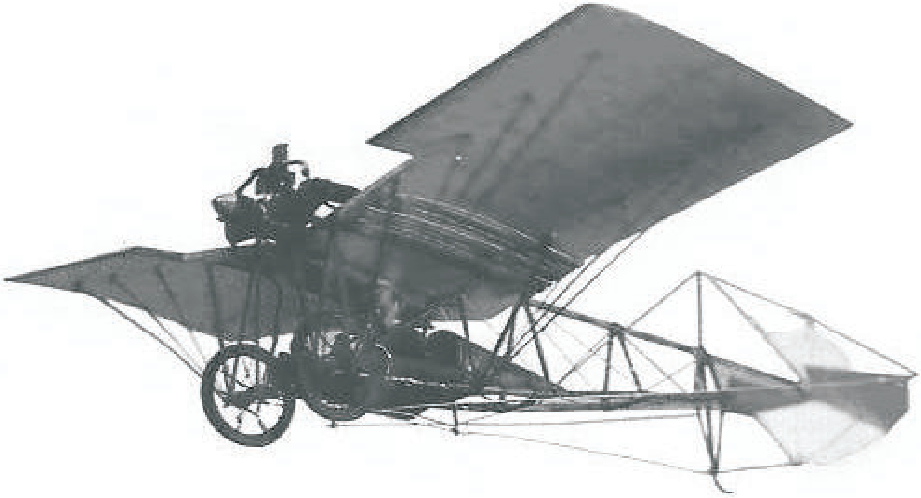
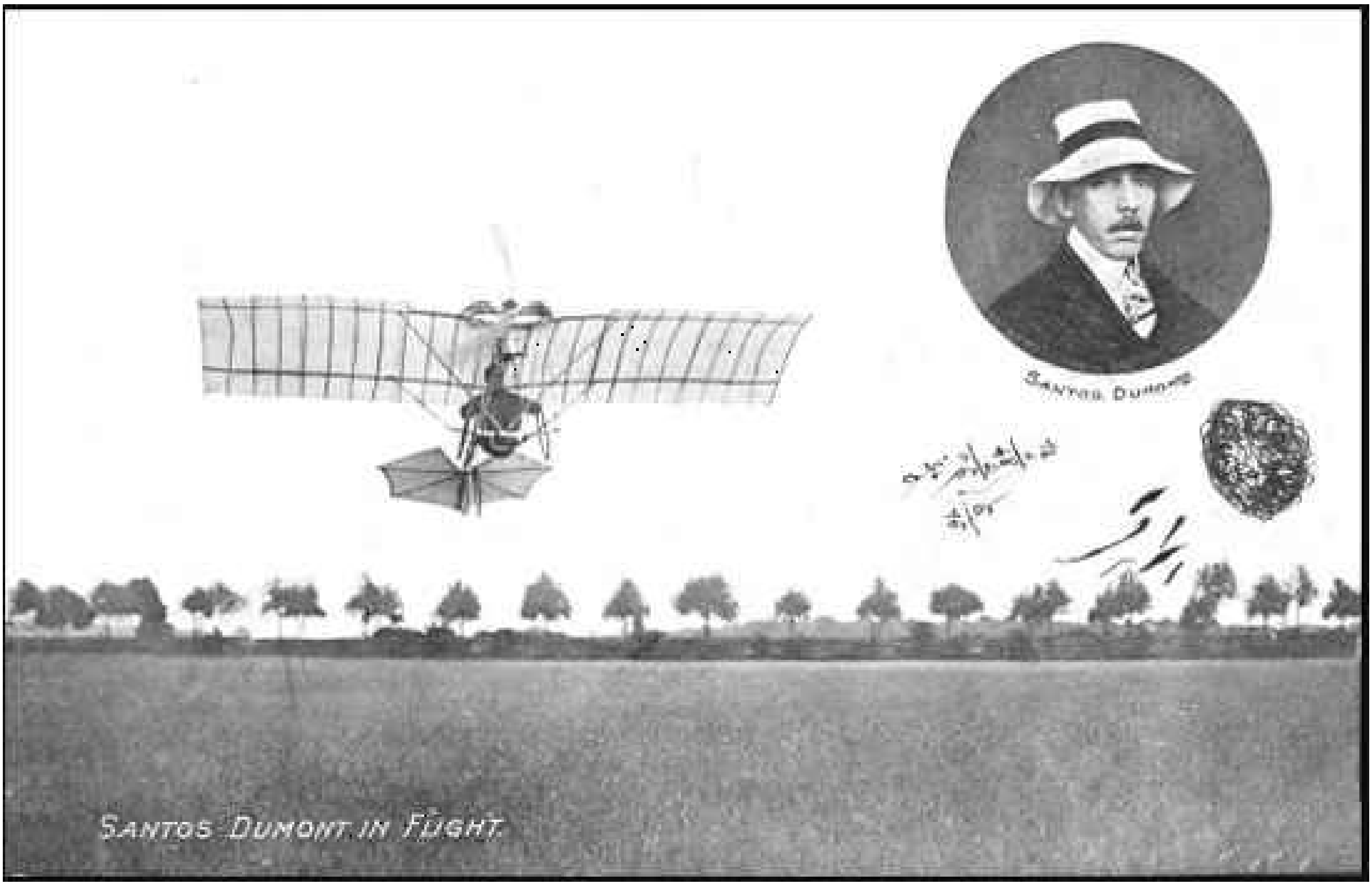
"Demoseille"
Santos Dumont





◦ AÉROPLANE MONOPLAN ◦

TYPE " *DEMOISELLE* " SANTOS-DUMONT

POIDS environ : 125 kilogrammes.

ENCOMBREMENT : longueur 6 m. 20, largeur 5 m. 50.

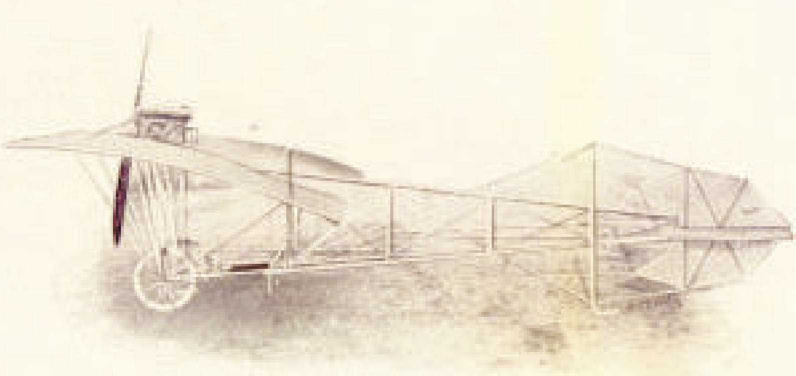
SURFACE portante, environ 10 mètres.

MOTEUR horizontal 2 cylindres.

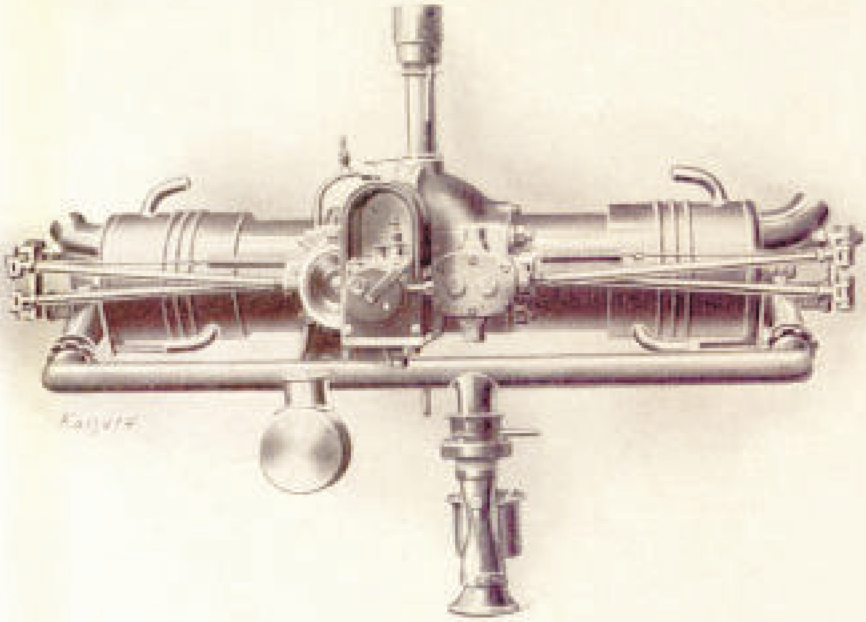
REFROIDISSEMENT par eau.

Prix : 7.500 fr.

51



MOTEUR 30 HP LÉGER pour l'Aviation



MOTEUR à deux cylindres opposés, horizontaux.

ALÉSAGE, 130 m/m; Course, 120 m/m.

POIDS : 50 kilos environ.

SOUPAPES d'admission et d'échappement, commandées, situées dans le fond des cylindres et actionnées par des culbuteurs que commandent les deux arbres à cames par l'intermédiaire de tiges extérieures.

GRAISSAGE automatique par pompe.

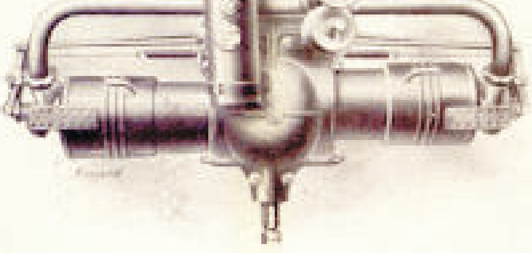
ALLUMAGE par magnéto à bougies.

CYLINDRES en acier avec chemises d'eau rapportées en cuivre.

REFROIDISSEMENT par eau.

DISPOSITIF spécial permettant de lancer le moteur en utilisant un accumulateur, sans qu'il soit besoin de bobine.

