I. ETRICH.

SUPPORTING SURFACE FOR FLYING MACHINES.

APPLICATION FILED AUG. 12, 1910.

983,697.

Patented Feb. 7, 1911.

3 SHEETS—SHEET 1.

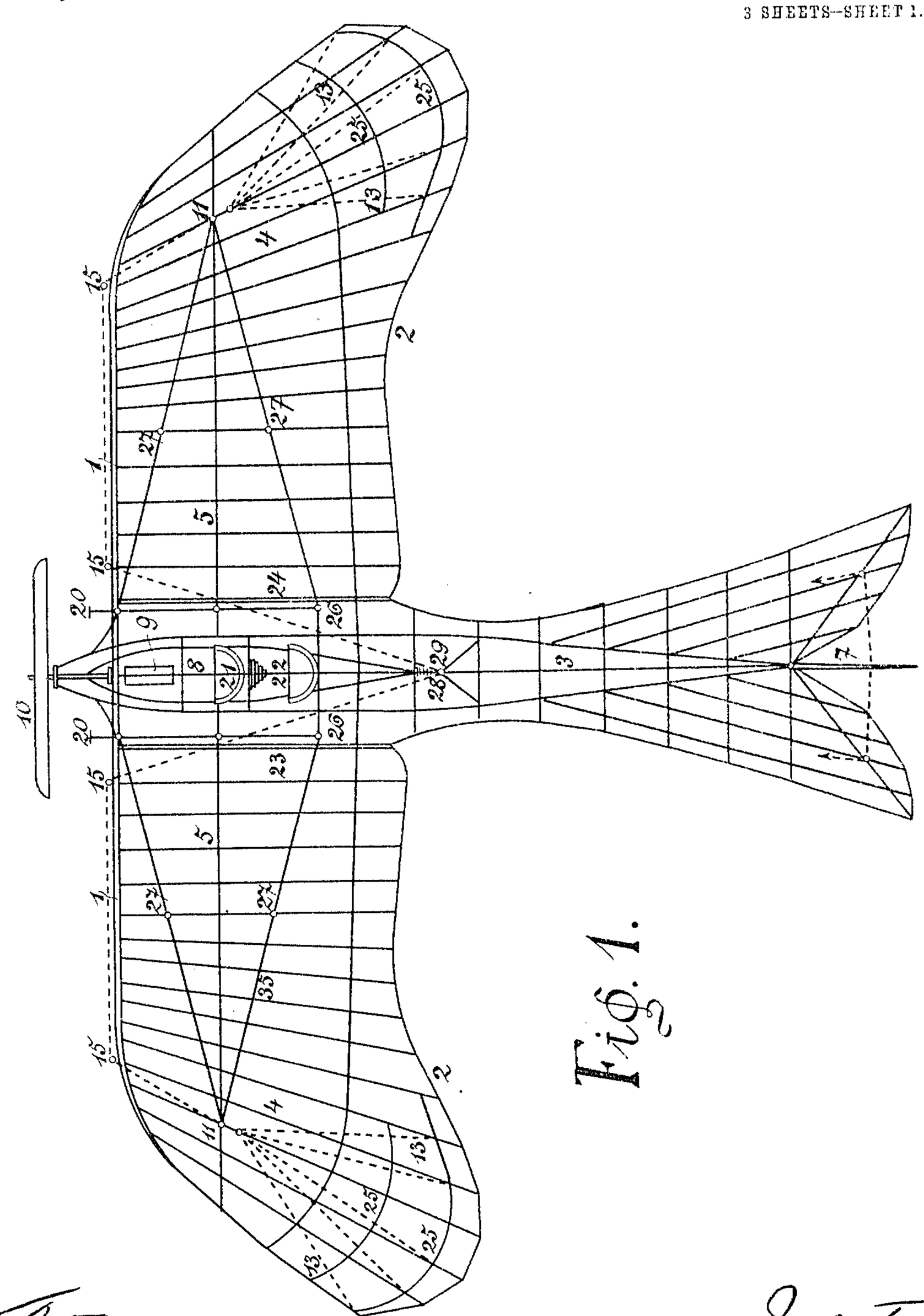

Fig. 1.

