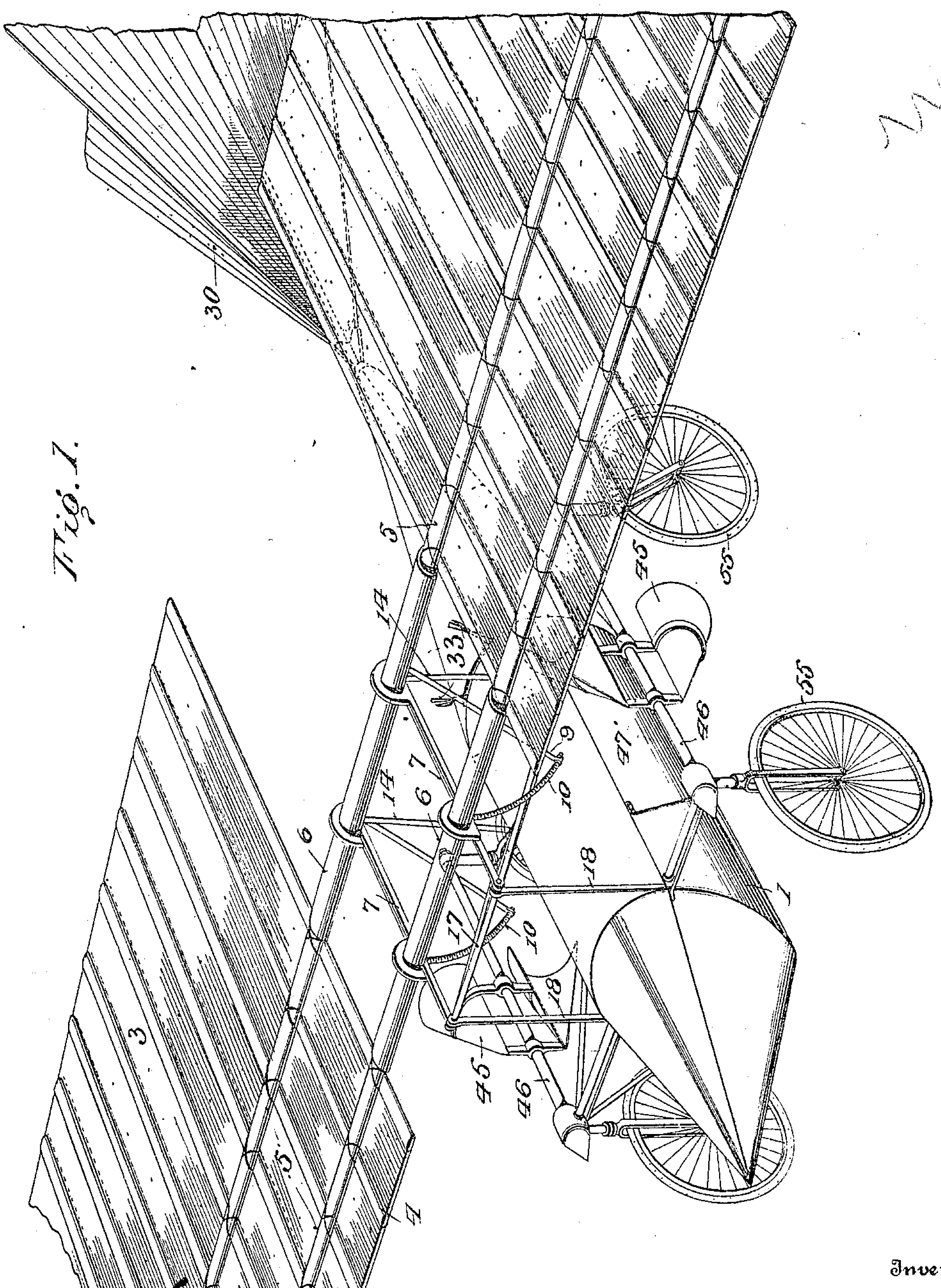
J. L. NICHOLS.
AERIAL NAVIGATION.
APPLICATION FILED OCT. 26, 1909.

991,528. Patented May 9, 1911.

5 SHEETS—SHEET 1.

Fig. 1.



