

DRAWINGS ATTACHED

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(54) MAN-POWERED FLYING MACHINE

(71) I, CHARLES ALFRED GILHAM, a British subject of 197 Tubbenden Lane, Orpington, Kent, England do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to manpowered flying machines.

For some time now, efforts have been made to produce a manpowered flying machine but most of these endeavours have been directed to flying machines of conventional type having a fuselage and wings to provide the lift when the machine is driven forward by a pedal powered driving means, such as one or more propellers.

The present invention however is not concerned with flying machines of this type but more with those of the helicopter type.

According to the invention, a manpowered flying machine comprises an airframe provided with an overhead rotor adapted to provide both vertical lift and forward thrust for the machine and a second rotor at the tail of the airframe for steering the machine, the overhead and second rotors being drivable through a drive train by means of power provided, in use, by the rotation of a set of pedals.

Preferably the overhead rotor comprises two blades attached to a hub, the blades rotating in a substantially horizontal plane for landing and take-off. However more than one pair of blades can be provided.

In the preferred construction the set of pedals, is rotated by the legs of the person flying the machine. Although it is preferable to have the pedals driven by the legs of the pilot, it may be more convenient to make them so that they can be rotated manually.

A preferred construction of a flying machine of the invention will now be described by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 is a general side view of the flying machine of the invention,

Fig. 2 shows means for varying the pitch of the tail rotor blades,

Fig. 3 is a view similar to Fig. 2 but with the lever 11 moved from its normal position, the tail rotor hub being viewed from above when the rotor blades are vertical,

Fig. 4 is a diagrammatic drawing showing how the inclination of the tip path plane of the overhead rotor can be varied,

Fig. 5 is a diagrammatic drawing showing how the pitch of the overhead rotor can be varied, and

Fig. 6 is a simplified schematic diagram of the driving mechanism for the overhead and tail rotors.

Referring to Fig. 1 of the drawings, there is shown a flying machine which comprises a main structure made from a number of suitably shaped struts 22 to form a cabin portion which may be open or enclosed by any suitable transparent material. The airframe in the preferred embodiment is made from light alloy and the struts are rivetted together. Any other suitable light material could however be used and the struts can be welded together if required.

The dome shaped cabin rests on a pair of skids 23 which can be provided with wheels.

At the top of the body structure, a frame 3 supports an overhead rotor 14 having two rotor blades 42 attached to a rotor hub 43. In the flying machine illustrated, two rotor blades are shown but more than two could be attached to the hub. The function of this overhead rotor is twofold, firstly, to provide the necessary vertical lift for the flying machine and secondly to provide the forward thrust.

A tail structure 2 is attached to the cabin portion 4 and a stabilizing or steering rotor is provided at the free end thereof. The drive to this rotor 5 is achieved from a set of pedals 9 suitably mounted in the body structure and powered by the pilot, the pedals being connected to a tail rotor drive shaft 7 by means of a right angled driving mechanism 6, the drive being transmitted to the tail rotor from the

pedals by the shaft 7 via a free wheel mechanism 24 and several universal joints 8 to another right angled drive mechanism 16.

5 The drive for the overhead rotor 14 also comes from this shaft 7 and is transmitted to the rotor by means of a further right angled drive 18, through a shaft 20 including universal joints 19 and 21 to the rotor hub 43 (see Fig. 6).

10 In order to fly the machine, a pilot would sit on seat 10 in the cabin portion which is so positioned above the pedals as to enable the pilot to exert the maximum thrust thereon. The pilot then works the pedals thereby rotating the overhead and tail rotors in synchronism
15 until such time as he feels the rotors are turning at sufficient speed to lift the flying machine off the ground. At this stage, the pilot would increase the pitch of the overhead blades
20 by means of a lever 13 until sufficient lift is created to raise the flying machine into the air. Once airborne, the pilot can achieve, and vary the rate of forward movement by increasing or decreasing the inclination of the tip path
25 plane of the overhead rotor by means of the lever 12 and steer the flying machine by varying the pitch of the blades of the tail rotor 5 by means of a tiller lever 11, this lever being
30 movable in a substantially horizontal plane to either side of its mid position.