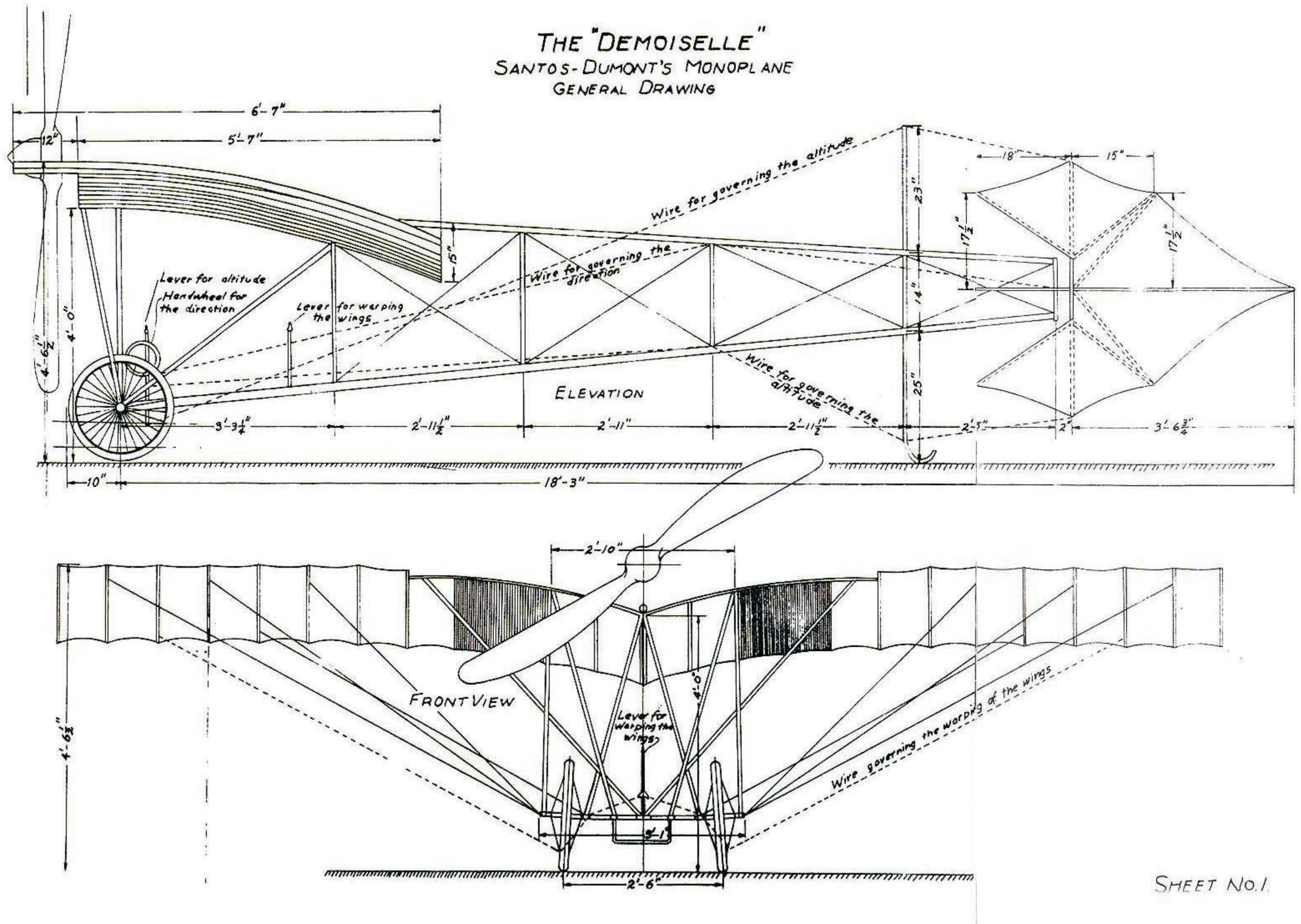
Prix : 4.000 fr.



THE "DEMOISELLE"

SANTOS-DUMONT'S MONOPLANE

GENERAL DRAWING

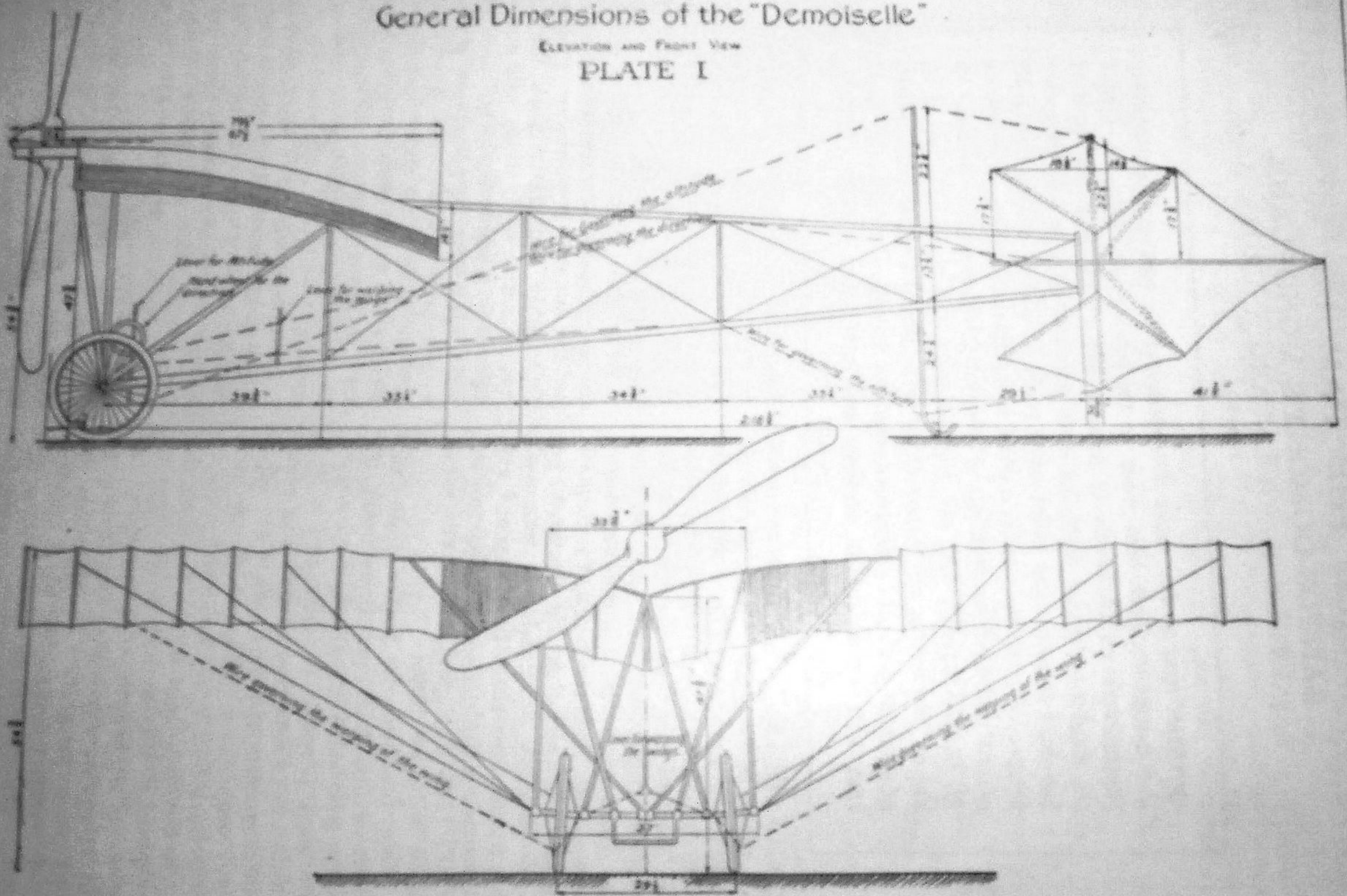


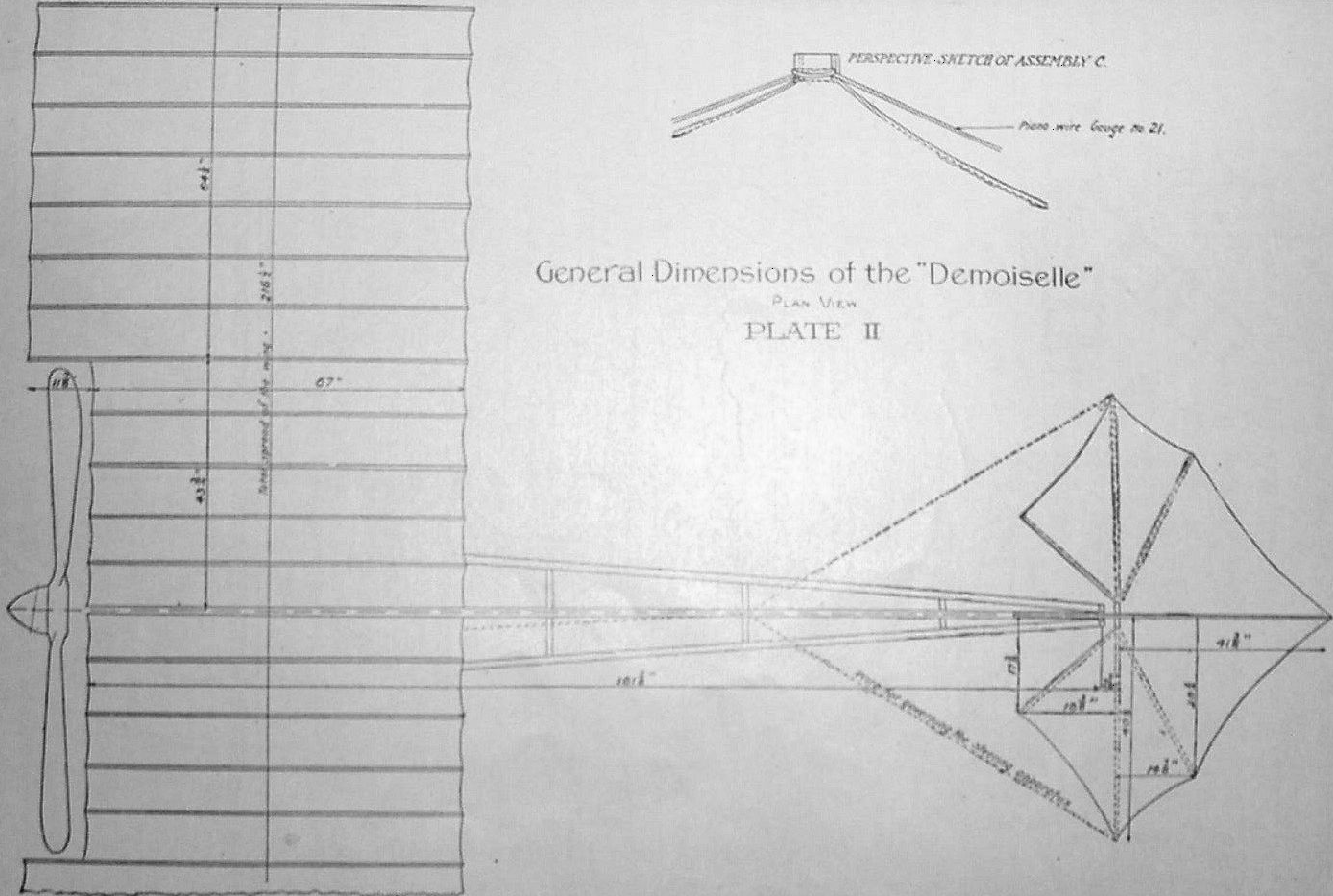
SHEET No. 1.