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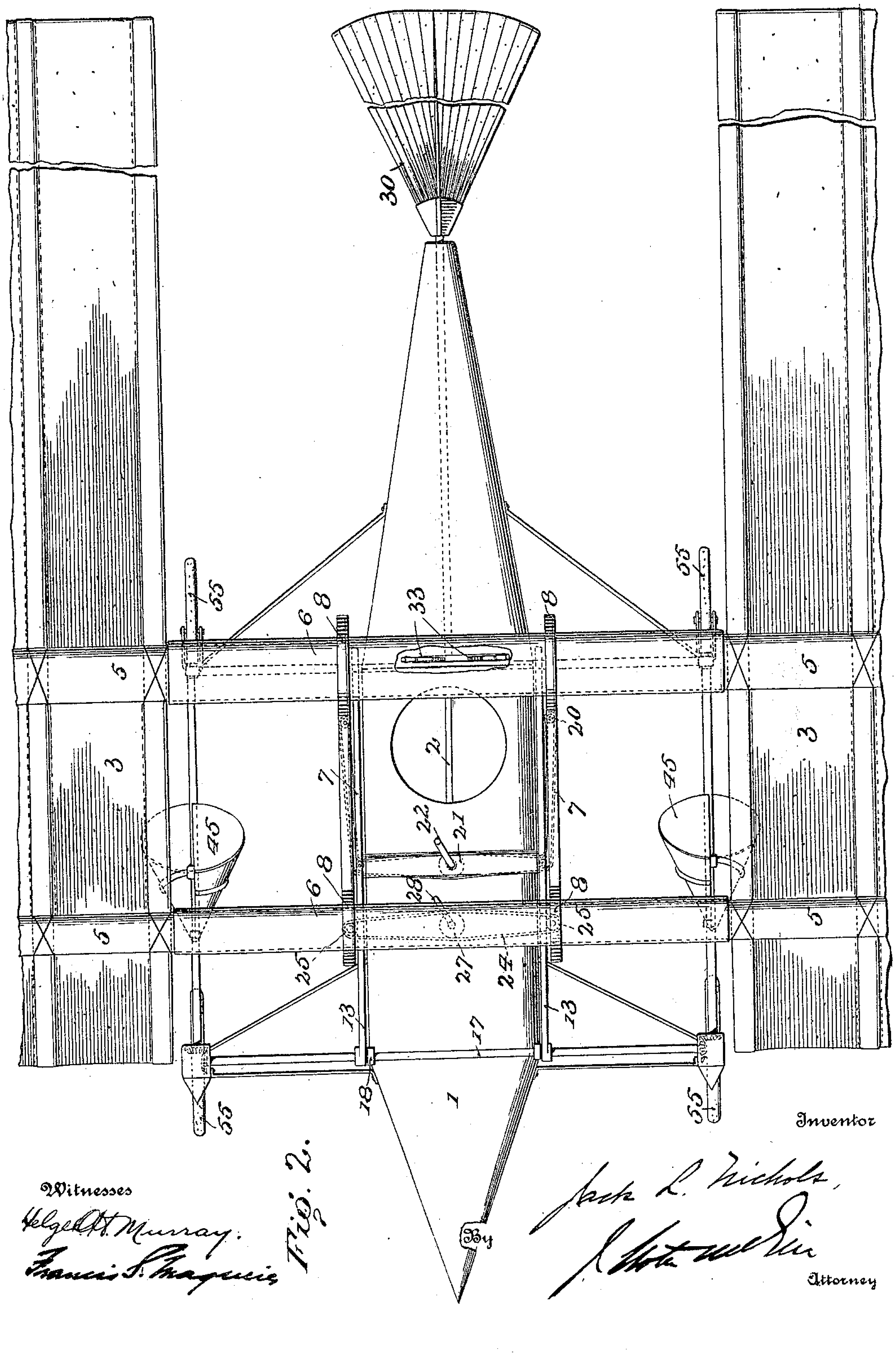

Fig. 2.

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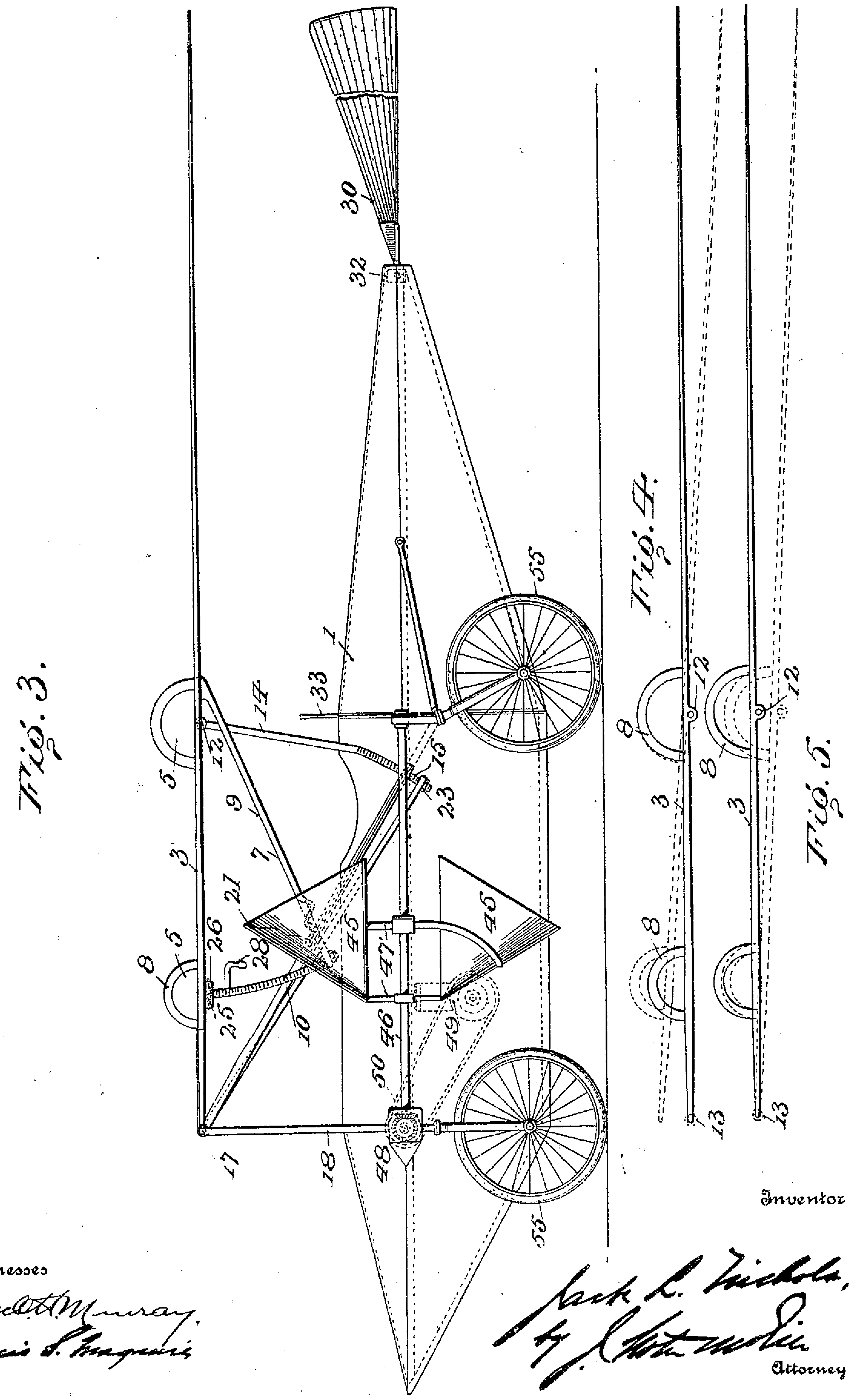

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5 SHEETS—SHEET 4.

Fig. 6.