In Figs. 2 and 3 there is shown the means whereby the tiller 11 varies the pitch angle of the tail rotor blades. The tiller is substantially 'S' shaped, when viewed in side elevation,
35 and the foot of the tiller is provided with an attachment plate 25. Cables 26 are attached to this plate and pass round jockey pulleys 28 to each end of a T bar 29 which is pivoted
40 at 30 on a plate 31 rigidly attached to the airframe adjacent the tail rotor.

A drive shaft 32 which comes from the right angled drive mechanism 16 passes through a bush 33 to a hub 34 for the tail rotor. A slip ring 35 is fitted round the bush 33 and is free to rotate round the stationary bush. A series of pivoted arms 36, 37 and 38 is provided,
45 the arm 36 being attached to the slip ring 35 and the arm 38 to the tail rotor hub 34. A similar set of arms is provided for the other rotor blade. A flat arm 39 is also slidably-mounted on the plate 31 and one end of this
50 arm is attached to the bush 33, the arm 39 having an upstanding pin 40 which co-operates with an elongated slot 41 in the T bar.

55 The hub 34 is of similar construction to that of the overhead rotor shown in Figure 1 and comprises two first hollow cylinders which are slidably fitted onto the ends of a second cylinder whose outer diameter is the same as or slightly less than the internal diameter of the
60 two first cylinders. The first cylinders can therefore be rotated about the outer surface of the second cylinder. The free ends of each of the first cylinders are provided with two

65 diametrically opposed slots adapted to receive and hold the tail rotor blades.

When the tiller 11 is moved to the position shown in Figure 3, the T bar 29 pivots about the pivot 30 and laterally displaces the arm 39. This movement draws the bush 33 along the drive shaft 32 towards the support plate 31 and this movement of the bush 33 causes the levers 36—38 to be displaced and the pitch angle of one of the tail rotor blades 5 to be
70 changed by turning the first cylinder into which it is fitted about the second cylinder. A set of link levers corresponding to levers 36—38 is provided to vary the pitch angle of the other tail rotor blade 5, these levers being moved simultaneously with the levers
75 36—38.

The manner in which the pitch of the blades of the overhead rotor can be varied is very similar to that of the tail rotor and can be seen in Fig. 5 of the drawings. The rotor
80 blades 42 are each fitted into a slot in opposite ends of a cylinder 44 which itself is slidably fitted around another cylinder 43 to which the drive 20 for the rotors is connected. A series of pivoted arms 45, 46, 47 is provided, the arm 45 being attached to the outer core 44 of the rotor cross shaft 43 and the arm 47 being attached to the top portion of a moving member 48. This portion revolves with the rotor blades while the portion 49 remains stationary,
85 the lower part 50 of the moving member being connected to the upper portion and rotating therewith. The drive shaft 20 for the overhead rotor passes through the moving member 48.

A series of levers 51—55 is connected to the lever 13 so that the pitch of the overhead rotor blades can be varied upon movement of the lever 13. As shown by the chain dotted lines in Fig. 5, when the lever is moved forward,
90 the levers 52—54 move and in so doing, slot 56 in the lever 52 exerts a downward pressure on a pin 57 which is attached to the arm 51 which itself is rigidly fixed to the stationary part 49 of the moving member. The resulting downward movement of the moving member actuates the levers 45—47 with the result that the lever 45 is pulled downwardly. As it is attached to the outer core 44 of the rotor cross shaft and is movable with respect thereto,
95 the outer core 44 with the rotor blades attached thereto is moved as indicated by the arrow and the pitch of the rotor blades varied accordingly. A set of levers 45—47 is of course also provided for the other rotor blade 42, the lever 47 for the other blade also being attached to the upper portion of the moving member 48.