General Dimensions of the "Demoiselle"

ELEVATION AND FRONT VIEW

PLATE I





General Dimensions of the "Demoiselle"

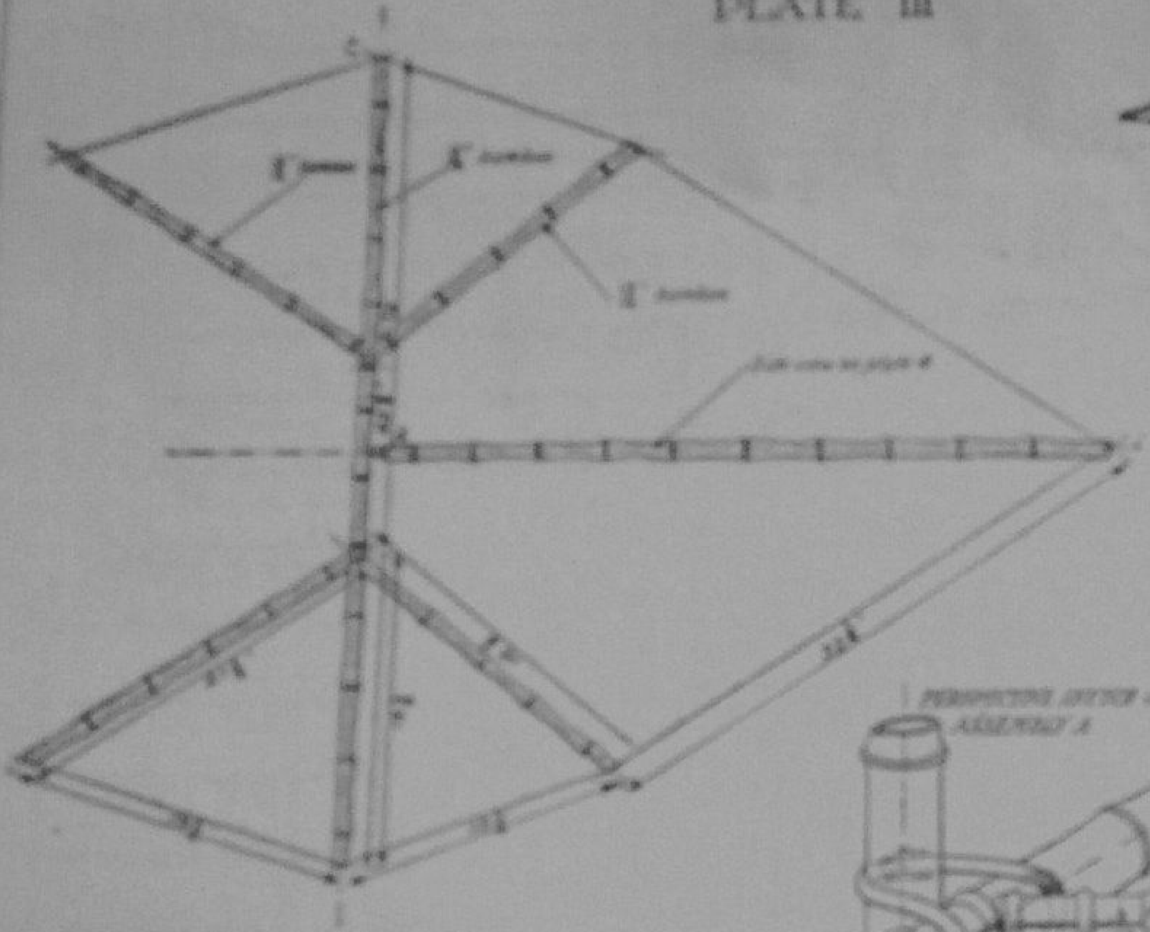
Plan View

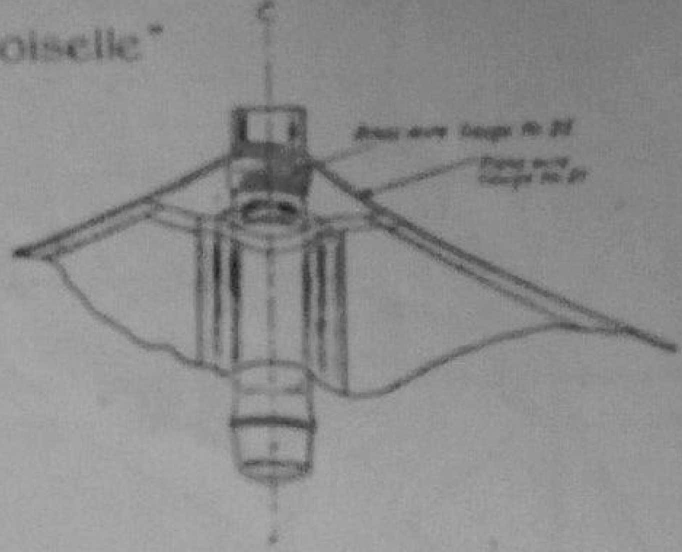
PLATE II

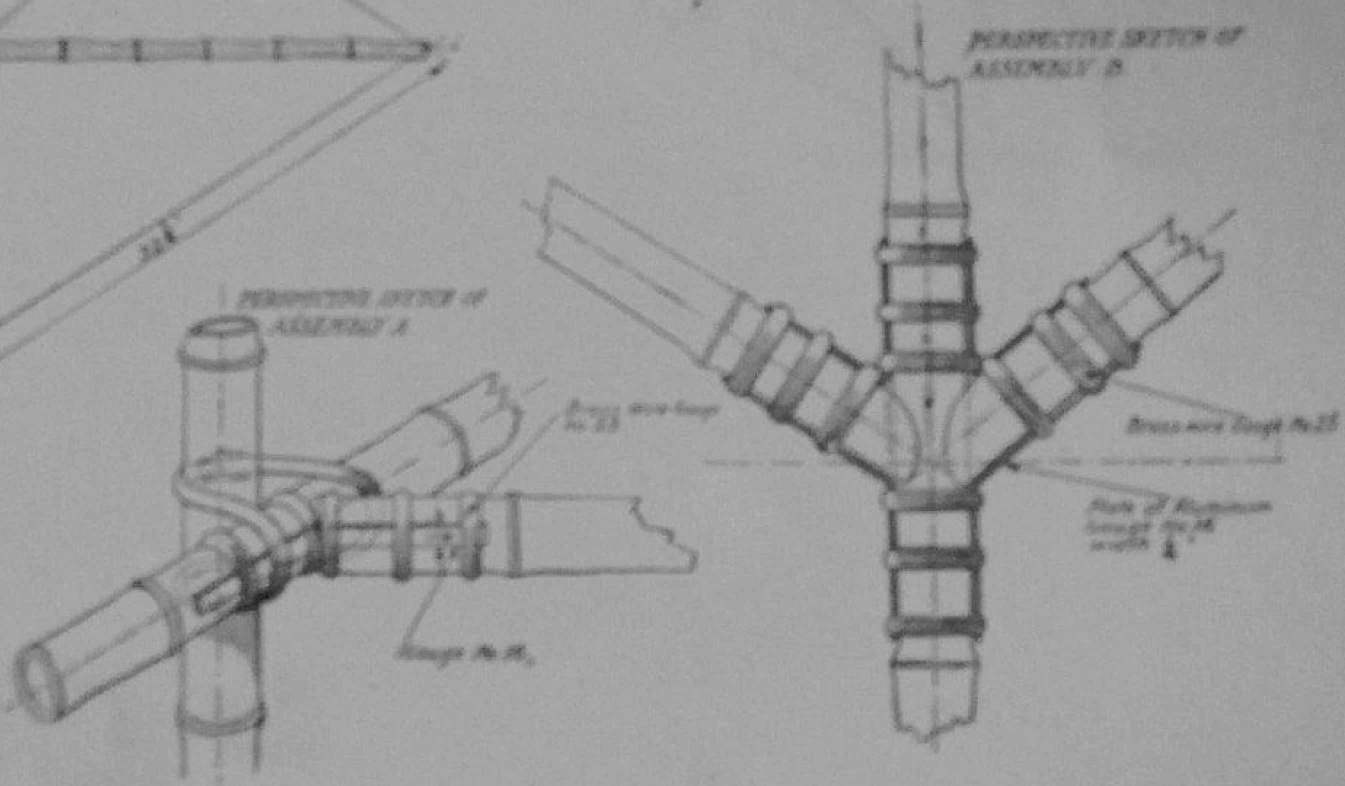
General Dimensions of the "Demoiselle"