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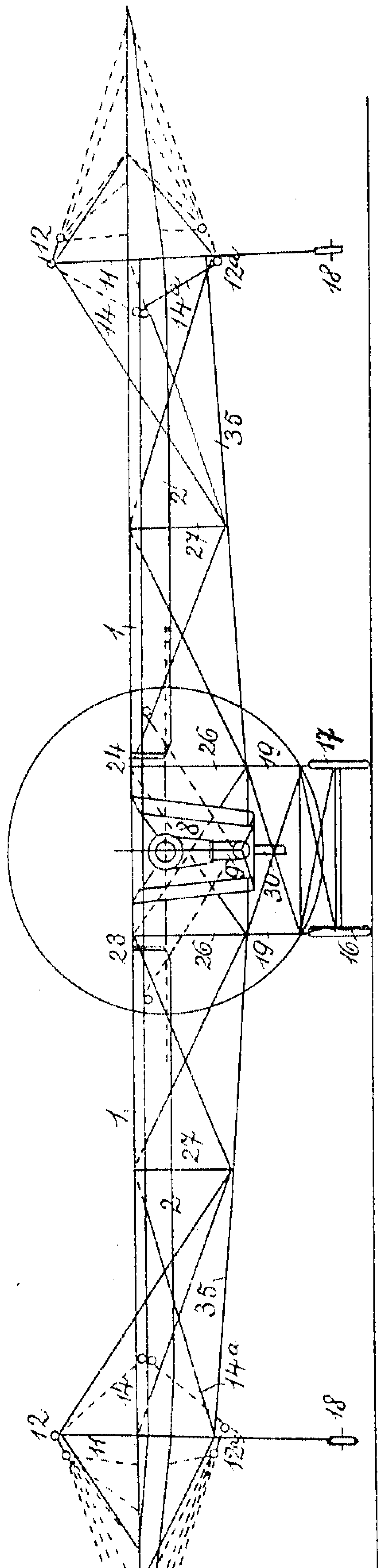

Fig. 2.

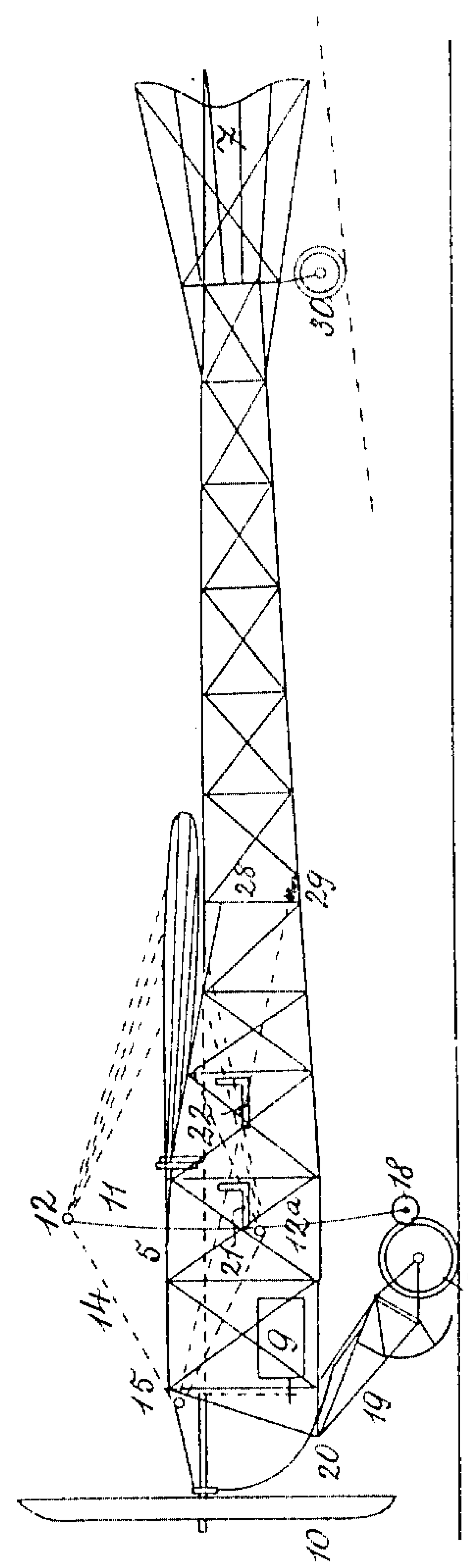

Fig. 3.

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3 SHEETS-SHEET 3.