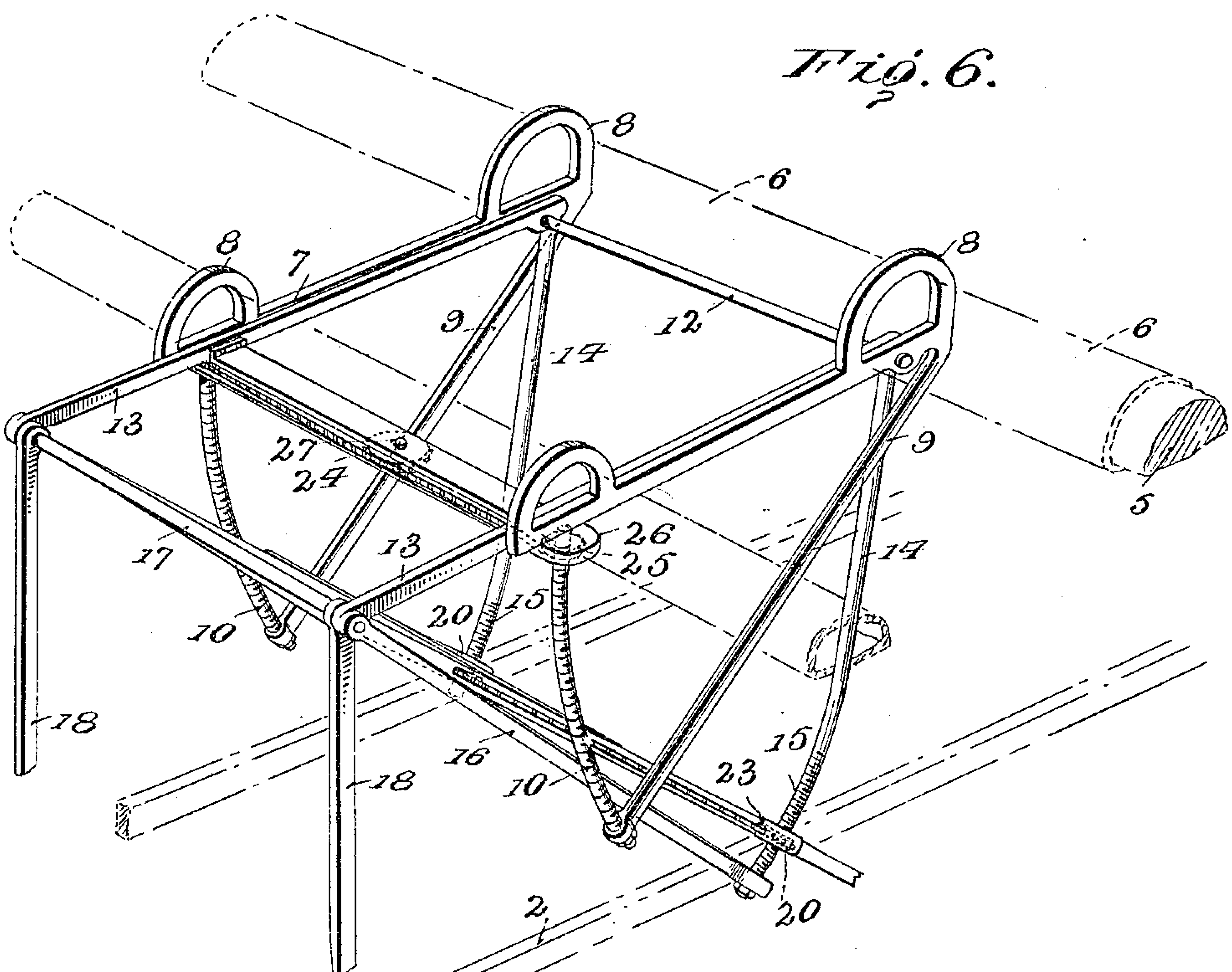


Fig. 7.

