which contains the boilers and engins which drive twin screws. At either end of this tube or body is fastened an aeroplane

The building of it has been kept very secret, even from the watchman who guard the room where it has been built. Though it may be all a newspaper sensation, it is probably true, for Prof. Langley is surely making extensive experiments in this line.

In trying a few simple experiments this spring, I made a frame consisting of a wooden backbone nine inches long, through the front end of which an aluminum wire was inserted extending six inches on either side, over this frame was stretched tissue paper, the lateral edges being left free. In front was a screw twelve inches in diameter propelled by twisted ruber bands. When released it would stand on end, screw up, and with the plane revolving slowly in the oposet direction from screw would rise to a hight of twelve to fifteen feet. Indoors it once flew horizontally about thirty feet. As these results were in a measure unsatisfactory

I substituted for the foot wire, one two feet long and added a foot behind, and covered all as before with tissue paper, this gave an aeroplane with a surface of about four square feet or five times as much surface as before. Using the same screw and power as before. The plane now ceased to revolve and remained horizontal though it showed a slight tendency to revolve. With sixty turns of the rubber it flew on one occasion ninety feet horizontally from my hand without rising more than seven feet from the ground, the bands being completly untwisted. It would usually go from thirty to forty feet and end its flight by taking a forcible dive for the ground, or make a complete somersault backwards. This was due to there being no method of steering, and changing currents of air, while in the long flight its equilibrium was undisturbed. These results had considerably exceeded my expectations.

There have been many prophecies as to what affect the successful fling machine will have on the social, moral, political, and economic conditions of the world. Perhapse the most radical of these is Julian Hawthorne in his article "June 1993." He pictures an intermingling of all people regardless of race or nationality into one homologous people speaking one language. War is impozible, Free-trade is universal. Cities are no longer necessary, all living in the country and having three or four large manufacturing centers And due to the universal use of a practical flying machine

Though such a result may come as I believe it will, I do not think it can all take place in one or even two hundred years. Though I believe that we the class of '93 will all live to see and enjoy the flying machine of the near future, and to recognize its future affect upon humanity.

Henry L. Pellet