VERTICAL RUDDER

PLATE III



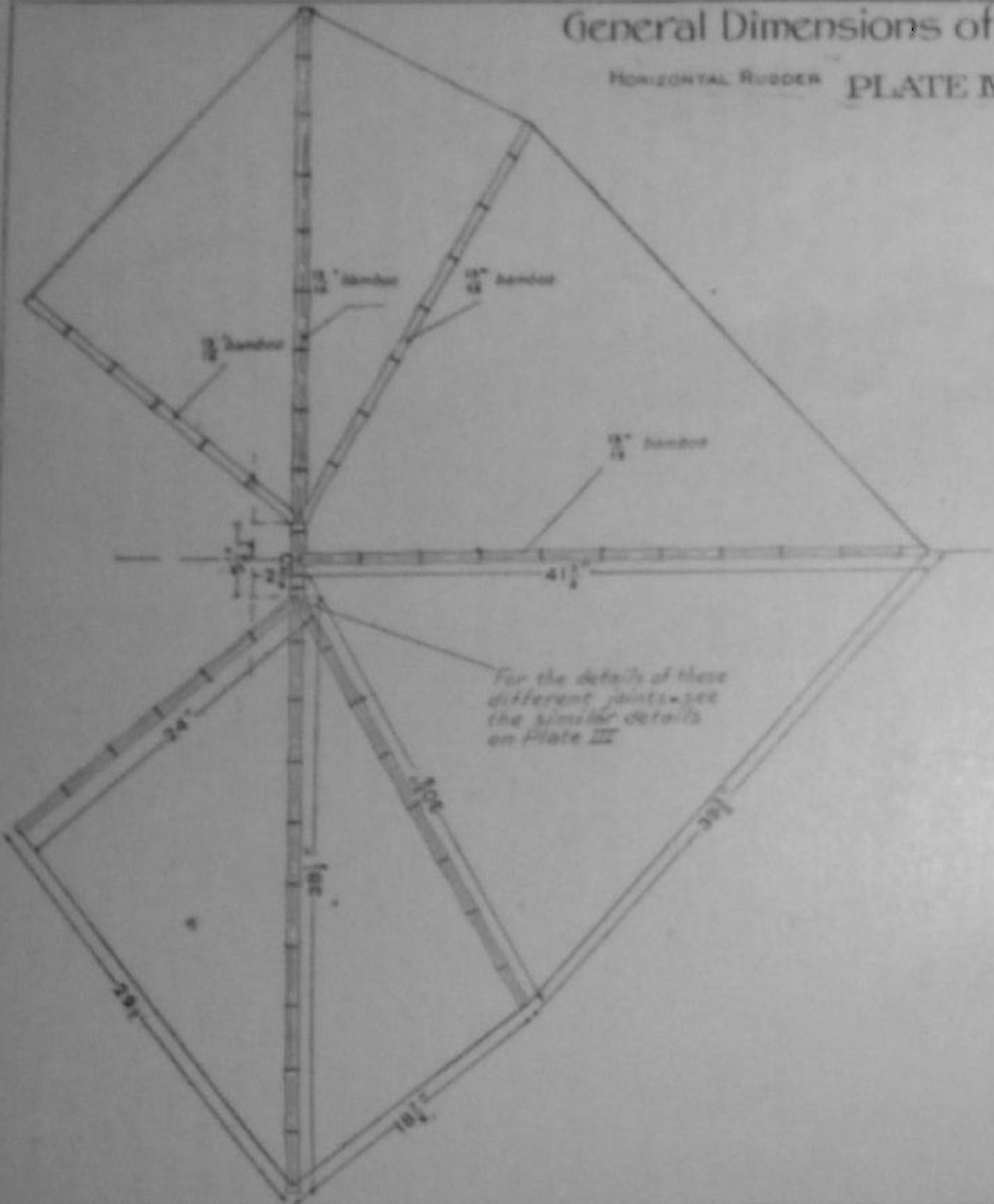




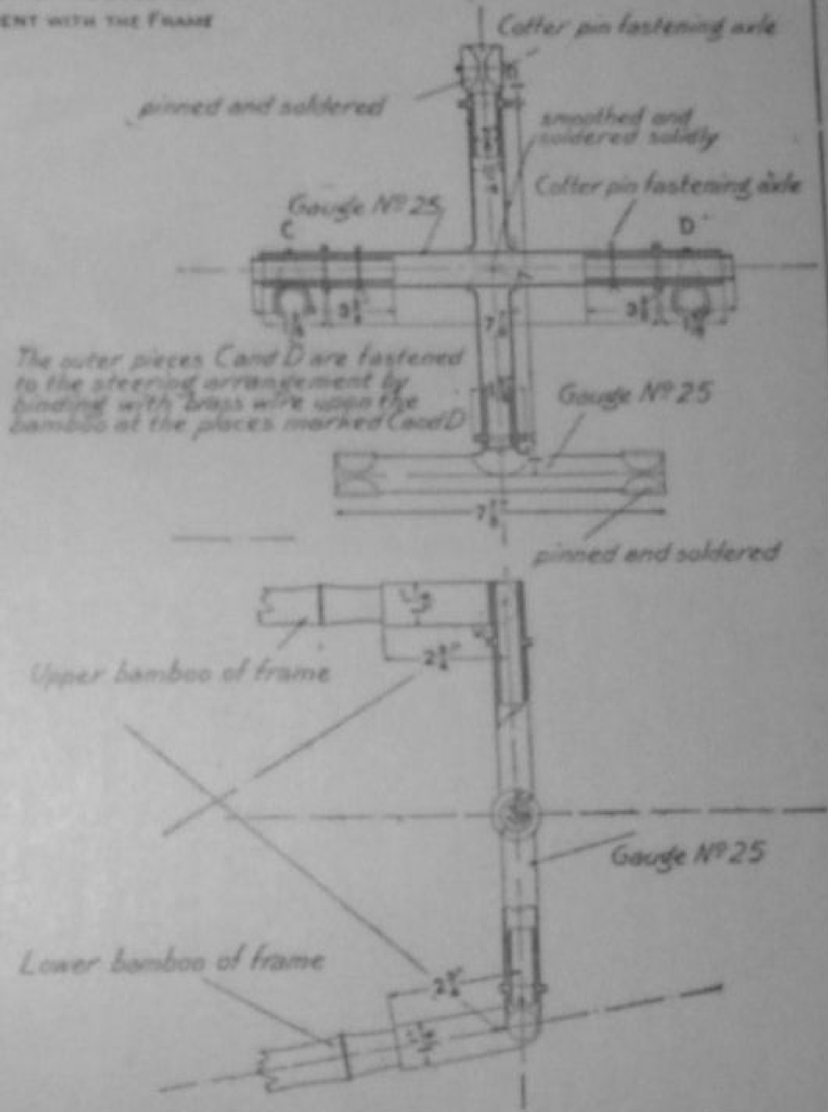
General Dimensions of the "Demoiselle"