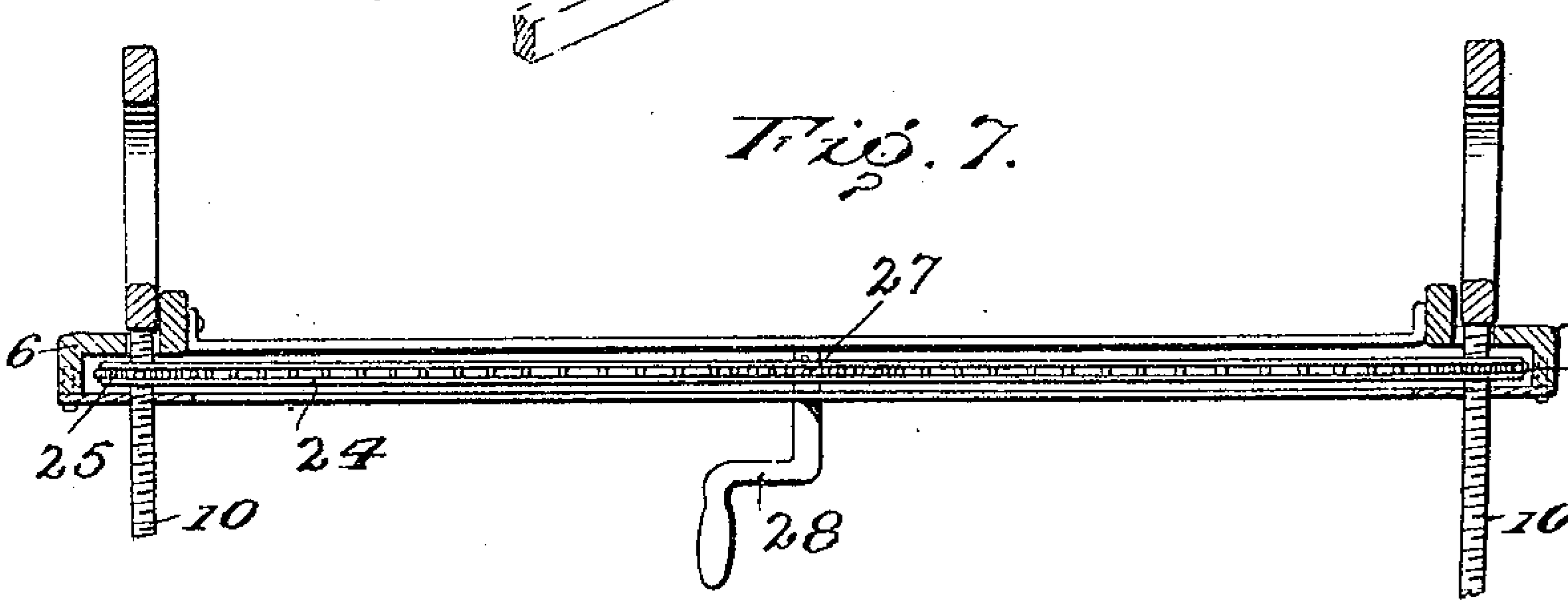
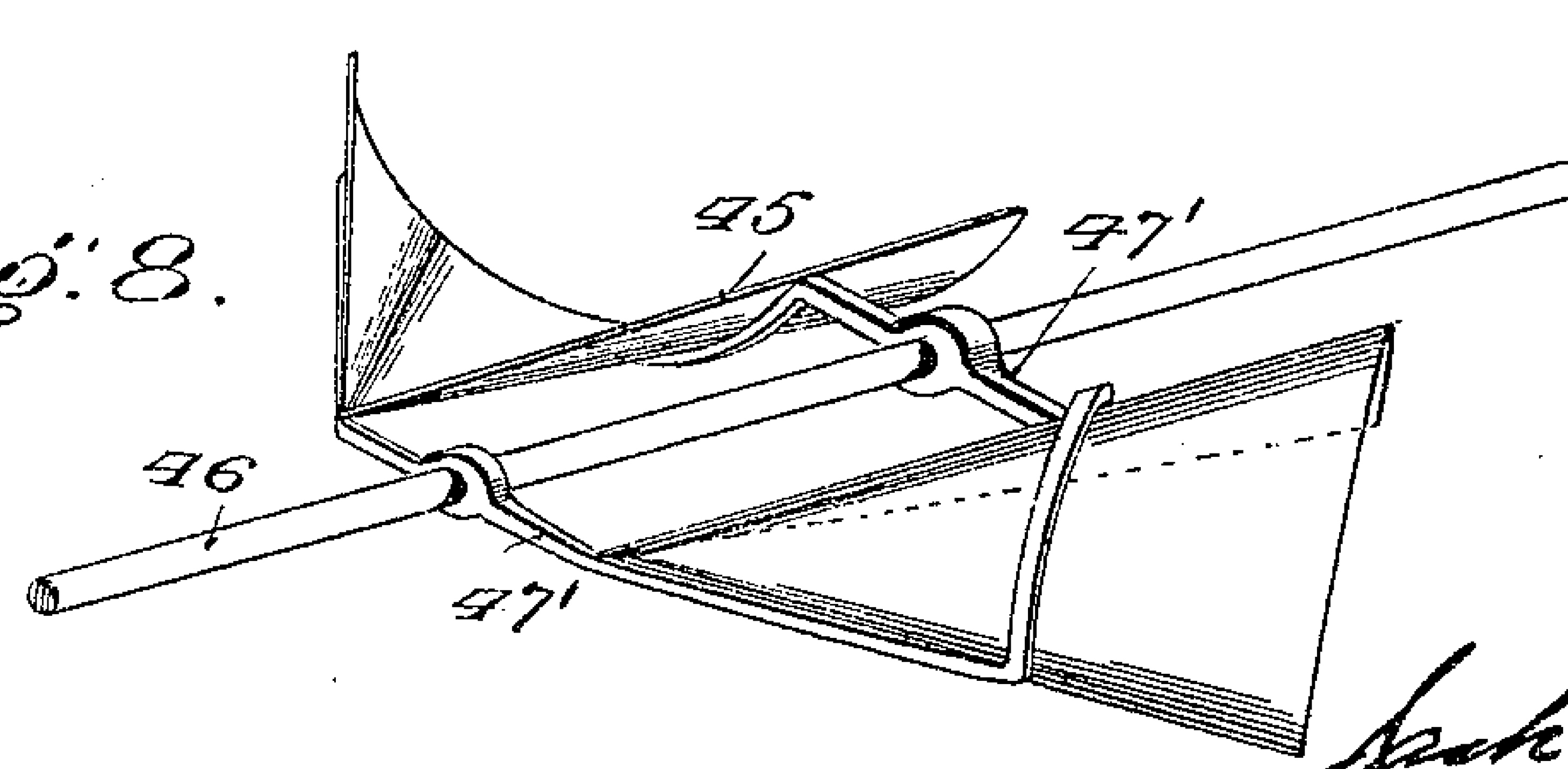


Fig. 8.



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5 SHEETS—SHEET 5.