In order that the angle of inclination of the tip path plane of the overhead rotor may be varied, the moving member 48 is pivoted at
100 58. (Fig. 4). An arm 59 is rigidly attached to the moving member at one end and pivotally attached at the other end to another arm
105 120 125

60, whose free end is in turn pivotally connected to the lever 12. As can be seen from the drawing, movement of the lever 12 will tip the entire rotor assembly about the pivot point 58 and so vary the inclination of the tip path plane of the overhead rotor assembly.

The tail rotor 5 can be connected to the tiller 11 by means of a series of rods and this tiller serves not only as a steering mechanism but also to stabilize the flying machine, the thrust of the tail rotor being such as to counteract the tendency of the fuselage to rotate about the axis of the main rotor.

The right angled drives are preferably cast steel bevelled gears although a suitable hard plastics material could be used for these gears. Preferably the driveshafts are steel and revolve in bearings cast in cast metal bodies.

The embodiment described discloses the use of leg powered pedals, but it is within the scope of the invention to make the pedals manually operated with the pilot in the prone position. As the pilot would need to keep both his hands on the pedals at all times, the levers 12 and 13 would have to be made into foot operated controls and the tiller 11 could be incorporated into the pedal unit. An advantage of this system is that the overall height of the flying machine could be considerably reduced with a corresponding saving in the overall weight of the machine.

WHAT I CLAIM IS:—

1. A manpowered flying machine comprising an airframe provided with an overhead rotor adapted to provide both vertical lift and forward thrust for the machine and a second rotor at the tail end of the airframe for steering the machine, the overhead and second rotors being drivable through a drive train by means of power provided, in use, by the rotation of a set of pedals.

2. A flying machine as claimed in claim 1, wherein the second rotor is rotatable in a substantially upright plane.

3. A flying machine as claimed in claim 1 or claim 2, wherein the overhead rotor is rotatable in a substantially horizontal plane for landing and take-off.

4. A flying machine as claimed in any one of the preceding claims wherein the second rotor is mounted on one end of a boom extending from the airframe.

5. A flying machine as claimed in any one of the preceding claims, wherein the drive train includes a universally jointed shaft rotatable by the pedals to drive the second rotor.

6. A flying machine as claimed in claim 5, wherein means are provided in the universally jointed shaft for drivingly engaging a further shaft adapted to drive the overhead rotor.

7. A flying machine as claimed in any one of the preceding claims wherein means are provided whereby the pitch of the blades in the overhead rotor can be varied.

8. A flying machine as claimed in any one of the preceding claims, wherein means are provided whereby the tip path plane of the overhead rotor can be inclined.

9. A flying machine as claimed in any one of the preceding claims wherein means are provided for varying the pitch of the blades of the second rotor.