Fig. 4.

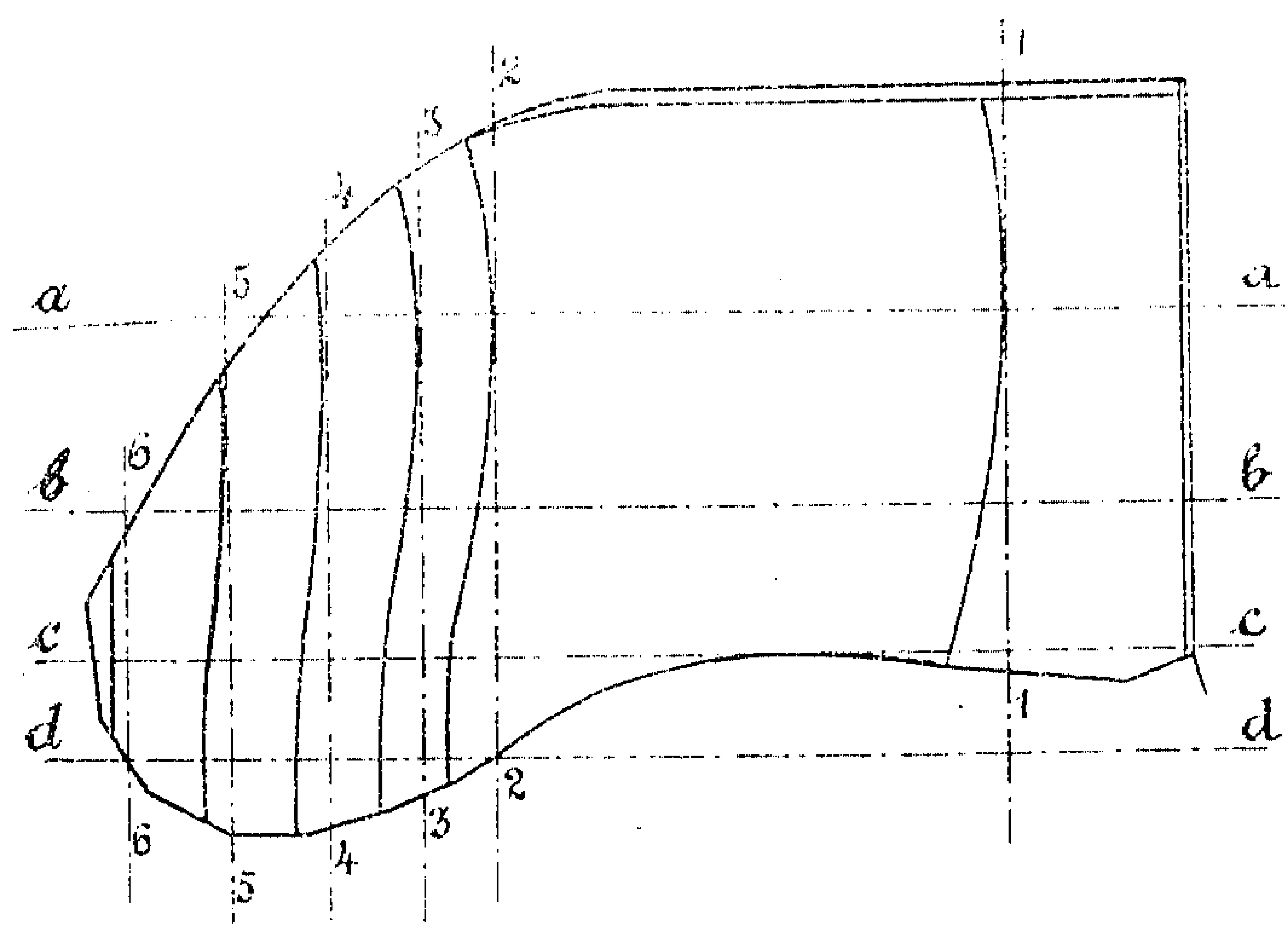