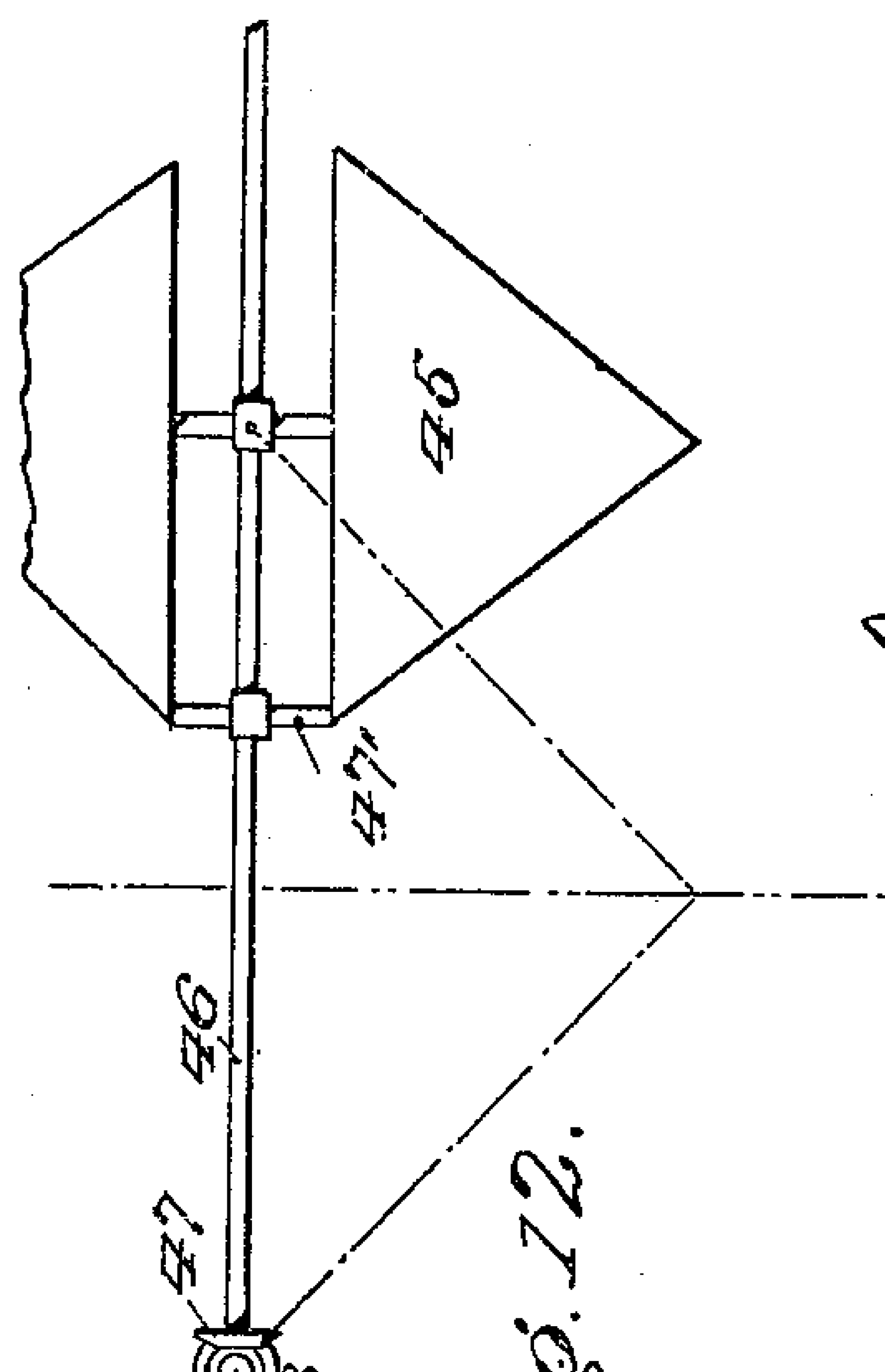

Fig. 12.

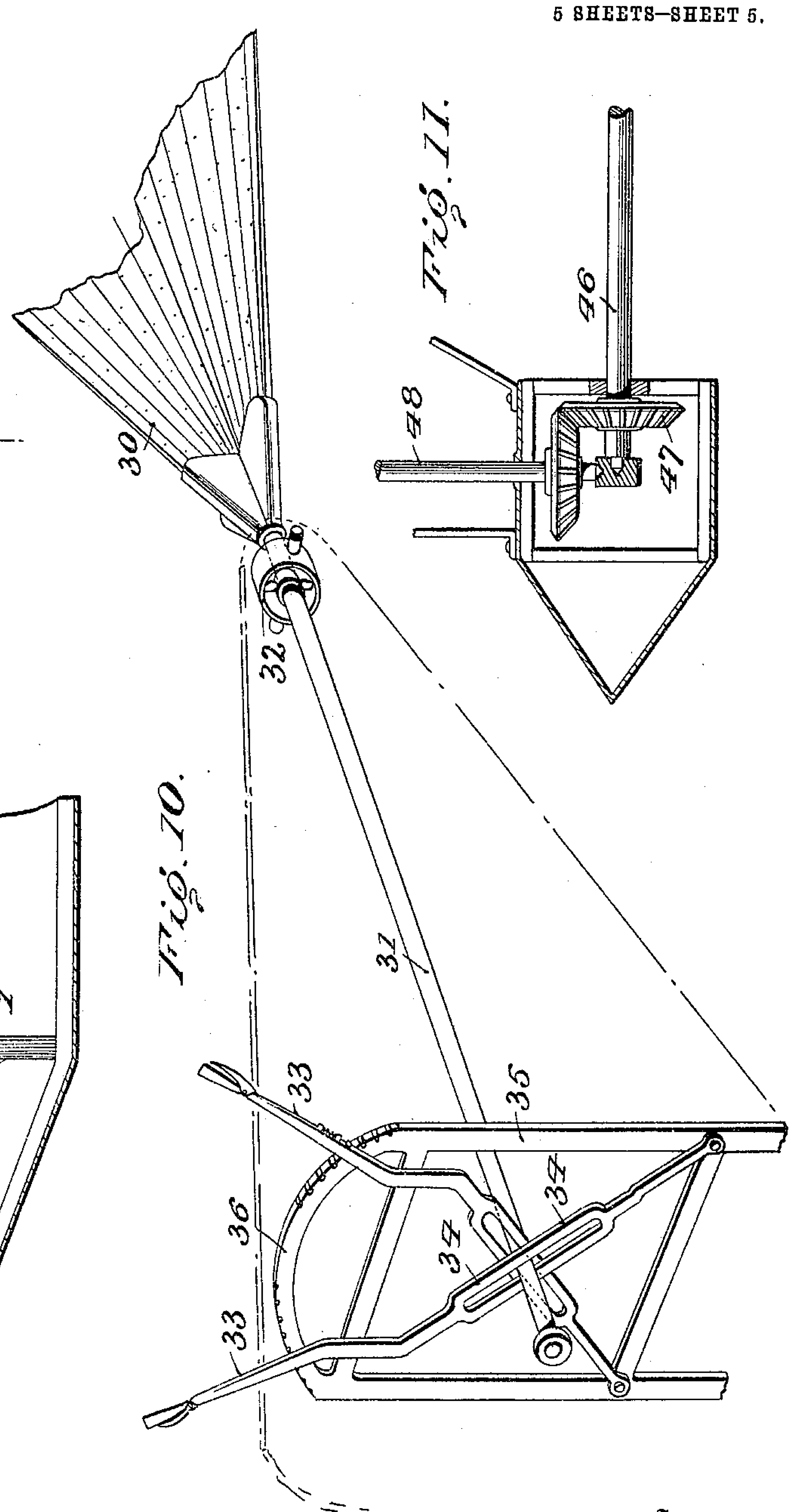

Fig. 11.