10. A flying machine substantially as herein described with reference to the accompanying drawings.

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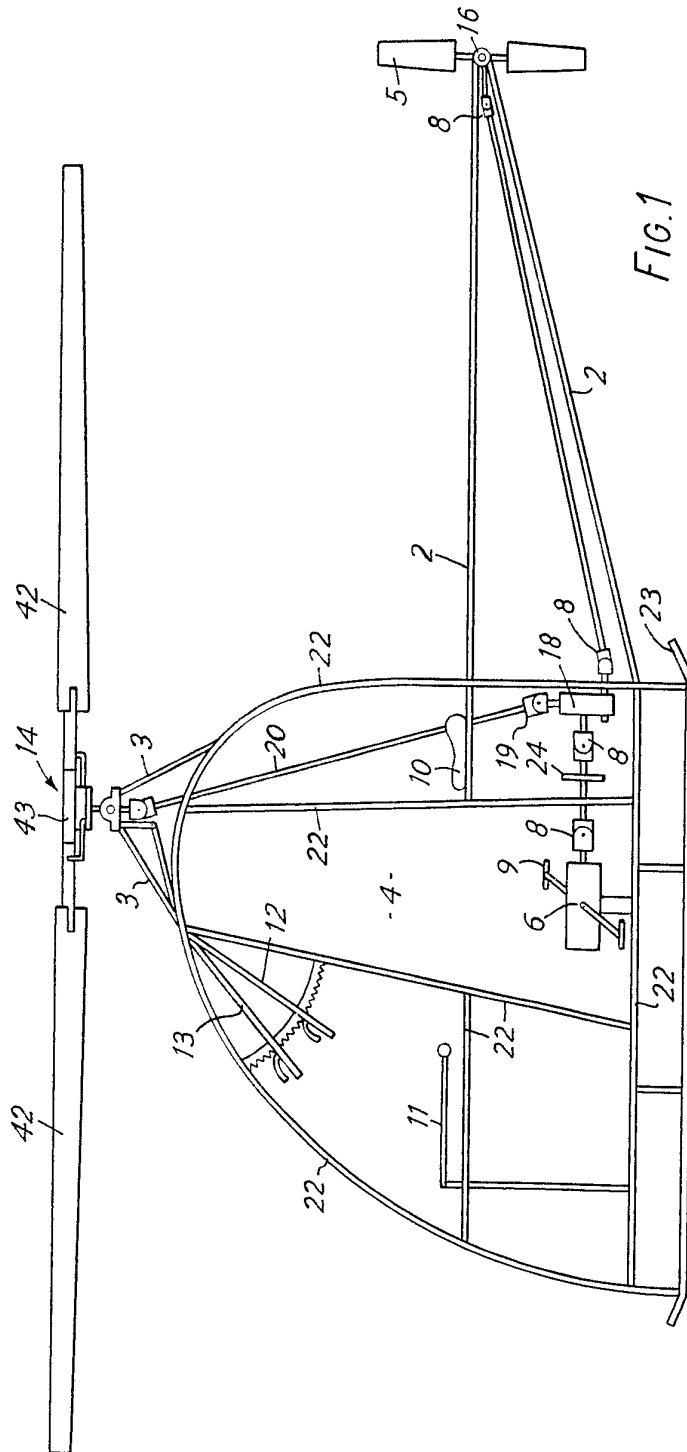