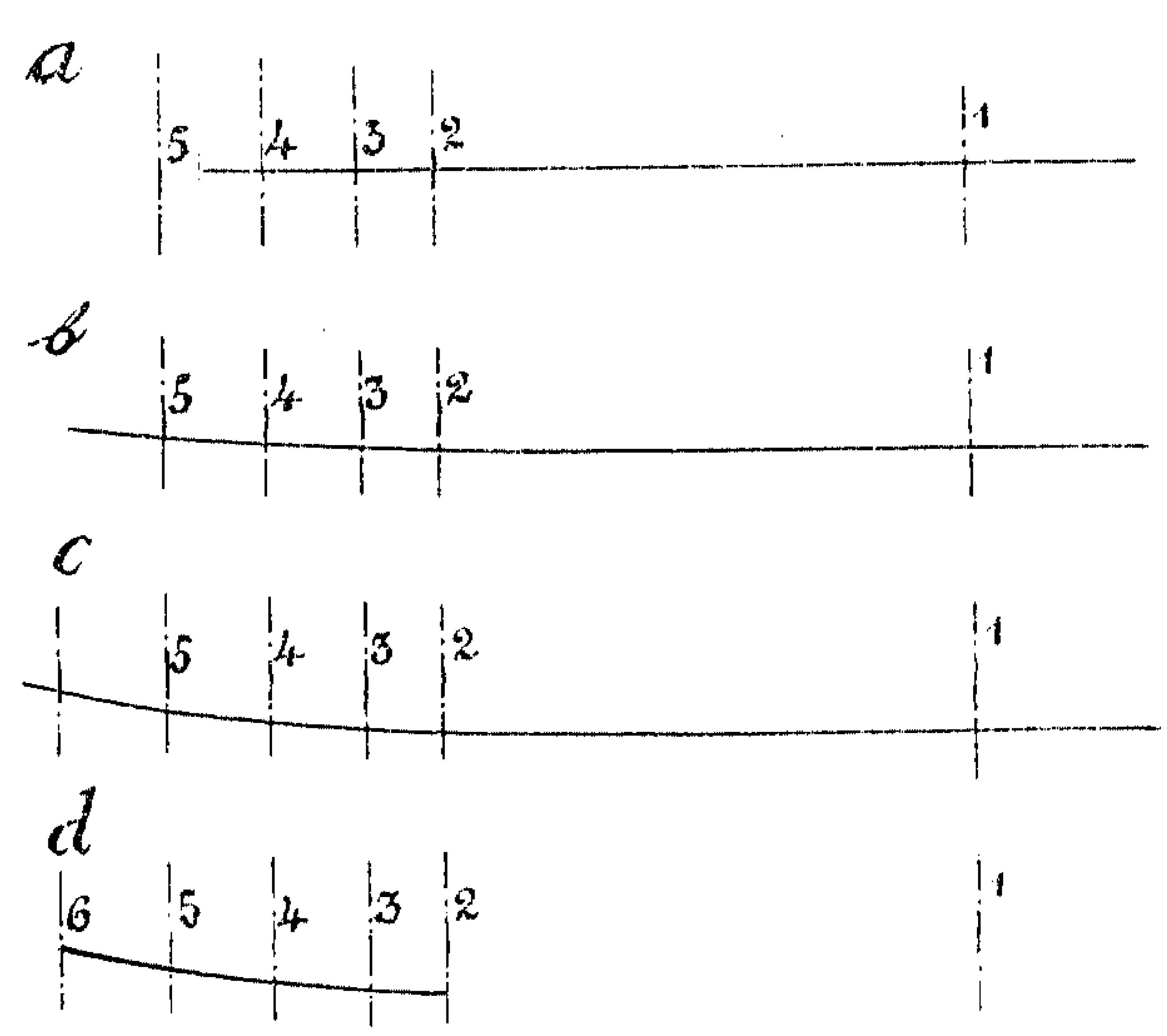