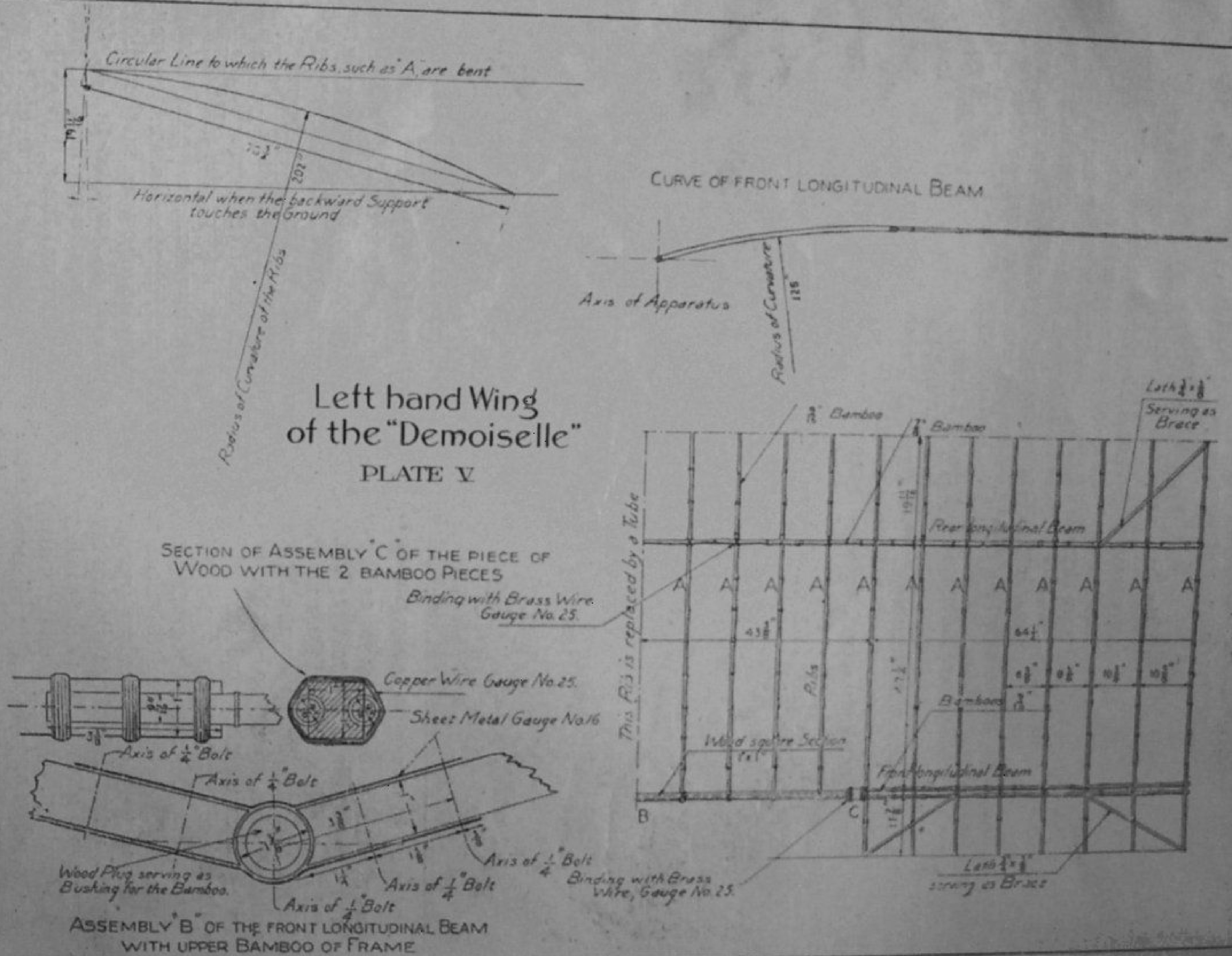
PLATE IV

HORIZONTAL RUDDER



CONNECTION OF THE STEERING ARRANGEMENT WITH THE FRAME



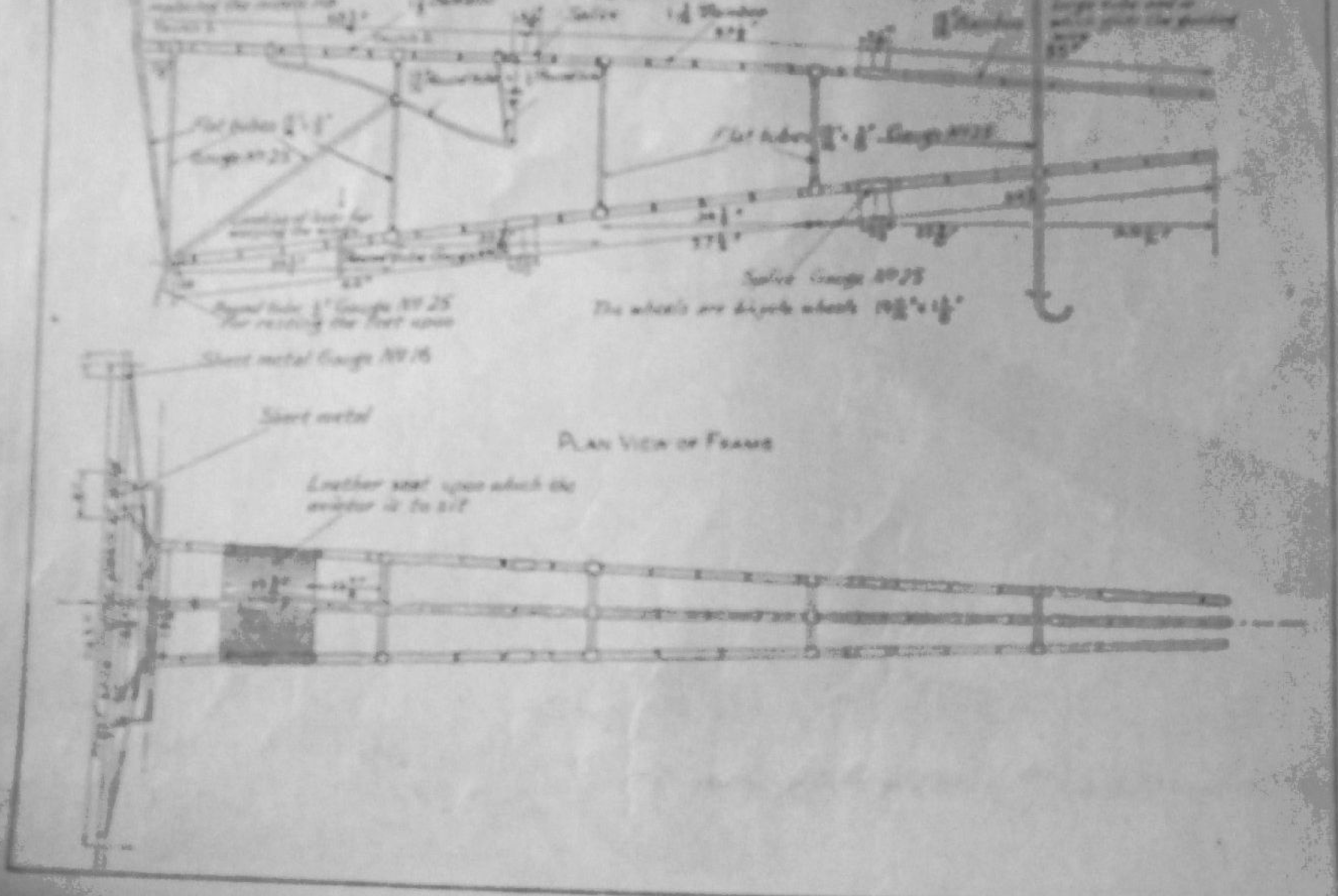


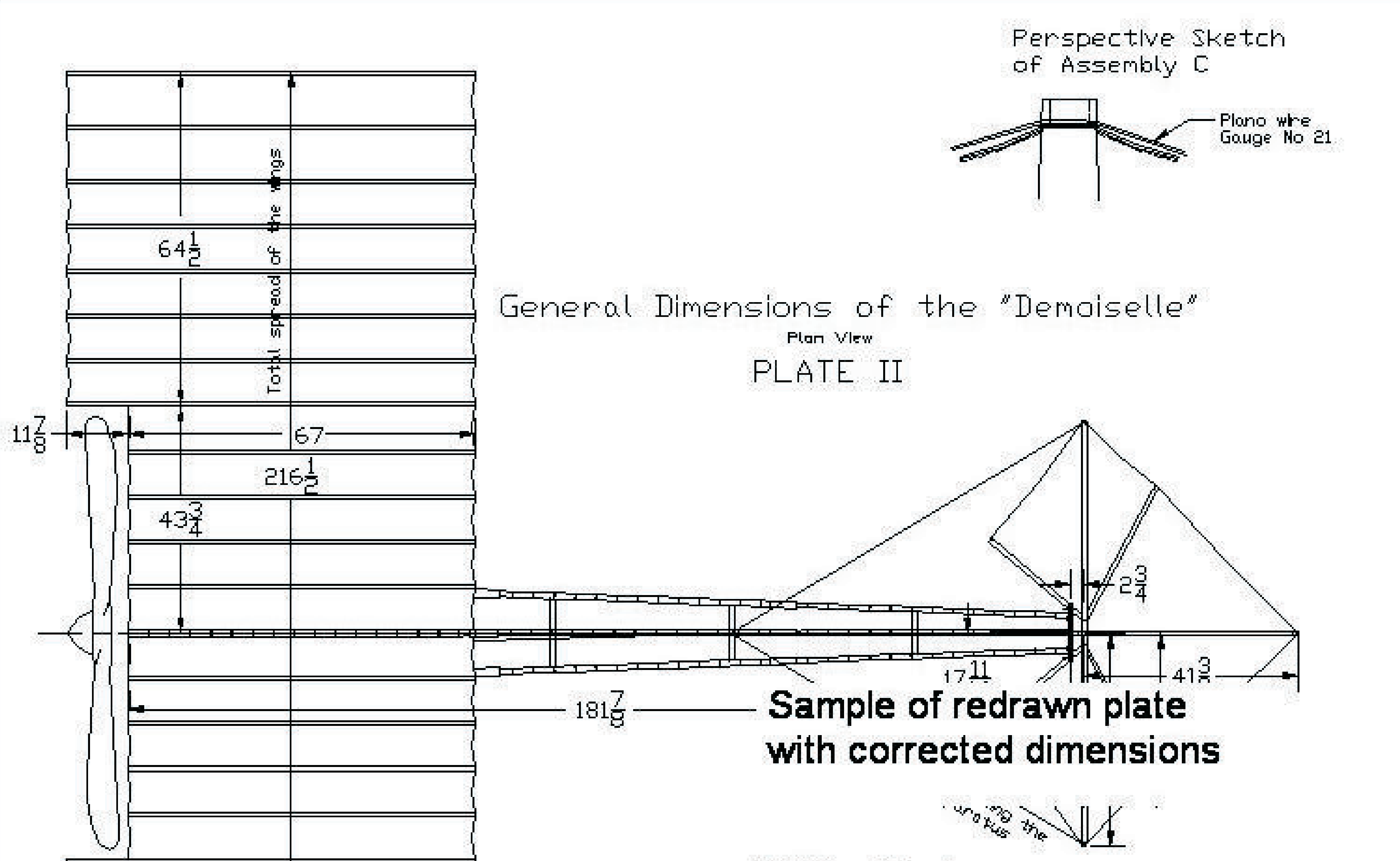
Left hand Wing of the "Demoiselle"