Fig. 10.

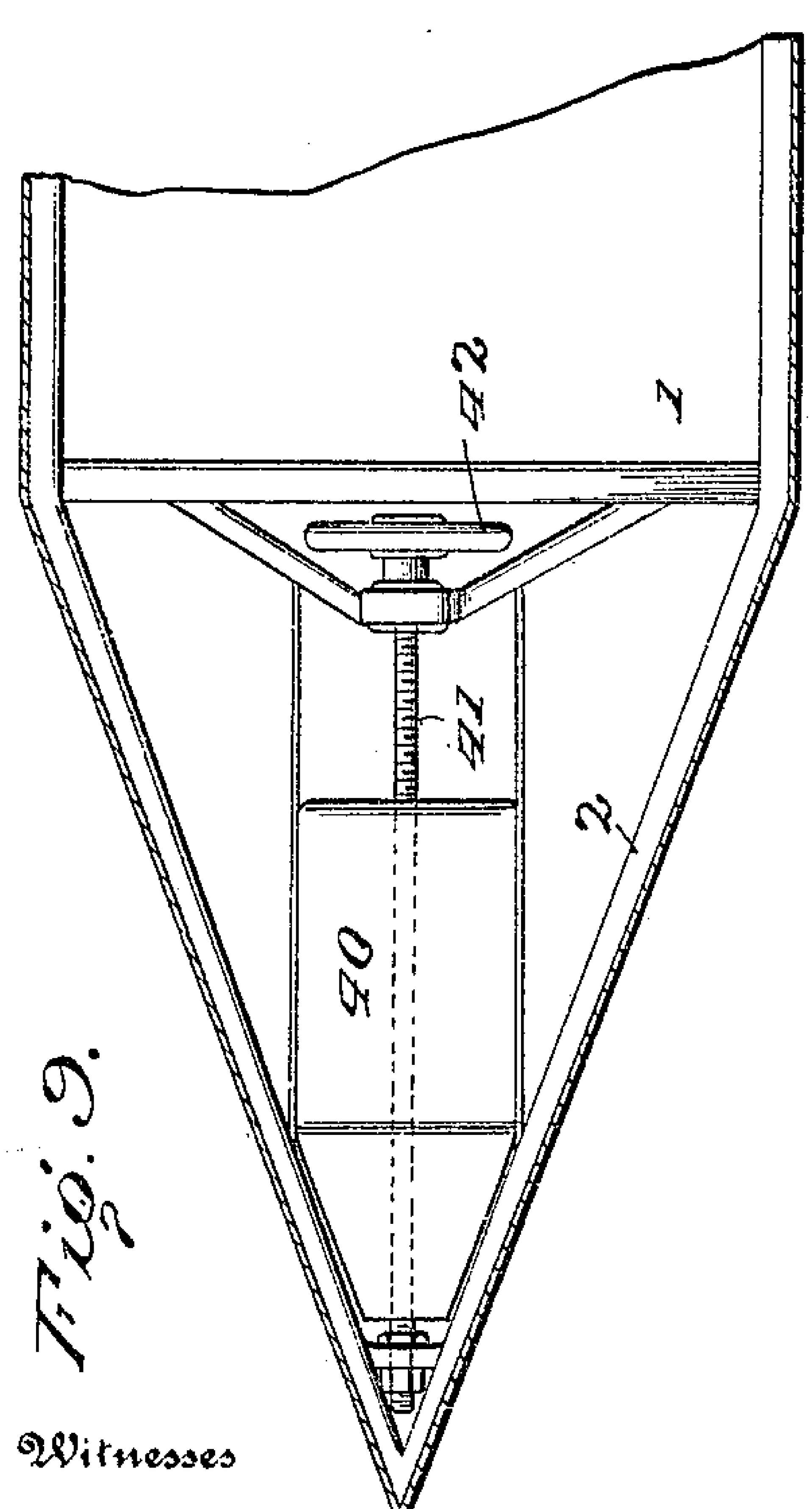

Fig. 9.

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UNITED STATES PATENT OFFICE.

JACK LLOYD NICHOLS, OF BELTON, TEXAS, ASSIGNOR OF ONE-FOURTH TO ALBERT LEE JACKS AND ONE-EIGHTH TO ROBERT LEE WILLIS, BOTH OF BELTON, TEXAS.

AERIAL NAVIGATION.

991,528. Specification of Letters Patent. Patented May 9, 1911.

Application filed October 26, 1909. Serial No. 524,615.

To all whom it may concern:

Be it known that I, JACK LLOYD NICHOLS, of Belton, in the county of Bell and State of Texas, have invented certain new and useful Improvements in Aerial Navigation; 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.

The primary object of this invention is to provide an aerial machine wherein the center of gravity will be practically uniform under all conditions. And further objects are to provide, in aerial navigation, means for readily and easily controlling the ascent and descent of the machine; to control the direction of flight thereof; to provide improved propelling mechanism capable of imparting a maximum degree of power; to so locate the propellers relatively to the driving agency as to off-set the reaction of one by the other; to have all the controlling means within easy reach of the operator; and to generally improve and simplify the construction and operation of aerial machines, and to provide one which may be constructed and maintained at a comparatively small cost.

The invention will be hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in perspective, portions of the planes being broken away. Fig. 2 is a plan view with parts broken away. Fig. 3 is a view in side elevation. Figs. 4 and 5 are diagrammatic views. Fig. 6 is a view in perspective of the mechanism for supporting the aeroplanes. Fig. 7 is an enlarged view of the means for tilting the planes on their support. Fig. 8 is a view in perspective of one of the propellers. Fig. 9 is an enlarged view, partly in section, of the front end of the car, showing the counterbalancing weight. Fig. 10 is a view in perspective of the rudder and the operating means therefor, a portion of the rudder being broken away. Fig. 11 is an enlarged view of the gearing between the motor driven shaft and a propeller shaft. Fig. 12 is a diagrammatic view of one of the propellers showing its location relative to the motor.