FIG. 1

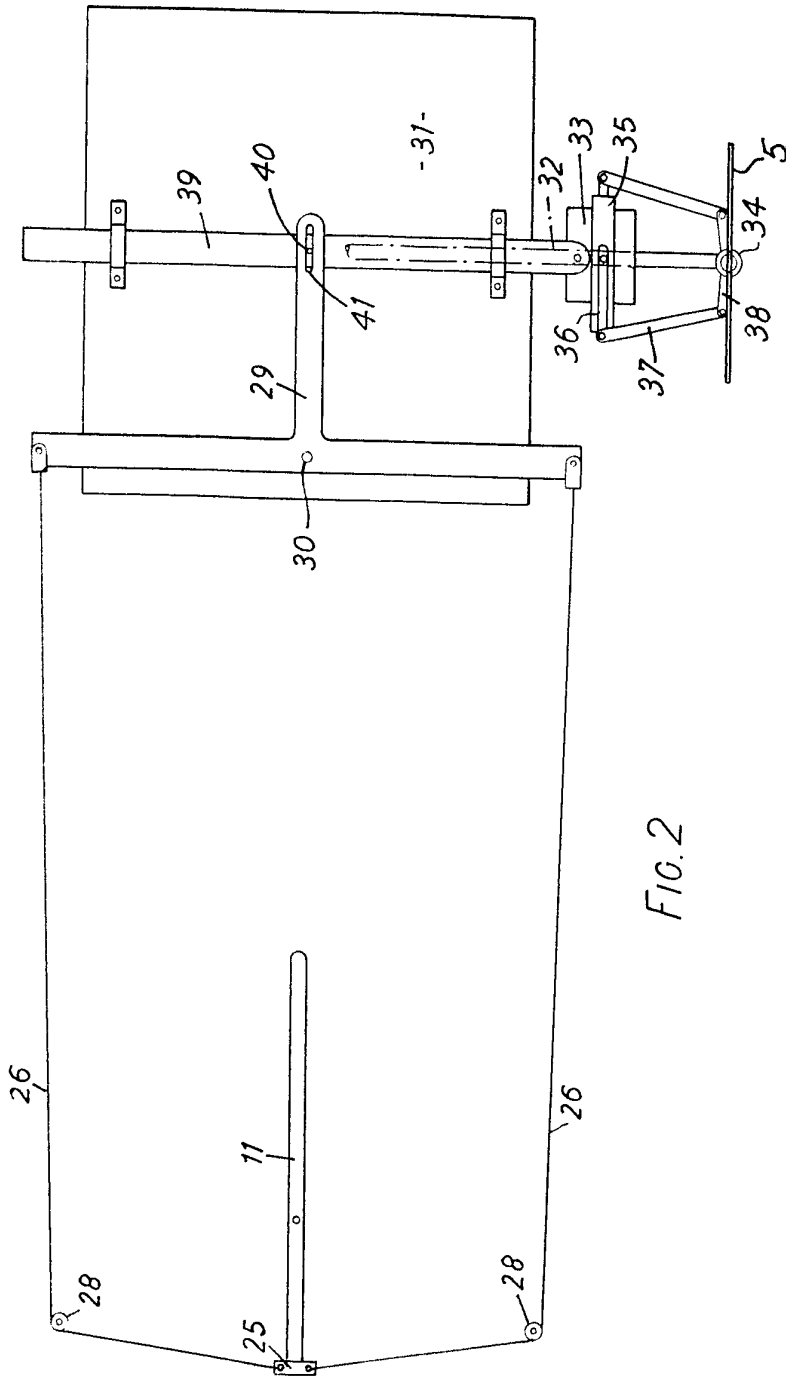


FIG. 2