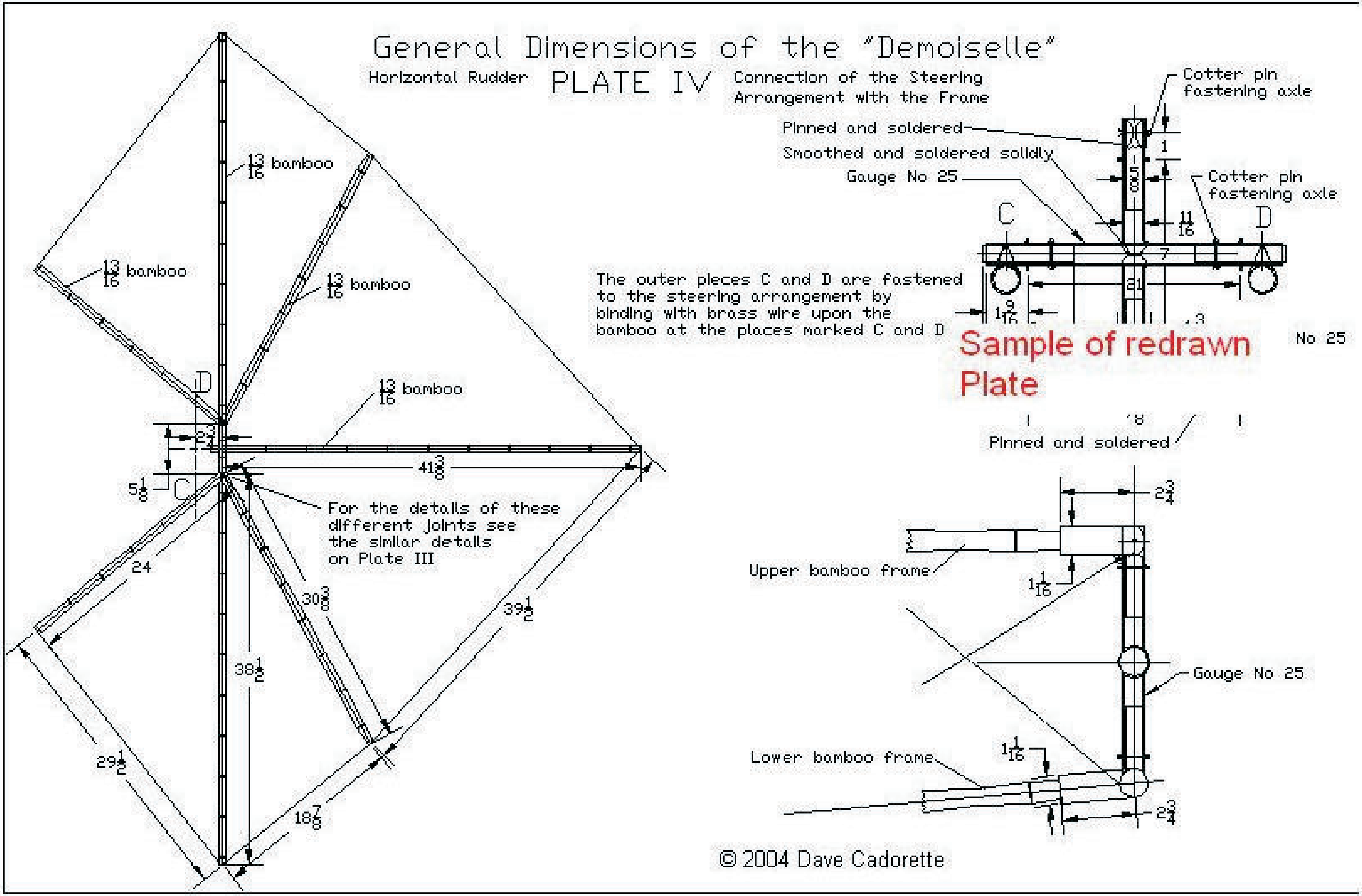
PLATE V

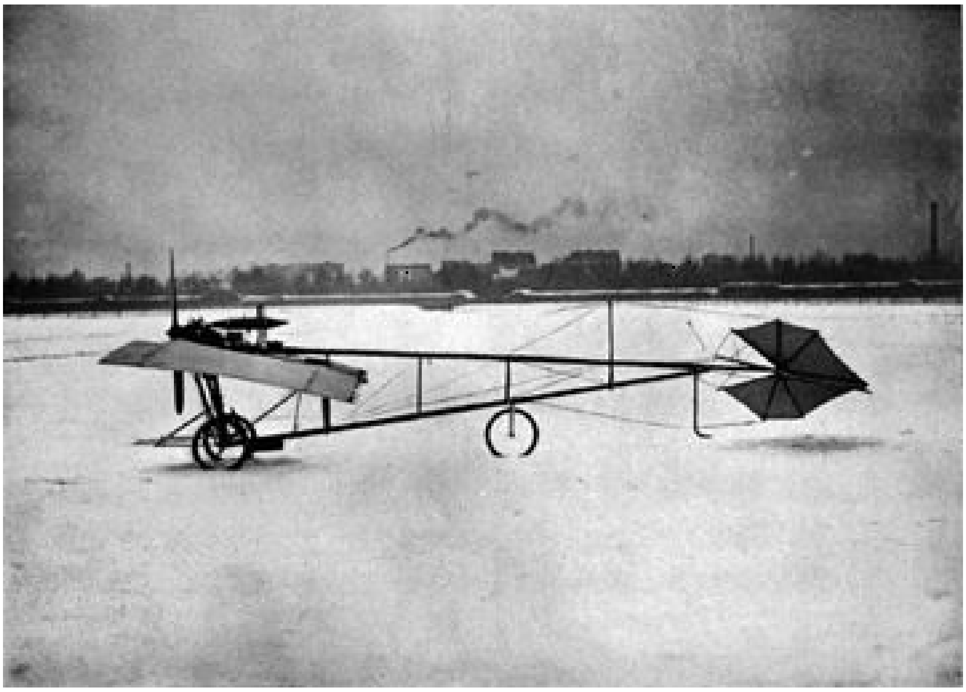
General Dimensions of the "Demoiselle"