Fig. 5.



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UNITED STATES PATENT OFFICE.

IGO ETRICH, OF VIENNA, AUSTRIA-HUNGARY.

SUPPORTING-SURFACE FOR FLYING-MACHINES.

983,697. Specification of Letters Patent. Patented Feb. 7, 1911.

Application filed August 12, 1910. Serial No. 576,853.

To all whom it may concern:

Be it known that I, IGO ETRICH, a subject of the Emperor of Austria-Hungary, residing at Vienna, Empire of Austria-Hungary, have invented certain new and useful Improvements in Supporting-Surfaces for Flying-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object a supporting surface for flying-machines, the central portion of which is as usual substantially uniformly curved throughout its length, that is to say, all sections through such central portion parallel to the vertical plane of symmetry are concave downward while the vertical sections of the central portion at right angles to the vertical plane of symmetry are straight lines. This central portion, the front edge of which is at a higher level than its rear edge merges into end portions in which the sections parallel to the vertical plane of symmetry are approximately straight and horizontal lines at the extreme outer ends while as such sections approach the central portion of the supporting surface a gradually increasing front part of such sections is concave downward and a gradually diminishing rear part of them is approximately straight and horizontal. The sections of these end portions at right angles to the vertical plane of symmetry of the supporting surface are in the front part of the same straight lines while in the rear part of the end portions they are convex downward rising towards their outer ends. Thus the curved central portion of the supporting surface merges gradually into the rear approximately plane part of the end portions. By thus shaping the supporting surface a very favorable flowing off of the air is provided for and the formation of eddies is avoided or reduced to a minimum which greatly increases the stability. For still more perfectly insuring lateral stability the elastic parts of the supporting surface, which normally are in the direction of flight or approximately plane and horizontal, are connected by wires in a well known manner to wires or ropes running over guides arranged above and below the supporting surface on rods on both sides of the vertical plane of symmetry, such wires or ropes running to the car. By pulling one of the wires or ropes connected to one end portion of the supporting surface and slackening the other wire or rope connected thereto the curvature of this end portion may be varied at will for the purpose of side steering or stabilizing.

One form of the invention, in which the improved supporting surface is applied to a monoplane, is illustrated in the accompanying drawing in which:

Figure 1 is a plan. Fig. 2 is a front elevation, and Fig. 3 a side elevation. Fig. 4 shows one half of the supporting surface with the sections on the lines I, I; II, II; III, III; IV, IV; V, V and VI, VI. Fig. 5 shows the sections on the lines *a*, *a*; *b*, *b*; *c*, *c* and *d*, *d* of Fig. 4.

The supporting area has a straight leading edge 1 and a rear edge 2 as shown in the drawing—a bird-like tail 3 extends rearward from the middle of the rear edge and widening somewhat toward the rear in the well known manner. The two ends of the rear edge are preferably first of all curved rearward and outward and then forward and inward so that apart from the tail, the supporting surface has the shape of a symmetrical trapezium in plan, upon the mutually inclined opposite sides of which, end portions 4 extending rearward beyond the rear edge and approximately semi-elliptical in form are arranged.

The sections parallel to the vertical plane of symmetry of the supporting surface rise from the front edge to a ridge line 5 perpendicular to the said plane of symmetry and are slightly concave downward and run from this ridge line in the end portions approximately straight and horizontal that is to say in the direction of flight and more toward the central portion of the supporting surface slightly downward, while in the central portion of the supporting surface the said sections descend from this ridge line with slight concavity toward the rear edge 3 which is located somewhat lower than the front edge. The shape of these sections is clearly seen from Fig. 4. The vertical sections of the supporting surface perpendicular to the plane of symmetry are approximately horizontal and straight in the central portion but are slightly curved upward in the end portions 4 so that the central portion of the supporting surface merges gradually into the end portions as shown in Fig. 5. It will be noted that in

the normal position none of the points of the supporting surface is at a higher level than the straight horizontal ridge line 5.

The tail 3, the construction and arrangement of which is well known in the art is plane and in its normal position is located coaxially with the propeller and its inclination relatively to the supporting surface is positively adjustable by means of a suitable device 29, such as a screw for example, in such a manner that the entire surface of the tail acts as an elevating rudder. The lateral rudder 7 is arranged in the well known manner on the end of the tail serving as the elevating rudder; on the vertical axis of rotation of this rudder 7 is arranged a wheel 30 for preventing the said rudder from coming into contact with the ground.

As usual the supporting surface consists of material arranged on suitably stayed ribs and is carried by lattice work, the middle part or car 8 of which carries the motor 9 with seats 21, 22 and supplies, while the aerial propeller 10 is mounted as usual at the front end of the car.