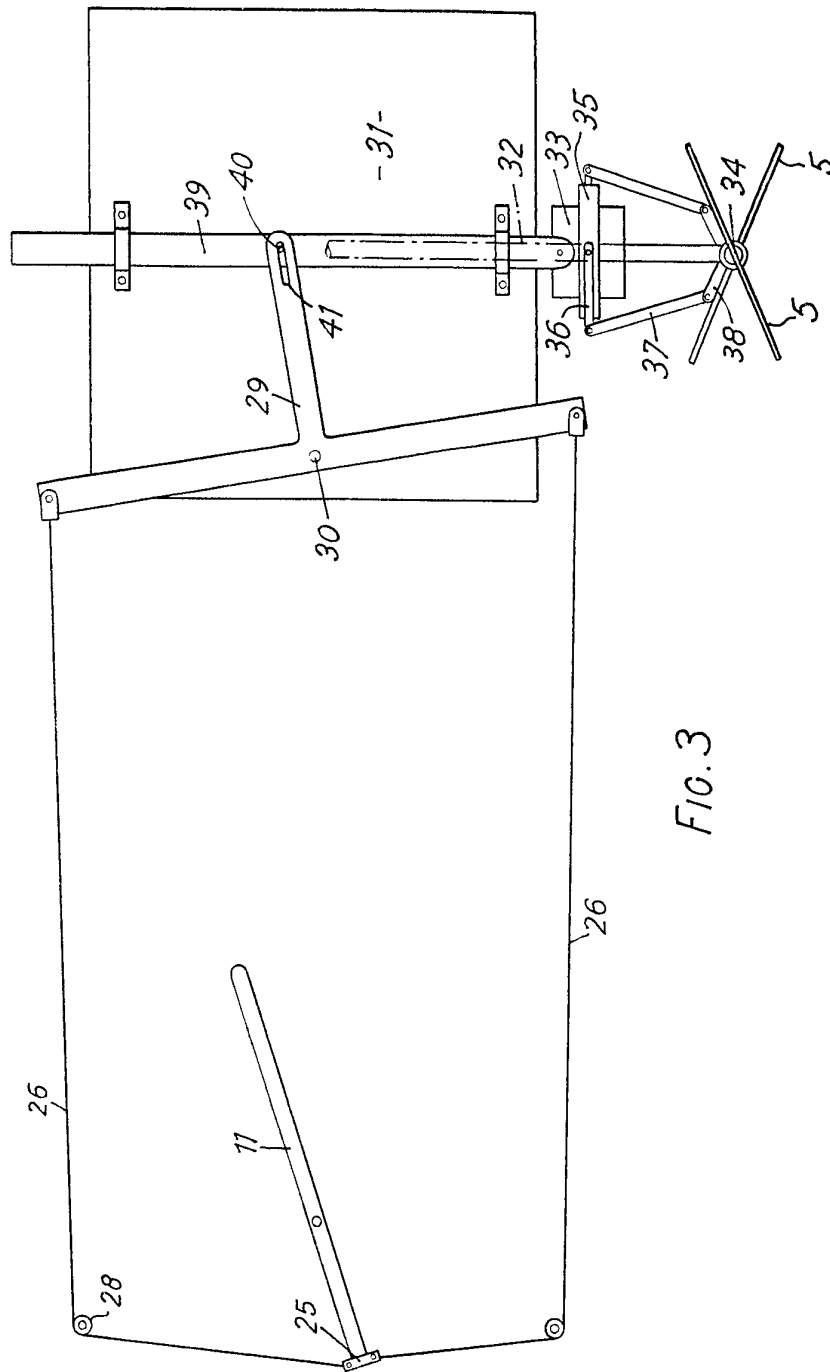


FIG. 3

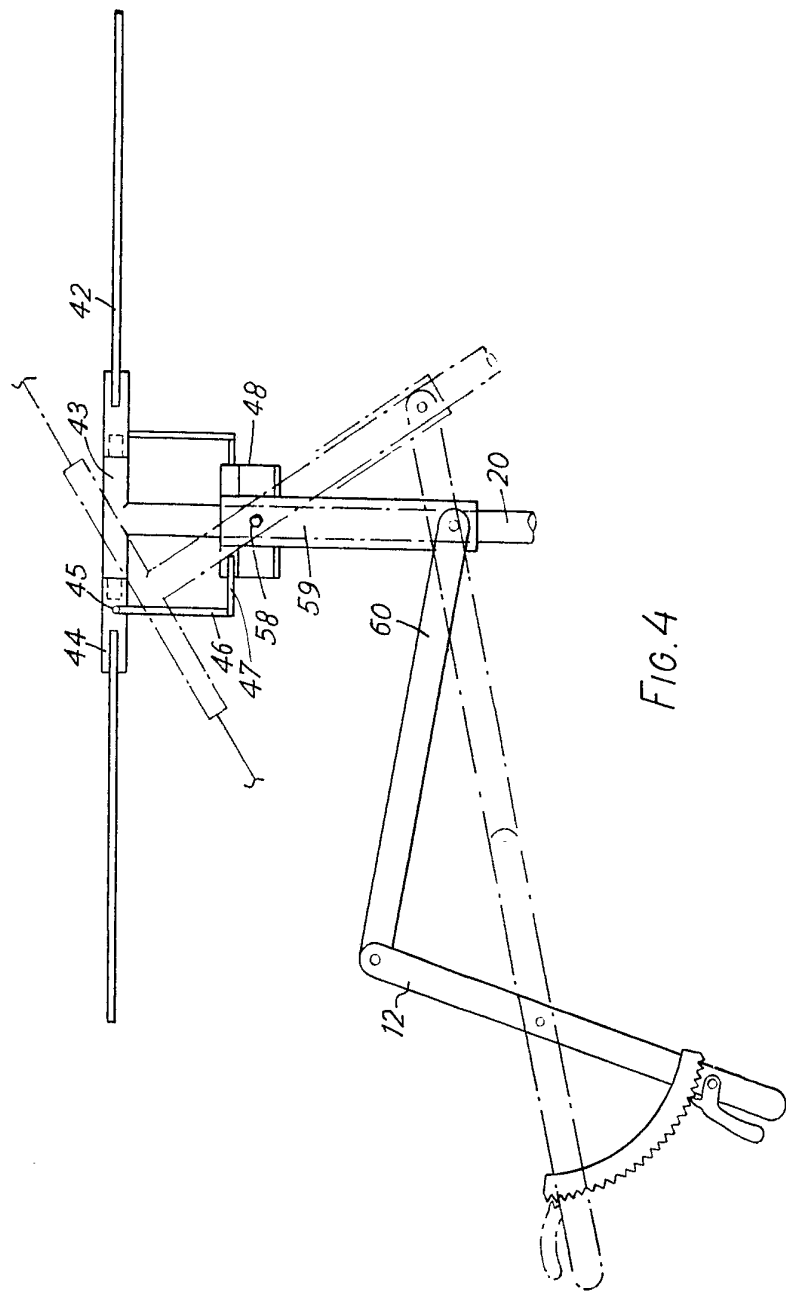