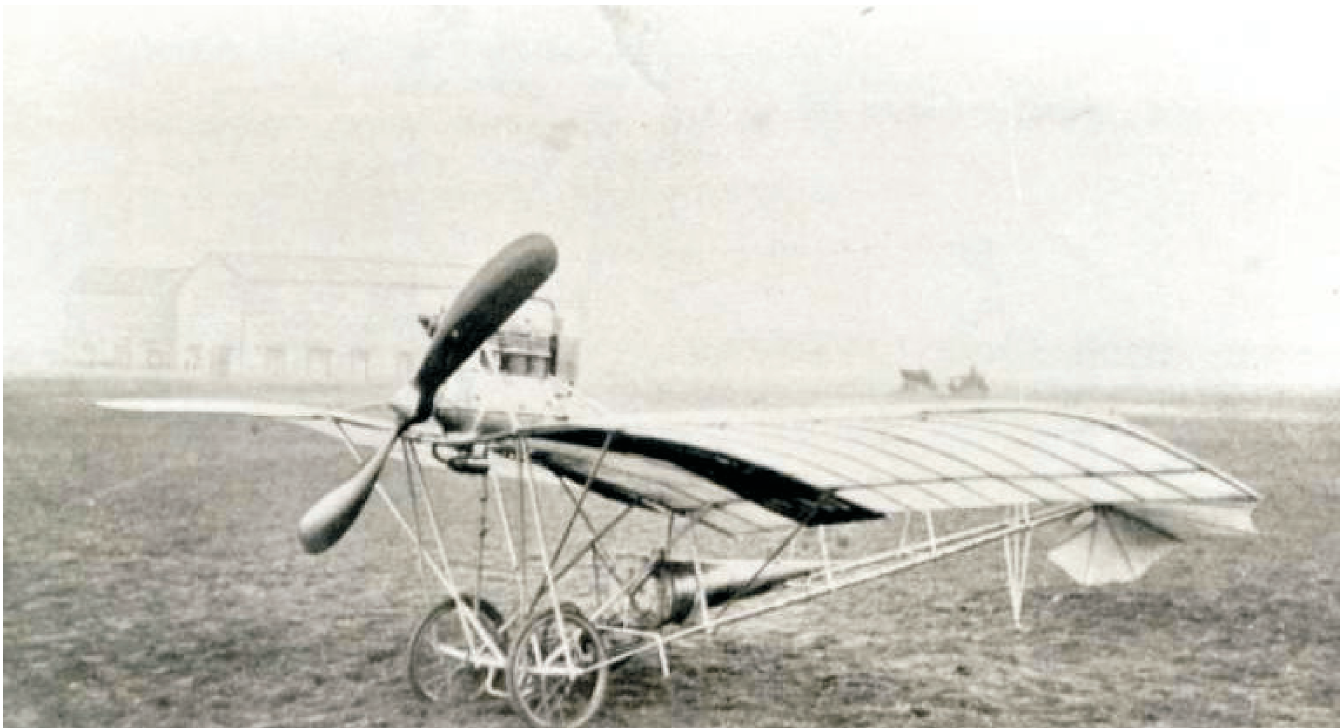
PLATE VI

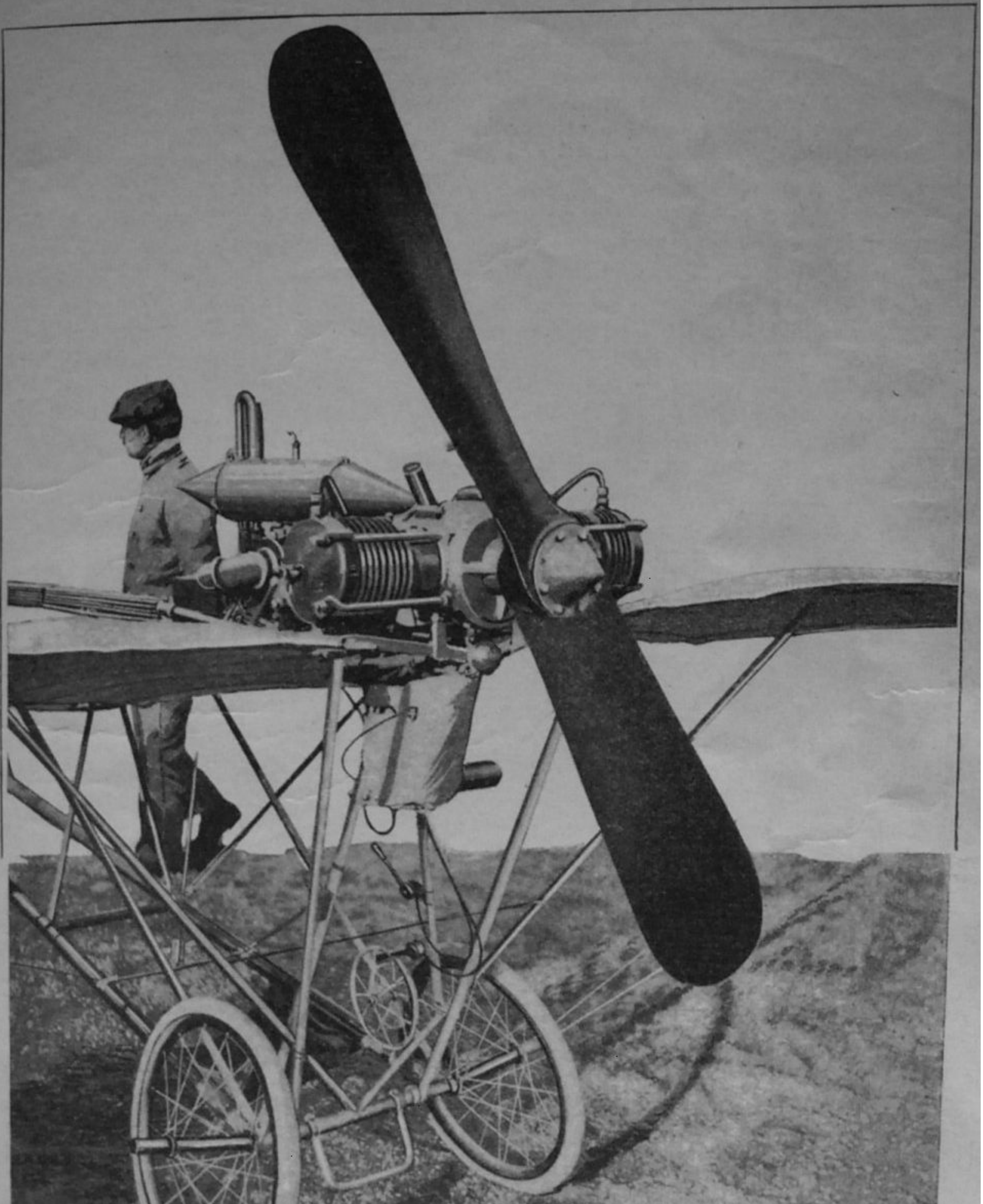



Perspective Sketch
of Assembly C
Piano wire
Gauge No 21
General Dimensions of the "Demoiselle"
Plan View
PLATE II
Total spread of the wings
$64\frac{1}{2}$
$11\frac{7}{8}$
67
$216\frac{1}{2}$
$43\frac{3}{4}$
$2\frac{3}{4}$
$17\frac{11}{}$
$41\frac{3}{}$
$181\frac{7}{8}$
Sample of redrawn plate
with corrected dimensions


General Dimensions of the "Demoiselle"
PLATE IV
Horizontal Rudder
Connection of the Steering Arrangement with the Frame
13/16 bamboo
13/16 bamboo
13/16 bamboo
13/16 bamboo
D
C
2 3/4
5 1/8
41 3/8
24
30 3/8
39 1/2
38 1/2
29 1/2
18 7/8
For the details of these different joints see the similar details on Plate III
The outer pieces C and D are fastened to the steering arrangement by binding with brass wire upon the bamboo at the places marked C and D
Cotter pin fastening axle
Pinned and soldered
Smoothed and soldered solidly
Gauge No 25
Cotter pin fastening axle
1
5/8
11/16
7
21
1 9/16
No 25
Sample of redrawn Plate
Pinned and soldered
2 3/4
Upper bamboo frame
1 1/16
Gauge No 25
Lower bamboo frame
1 1/16
2 3/4
© 2004 Dave Cadorette







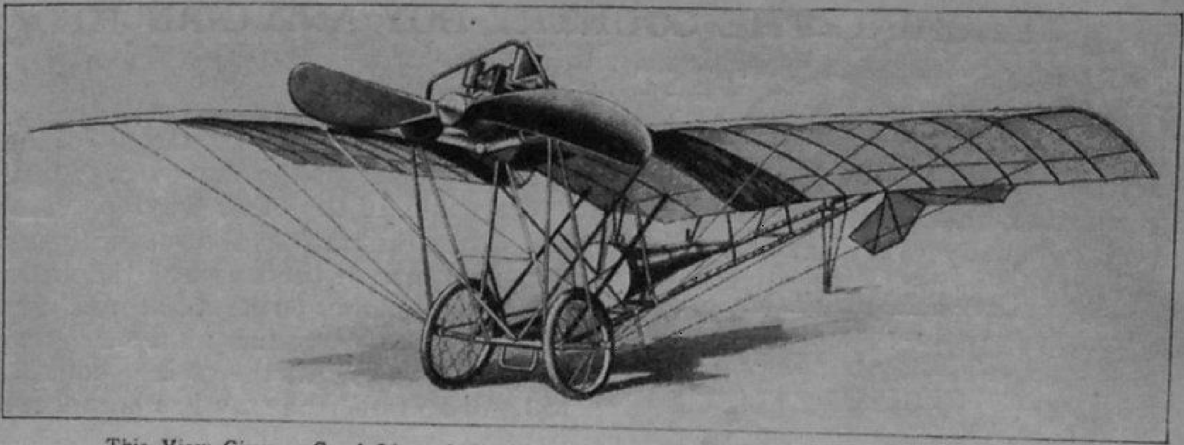
View of the "Demoiselle" Showing Position of Motor and Propeller ordinary bicycle wheel. In the construction of these wheels it would be well to use strong wire spokes, for at times, when the machine strikes the ground suddenly, great stress is put upon them. Santos-Dumont experimented a long time with the wheels before he finally settled on a hub length of 6 in. This he found was strong enough to support the machine when he used a 35-hp. motor. If a lighter motor is used, the size of the wheel hubs may be modified. These hubs are, as may be seen in the drawings, simply put on over the tubes and fastened by a cotter pin. The tubes should be allowed to extend out several inches beyond the end of the hub. Great care should be taken in the selection of this lower tube, for almost the entire weight of the machine comes upon it. It is not necessary to provide any special bearings for the wheels, as it is intended they should work with a slight friction. It may readily be seen that the wheels are inclined toward one another at the top. The angle of inclination of that part of the tubing, which forms the axle, is 1 to 9. This manner of placing the wheels prevents them from being broken when subjected to a slight jar if the machine takes to the ground unexpectedly.

The connection of the tubing with the framework of bamboo is somewhat difficult, but the details of assembling are always the same in principle, and are shown on Plate VII. The pieces, which are to hold the tubes, are prepared beforehand, and when the tubes are introduced, the whole is firmly bolted. (See Detail of Assembly "A" on Plate VII.) If the builder does not care to prepare these special pieces, the flattened end of the tube may be affixed to a square piece of metal by means of an additional bolt. It is considered better, however, to prepare these special pieces as receptacles for the ends of the tubes.

It would be imprudent and dangerous to make a hole in any of the three main bamboo rods which constitute the frame of the machine, for this would detract from their strength. When we are ready to attach the tubing to the frame, it would be well to follow the method shown on Plate VII. (Detail of Assembly of a Post with the Bamboo.) Out of a piece of sheet metal a joint may be formed so as to make a receptacle for the end of the tube. Provision should be made by a small piece of metal so that the bamboo will be protected if the end of the tube should strike it. Pieces of sheet metal can be wound around the bamboo rod as indicated on the drawing.

Let us now call your attention to the joint at the junction of the lower bamboo rods with the two upright tubes at the inside bearing of each wheel. This fork-like joint should be brazed in the manner of a bicycle frame. It may also be forged or made of a piece of sheet metal forced into shape. There may be some play at the joint, but this does not matter, as the wire stretchers, to be put on afterward, will give the necessary strength, and prevent the pieces from gliding one upon the other.

The machine thus far completed, we may proceed to attach the piano wire stretchers, and then the wires controlling the horizontal and vertical rudders and governing the warping of the planes. The rudder controls may be installed in accordance with the builder's ideas, and the motor controls will vary, of course, with the type of motor used. In the "Demoiselle" the wire regulating the horizontal rudder is attached to a lever within easy reach of the pilot's right hand. The vertical rudder is governed by a wheel at the pilot's left hand. The lever which controls the warping of the planes is placed behind the pilot's seat. Santos-Dumont operated this by bending his body to the right or left, the lever fitting into a tube fastened to his coat in the rear. A side movement pulls the rear end of the wing opposite to the side to which the pilot leans. The balancing of the whole apparatus, is, therefore, in a manner, automatic. The pilot has but to bend over to one side in order to balance the machine. Springs are introduced on the wires which control the rudders of some of the machines so as to bring the rudder back to its normal position without effort on the part of the operator. The seat is a piece of canvas or leather stretched across the two lower bamboo rods just behind the wheels.



This View Gives a Good Idea of the Location of the Gasoline Tank and the Radiator

Santos-Dumont had his motor control so arranged that he could regulate the supply of gasoline by his foot. The spark switch may be placed on the steering lever. These controls may be arranged differently, however, with other motors.

It is of prime importance that the motor should be perfectly balanced. It should be direct connected to the axle holding the propeller. The gasoline reservoir is located behind the pilot's seat, the fuel being forced up into a smaller one just above the motor. In his remarkable flight from St. Cyr to Buc, the inventor of the monoplane used a two-cylinder Darracq motor of 30 hp., which gave the propeller 1000 r.p.m. It weighed a little over 99 lb. The entire machine weighed 260 lb. without the pilot. At the end of the crankshaft, opposite the propeller, is a pinion and eccentric working the oil pumps. This pinion also meshes with the gear which operates the water pumps. The cams which raise the valves at the same time operate the magneto. The radiator, which is composed of a great many small copper tubes connected up to a larger tube at the front and rear, is placed under the main surface of the wings and extends from the front to the rear of the planes.