Referring to the drawings, 1 designates the car or cage which may be of any preferred formation in general outline, but which I have shown shaped like a torpedo since less material is required in its construction and it affords a minimum of resistance. I have shown the car as composed of a suitable internal frame 2 and an exterior covering, but any arrangement which will afford the necessary strength commensurate with the desired lightness may be employed.

3, 3, designate the aeroplanes which are located above and extend laterally from the car, the length of such aeroplanes being about double their width. These planes are preferably composed of a series of spaced-apart transverse ribs 4 to which sheeting of any suitable material may be secured, said ribs being attached to two parallel bars 5 which run longitudinally of the planes and extend beyond the inner ends thereof so as to be connected with keepers 6 superposed on the car. I have shown the keepers in the form of semi-cylindrical bars open at their ends and designed to receive the inner ends of bars 5, which latter, in cross section, conform to the contour of the keepers.

The keepers 6 are directly secured to two corresponding frames 7 having loops or arches 8 to accommodate said keepers, although the latter may be secured to the frames in any preferred manner. The frames 7 are of approximately triangular formation, being composed of an upper horizontal member carrying the arches 8, and a diagonally arranged bracing member 9 which at its lower forward end is connected by a threaded rod 10 to the forward end of the horizontal member, said rod 10 being slightly curved.

The frames 7 are pivotally hung, preferably by a cross rod 12, to two corresponding frames 13, which, like frames 7, are of approximately triangular formation. These frames 13 are composed of upper horizontal members which, at or near their rear ends, support the pivot rod 12 of the frames 7, and from such rear ends depend rods 14 which, near their lower ends, are slightly deflected and formed with external screw threads 15. The lower ends of rod 14 are connected by brace bars 16 to the forward ends of the horizontal members. These frames 13 are themselves pivotally mounted at their upper forward ends on a cross-rod

17 supported by two uprights 18 carried by the car.

I contemplate swinging the pivoted frames 13 on their pivot rod when it is desired to raise or lower the rear ends of the aeroplanes 3; and I also contemplate pivoting each of the aeroplanes, intermediate the forward and rear ends thereof, so that their front and rear edges may be moved in opposite directions. Thus by swinging frames 13 on their pivots the planes may be raised or lowered on centers in line with their forward edges, as shown in Fig. 5. Any suitable means may be employed for swinging frames 13, but I have shown for this purpose an endless chain 19 (see Fig. 2) engaging two nuts 20 on the threaded portions 15, said chain engaging a sprocket wheel 21 which may be readily turned by the operator through a crank 22. The nuts 20 are located in keepers 23 which project from some fixed part of the car.

As shown diagrammatically in Fig. 4, the aeroplanes may be swung on individual axes intermediate their forward and rear ends through the swinging of frames 7 on pivots 12, the frames 13 remaining fixed. The swinging of frames 7 may be accomplished by any suitable means. I have shown, for this purpose, an endless sprocket chain 24 engaging nuts 25 working on the threaded portions of rods 10, said nuts 25 being located in keepers 26 projecting laterally from pivoted frames 13. Chain 24 engages a centrally-located sprocket-wheel 27 which may be readily turned through crank shaft 28. The turning of the planes on their intermediate pivots is for the purpose of controlling the descent of the machine, the portions of the planes forward of their pivots serving to retard the descent by the resistance of the air against their undersides. The degree to which the planes may be thus tilted is within the control of the operator, being effected by the turning of wheel 27. In ascending the planes are usually rearwardly inclined, as shown in Fig. 5, by swinging frames 13 on their pivots; and likewise when a quick descent is desired the planes may be upwardly inclined by being raised at their rear ends. The inclinations of the wings from or toward their forward ends is controlled wholly by the turning of wheel 21.

30 designates the rudder which I have shown as having a horizontal fan-like portion and a vertically disposed web-portion arranged centrally of and at right angles to the horizontal portion. By this formation the control of the direction of the car is easily maintained. The horizontal and vertical portions of the rudder are preferably composed of spaced apart ribs covered with suitable material. The rudder is mounted on the rear end of a shaft 31 located longitudinally within the rearwardly extended portion of the car, said shaft 31 being mounted in a universal bearing 32 at the rear end of the car to permit the shaft to be turned in any desired direction. Any suitable means may be employed for controlling the rudder shaft, but for this purpose I prefer to use two separate levers 33, having longitudinal slots 34, the slotted portions of the two levers crossing each other, such slots at such points of crossing receiving the forward end of the rudder shaft. The levers 33 are fulcrumed at their lower ends to a frame 35 within the car, which frame at the top has a curved rack bar 36 with which engage known retaining pawls carried by the handle-ends of the levers. The rudder and its shaft are equally balanced at the universal bearing 32 so that no change in position of the rudder will unduly throw the car out of balance or change the center of gravity of the machine.

For the purpose of controlling the center of gravity I mount within the forward end of the car a weight 40 which, as shown in Fig. 9, is located between parallel guideways and is capable of being shifted forward or rearward by the turning of a threaded rod 41 passed longitudinally through the weight, said rod 41 having at its rear end a turning wheel 42.