FIG. 4

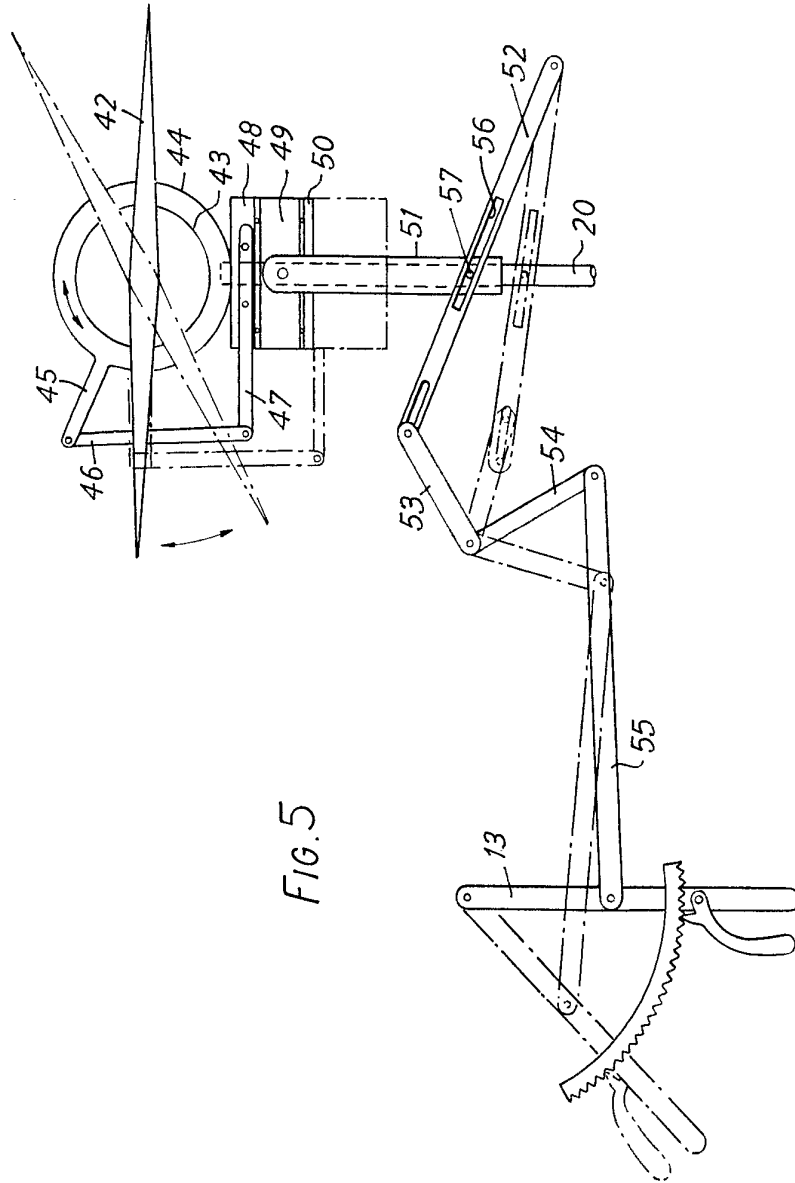


FIG. 5