RAZORLESS SHAVING OUTFIT

A razorless shaving outfit, consisting of a sponge, two measures, a shaving cup, and a powder the mere application of which (mixed with water) removes the hair as faultlessly as the best razor, has just been introduced as the latest tonsorial discovery. The fact that it is warranted to contain no acids, give out no offensive odor, and accomplish shaving without danger of cutting, might persuade some shavers to contemplate substituting it for the time-worn razor. The powder is, however, only for post mortem shaving.

How Santos-Dumont Conveyed His Aeroplane to the Aviation Field proven so easy to balance as the monoplane. The principal objection to it up to within a short time has been the difficulty of bracing the plane. With the biplane the trussing was of great service in this connection. But with the guide wires firmly fixed from the frame to the wings there is little probability of any difficulty with the Santos-Dumont type.

At the very beginning it might be well to state that the greatest items of expense in the construction of the machine will be the motor and the propeller. Santos-Dumont used a Darracq motor of 30 hp. in his record-breaking flight, although he had previously made some fine flights with a 17-hp. motor. There are American motors which will do just as well, probably, and will undoubtedly be much cheaper, as the importation of one from France involves the expense of freight and customs duties.

The construction of the propeller is vitally important, and we would advise that this be purchased.

A good place at which to start would be the vertical rudder, Plate III. The thickness of the bamboo there given is the maximum one. The stronger and heavier portions are used for the centers where the joints are formed and the strain is heaviest. The detailed drawing C on this plate shows the manner in which the cloth is attached to the framework by gauge No. 21 piano wire. As it is done at this point so it should be done on all parts of the monoplane. After having sewn the piano wire into the outer edge of the cloth, taking care to leave open the part where the wire is to be attached to the framework, the wire should be stretched to get it to the extremity, and then dropped into the slot made for it to rest in on the outer end of the bamboo. Thus the planes of cloth are well stretched, and are held firmly in place, adding to the strength of the machine. The same end could not be accomplished nearly as well by first attaching the wire and then sewing the cloth thereon. This applies to the wings also where every added bit of strength and firmness adds to the successful completion. Slots are made at the end of the bamboos for the

M. Santos-Dumont about to Start Flight in the "Demoiselle"

wires to slip into and be held fast. It is a good idea to put a cork into the hollow ends of the rods, and to cut the slots in both at the same time. The brass wire, gauge No. 25, should also be wound around the rod just below the end of the slot. This prevents the piano wire on which the cloth is sewn from splitting the rods. It may seem that this arrangement is crude, yet it is the way that Santos-Dumont made the ends when he flew from St. Cyr to Buc. Later on—he had a number of "Demoiselles," and small breaks happened now and then—he put a little metal cap over the ends of the rods. Slots were made in these caps to receive the wires. We have described the former because it is by far the easier way for amateur airship builders.

The cloth used by Santos-Dumont was a very finely woven silk. Silk does not rot as easily as cotton and is considerably stronger. Silk has the great objection of expense, however, and it would probably be as well to use percale or strong muslin, care being taken to secure the best grade of closely woven and unbleached goods.

HOW TO BUILD THE FAMOUS "DEMOISELLE"
SANTOS-DUMONT'S MONOPLANE

By ARTHUR E. JOERIN AND A. CROSS, A. M.
(Paris)

FROM time to time vague descriptions of the manner of constructing aeroplanes have been given to the public. All over the United States there are thousands of persons who are intensely interested in the subject of aerial flight, but until now nothing of a tangible nature has been presented on which work could be started with a reasonable prospect of success. It is a great satisfaction therefore, to be able to present the working drawings of the wonderful monoplane invented by M. Santos-Dumont. As the authors point out, however, it would be useless for anyone not possessed of some mechanical skill, and plenty of common sense, to attempt to construct a copy of the famous flyer, even with such detailed workings and instructions.— THE EDITOR.

FOLLOWING the announcement, made some months ago by Alberto Santos-Dumont that he intended to give the plans of his latest aeroplane, the "Demoiselle," to the world in the interest of aeronautics, great interest has been centered in the wonderful monoplane. It is the lightest and smallest of all heavier-than-air machines, yet is thoroughly practical. It was with this monoplane that the renowned aviator made a flight from St. Cyr to Buc, on the 13th of September last at a speed of 56 miles an hour.

This machine is better than any other which has ever been built, for those who wish to reach results with the least possible expense and with a minimum of experimenting. The plans which accompany this article are identical with those from which the machines are now being built in France.

As it would lead us too far from the purpose of this article if we were to take up at length such questions as the strength, flexibility, and resistance and other properties of materials we shall restrict ourselves to a description of the manner of constructing the flyer. It would be well, of course, for the prospective aviator to make himself acquainted with the subject of atmosphere as it applies to aeronautics, to have a good general knowledge of gasoline motors, and to study the properties and qualities of the different materials which enter into the construction of the monoplane.

It is clearly impossible to go into these subjects at any great length here, but the one who is ambitious to become thoroughly conversant with the subject of aerial navigation, will not fail to consult suitable books on these subjects. Of course the possession of plans is the basis without which it would be impossible to set about building the airship, but at the same time it is necessary to possess some mechanical skill and ability, and plenty of common sense.

In presenting the plans through Popular Mechanics Magazine we trust that no one of our readers will start to build unless he possesses these qualities, especially the latter, without which he will never be able to accomplish anything.

That the monoplane is the superior form of heavier-than-air machine is the opinion of a majority of the aviation experts. Biplanes and even triplanes have made wonderful flights, but no flying-machine ever built has

HOW TO BUILD THE FAMOUS "DEMOISELLE"
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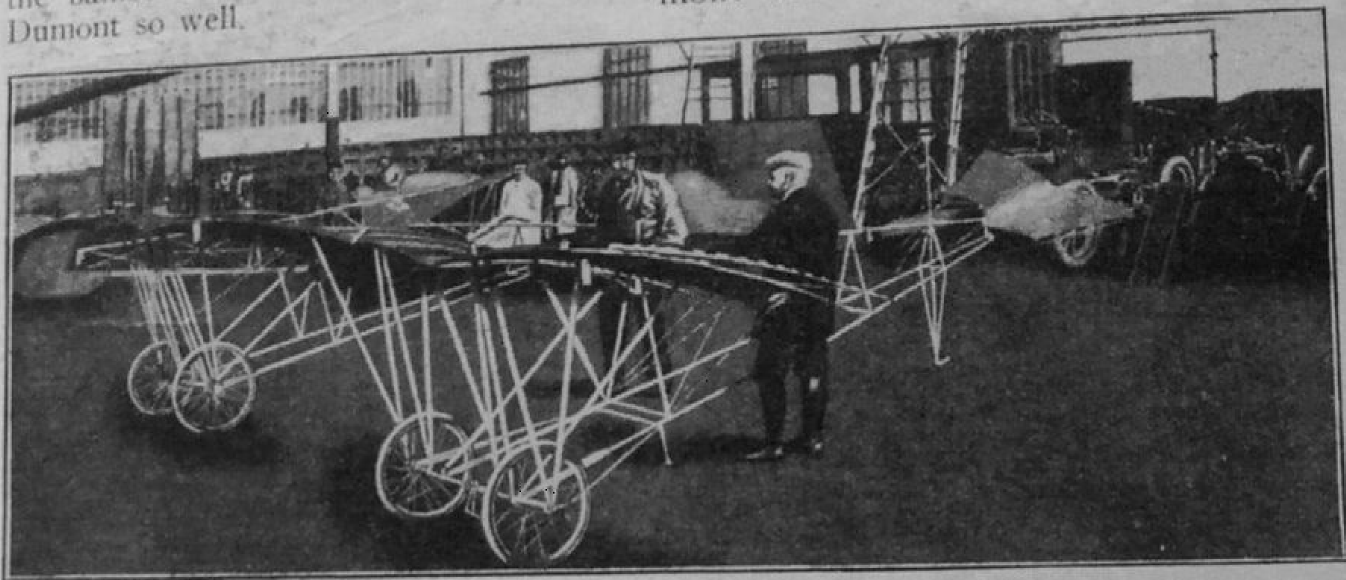
(Continued from the June number of Popular Mechanics)

Having finished the steering arrangement it would be wise to take up the construction of the wings. The wings of the "Demoiselle" are made entirely of bamboo rods with bamboo or ash lateral beams as shown in Plate V. However, Clement Bayard, at whose factory in France these monoplanes are being manufactured, makes them of poplar or ash. Aluminum tubes have also been used. It would be advisable, however, to stick to the bamboo rods which served Santos-Dumont so well.



Building Santos-Dumont Monoplanes at the Clement Bayard Factory in France

In order to secure the curves as shown at the top of Plate V, on the left, it would be sufficient to bend the rods over a form by force. They may also be bent by means of a string tied to the ends, drawing them together, and then plunging them into boiling water for about 15 minutes. The rods should be given plenty of time to dry before the strings are removed and they are placed in position. They will retain their shape if given time to dry, so no attempt should be made to hasten matters. If the builder desires to use wood he may proceed in like manner. The curve is almost the true arc of a circle.

It is not necessary to bend the rear lateral rod. It suffices to bend the one in front. The whole plane structure is kept rigid by guide wires running from the rods to the frame as shown in Plate I.

In order to attach the cloth to the extremities of the rods, it is not necessary to employ any other method than that shown at C, Plate III. This is the best method known. As with the steering device the front ends of the rods have to be covered by means of cloth hemmed over. This diminishes the friction of the air against the rods. Santos-Dumont has not always used the same method of attaching the cloth, but the method shown here is the one he used on the machine with which he made the famous flight, and is the method which the builder is advised to follow.

In the original flyer there was a rod just above the head of the pilot. It has been thought advisable, however, to leave this rod out. Santos-Dumont is quite short, and when he was in the pilot's seat, his head did not reach the rod. In the machines now being manufactured in France, the rod is omitted.

The wings completed, it would be well to next undertake the construction of the frame. The wheels are easily made, for, save that they have a longer hub, they are very similar in construction to the