By means of a special device it is possible to alter the curvature of the end portions 4 of the supporting surface relatively to its central portion. At both sides of the plane of symmetry rods 11 extend from the ridge line 5 in these end portions upward and downward at the ends above and beneath the supporting surface and these rods carry rollers 12 and 12^a. The rear ends of the resilient ribs 13 of each of the lateral parts 4 which are in the direction of flight and are set obliquely relatively to the front edge of the supporting surface and diverge rearward fanwise and which are stayed relatively to each other laterally by auxiliary ribs 25 are connected by wires with wires or cables 14 and 14^a running over the roller 12 and 12^a of the corresponding rod 11 and carried over suitably mounted guide rollers 15 to appropriate adjusting devices in the car. By tightening the upper cable 14 and slackening the lower cable 14^a the rear ends of the ribs 13 of the respective end portions 4 of the supporting surface can be raised and by slackening the upper cable 14 and tightening the lower cable 14^a they can be depressed. Lateral stability is therefore obtained owing to the fact that the ribs 13 of the end portions 4 present plane elastic extensions at their rearward part, which extensions normally lie in the direction of the flight and can be bent upward and downward as desired by the aviator, whereby the curvature of the end portions may be varied at will and the warping of the supporting surface and the rotary moment thereby produced is avoided. The curvature of the end portions 4 can therefore be altered independently of each other thereby facilitating maneuvering and insuring stability in side winds.

The usual running wheels 16 and 17 are mounted on the under side of the frame and on the extensions of the rods 11 extending beneath the supporting surface supporting wheels or casters 18 are mounted; in starting or coming to ground these casters encounter the ground before the supporting surface can come into contact with it so that they prevent injury to the frame and supporting surfaces. The front wheels 16 and 17 are mounted in the well known manner in frames 19 rotatable at 20 on the frame work and which can be resiliently mounted on the frame work of the aeroplane by means of springs or compressed air cylinders.

From the bottom of the car 8 two rods 35 proceed on both sides to the rods 11 which are stayed relatively to the supporting surface by vertical stays 26 and 27 and by means of suitable wire connections enabling a bridge construction which has heretofore been only possible with biplanes to be employed for a monoplane.

The supporting surface shown in the drawing comprises three parts which are detachably connected one with the other along the straight lines 23 and 24 parallel with the vertical plane of symmetry. If the monoplane is to be transported on land the supporting surface is disconnected along the lines 23, 24 and the outer parts are arranged in a vertical position on the middle part along the lines 23, 24. The monoplane can then travel similarly to an automobile on the wheels 16 and 17 and can be steered by the wheel 30.

Claims:

1. In a supporting surface for flying machines the combination of a central portion, the sections of which in planes parallel to the vertical plane of symmetry are concave downward throughout, the front edge of such central portion being at a higher level than its rear edge but at a lower level than the ridge line while the sections of such central portion in vertical planes perpendicular to the said plane of symmetry are substantially straight lines, and of end portions the sections of which in planes parallel to the vertical plane of symmetry of the supporting frame are substantially straight and horizontal in the extreme ends of the said end portions in substantially the level of the ridge line while such sections nearer to the said central portion are concave downward in their front part and gradually merge into substantially straight and horizontal lines to the rear, the sections of the said end portions in vertical planes perpendicular to the vertical plane of symmetry of the supporting surface being convex downward rising from the central por-

tion outward, substantially as and for the purpose described.

2. In a supporting surface for flying machines the combination of a central portion, the sections of which in planes parallel to the vertical plane of symmetry are concave downward throughout, the front edge of such central portion being at a higher level than its rear edge but at a lower level than the ridge line while the sections of such central portion in vertical planes perpendicular to the said plane of symmetry are substantially straight lines, and of end portions the sections of which in planes parallel to the vertical plane of symmetry of the supporting frame are substantially straight and horizontal in the extreme ends of the said end portions in substantially the level of the ridge line while such sections nearer to the said central portion are concave downward in their front part and gradually merge into substantially straight and horizontal lines to the rear, the sections of the said end portions in vertical planes perpendicular to the vertical plane of symmetry of the supporting surface being convex downward rising from the central portion outward, with a car carried by the supporting surface, rods secured in the supporting surface on both sides of the vertical plane of symmetry, guides on such rods above and below the supporting surface, ropes passing over such guides to the car and wires connecting such ropes to points of the rear edge of the end portions of the supporting surface whereby the curvature of each of the said end portions may be varied at will, substantially as and for the purpose described.

In testimony whereof, I affix my signature, in presence of two witnesses.

IGO ETRICH.

Witnesses:
ARTHUR BAUMANN,
AUGUST FUGGER.