45, 45, designate the propellers which are located at the sides of the car, beneath the aeroplanes. They are designed to be rotated on planes at right angles to the car on axes parallel with the latter. It has been one of the objects of my invention to so form the propellers as to secure a maximum of power for driving the car, and also to so locate the propellers relatively to the driving agency as to off-set the reaction of the latter. I have shown each propeller as composed of two oppositely set blades, but the exact number is immaterial. Each of these blades is shown as being triangular and of concavo-convex formation, as clearly indicated in Figs. 3, 5 and 12, the distances between the several points being equal. One of the edges of each blade is positioned on a line parallel to its operating shaft 46 to which the blades are secured by arms or spiders 47′. I have found that best results are obtained by setting each blade away from its shaft to an extent equal to one-fourth the length of the side of the blade. The inner edge of one blade is on almost exactly the same plane as the inner edge of the opposite blade so that uniformity in action is secured. By thus forming the propeller blades I am enabled to obtain the maximum of power, and the blades so coöperate that any reaction on the part of one is off-set by the other. The propeller shafts 46 are located outside of the car, being suitably supported, and at their forward ends these shafts are driven by beveled gearing 47 (see Fig. 11), from an engine driven shaft 48 located transversely of the car and extending

48

through the inclosing casing thereof. The beveled gearing 47 is preferably incased, as shown in Fig. 11. Any suitable motor for driving shaft 48 may be employed. I have conventionally indicated a motor at 49, Fig. 3, from which power is transmitted to shaft 48 by a chain or belt 50. It will be observed that the motor is located forward of the propellers. The object of this is to have the propellers off-set the reaction of the driving power as communicated to shaft 48. I do not limit myself to any exact location of the motor beyond positioning it forward of the transverse centers of the propellers. This will be clearly understood by the diagrammatic view, Fig. 12. The motor may be located at any point on a radius from the engine-driven shaft 48 within planes of a right angle formed between such shaft and the transverse centers of the propellers. Thus it will be seen that any tendency of the application of power to shaft 48 to cause the machine to turn upwardly at its forward end is counterbalanced by the action of the propellers.

I have shown the car as having carrying wheels 55 by which it may be transported on the ground in starting and landing.

The advantages of my invention will be apparent to those skilled in the art to which it appertains. By means thereof the ascent and descent of the car, as well as the direction of travel, may be readily and easily controlled, and not only am I enabled to secure high driving power, but all danger of the equilibrium of the car being destroyed is obviated by the fact that the reaction of the driving agency is off-set by the propellers, and vice versa. I am also enabled to secure a maximum of speed without interfering with the level of the car by reason of the fact that the points of connection between the engine-driven shaft and the propeller shafts are directly beneath or on line with the forward edges of the aeroplanes, and this advantage is maintained even when such planes are tilted by turning frames 13 on their pivots. The turning of the planes either on the pivots of frames 13, or on the intermediate pivots 12 may be easily and readily effected by the operator. It will also be observed that the rudder may be readily adjusted and held in any desired position, and that the propeller blades are so formed as to secure an even and uniform action and a maximum power.

I claim as my invention:—

1. An aerial machine comprising a car, aeroplanes extending laterally therefrom, propellers located on opposite sides of the car beneath the aeroplanes, a driving agency for revolving the propellers on planes at right angles to the car, and a driven shaft, forward of and driven by the driving agency, such driven shaft operating said propellers, and such driving agency being located forward of the transverse centers of the propellers.

2. An aerial machine comprising a car, aeroplanes extending laterally therefrom, propellers located on opposite sides of the car beneath the aeroplanes, shafts for said aeroplanes paralleling the sides of the car, a motor, a shaft driven by said motor located transversely of the car forward of the motor, and gearing between said driven shaft and the propeller shafts, said motor being located forward of the transverse centers of the propellers.

3. In an aerial machine, oppositely extended aeroplanes, frames to which said aeroplanes are connected at their inner ends, means for tilting such frames at the forward ends of the planes, and means for tilting the planes on axes in rear of the pivots of the frames.

4. In an aerial machine, oppositely extended aeroplanes, a frame to which the inner ends of the planes are connected, said frame being capable of being tilted on axes in rear of the forward ends of the planes, a second frame carrying the first mentioned frame, and means for tilting such second frame on axes adjacent to the forward ends of the planes.

5. In an aerial machine, oppositely extended aeroplanes, means for tilting such aeroplanes on axes adjacent to their forward ends, oppositely disposed propellers located beneath the planes and revoluble transversely of the machine, a motor, a shaft driven by such motor and located, when the machine occupies a horizontal position, in the same vertical plane as the axes of said planes, and propeller shafts actuated by said motor driven shaft.

6. In an aerial machine, oppositely extended aeroplanes, means for tilting such aeroplanes on axes adjacent to the forward ends of the planes, oppositely disposed propellers located beneath the planes and revoluble transversely of the machine, a shaft driven by said motor, and parallel shafts for said propellers geared to said motor driven shaft, the last mentioned shaft being, when the machine occupies a horizontal position, in the same vertical plane as the axes of said tilting means.

7. In an aerial machine, a car or cage having forward uprights and oppositely-extended aeroplanes, frames for supporting said aeroplanes, means pivotally connecting the forward ends of said frames to said uprights, and means engaging said frames for adjusting the positions thereof and thereby regulating the positions of the aeroplanes.

8. In an aerial machine, a car or cage having forward uprights and oppositely-extended aeroplanes, frames for supporting said aeroplanes, means pivotally connecting

the forward ends of said frames to said uprights, said pivoted frames having threaded portions, nuts working on said threaded portions, an endless chain for engaging said nuts to effect the adjustment of said frames and the aeroplanes, and means for operating said chains.

9. In an aerial machine, a car or cage, a frame mounted thereon, oppositely-extended aeroplanes, frames to which said aeroplanes are connected, said latter frames being pivoted to the first mentioned frame, and means for adjusting the positions of said pivoted frames.

10. In an aerial machine, a car or cage, a frame mounted thereon, oppositely-extended aeroplanes, frames to which said aeroplanes are connected, said latter frames being pivoted to the first mentioned frame and having threaded portions, nuts engaging said threaded portions, an endless chain engaging said nuts, and means for actuating said chains.

11. In an aerial machine having a frame, oppositely-extended aeroplanes, frames to which said aeroplanes are connected, said frames being of approximately triangular formation and having exteriorly threaded portions, means for pivotally connecting said latter frames to the first mentioned frame, nuts engaging said threaded portions, keepers for said nuts carried by the first mentioned frame, an endless chain engaging said nuts, and means for operating such chain.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

JACK LLOYD NICHOLS.

Witnesses:

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FRANCIS S. MAGUIRE.