

Sept. 1, 1970

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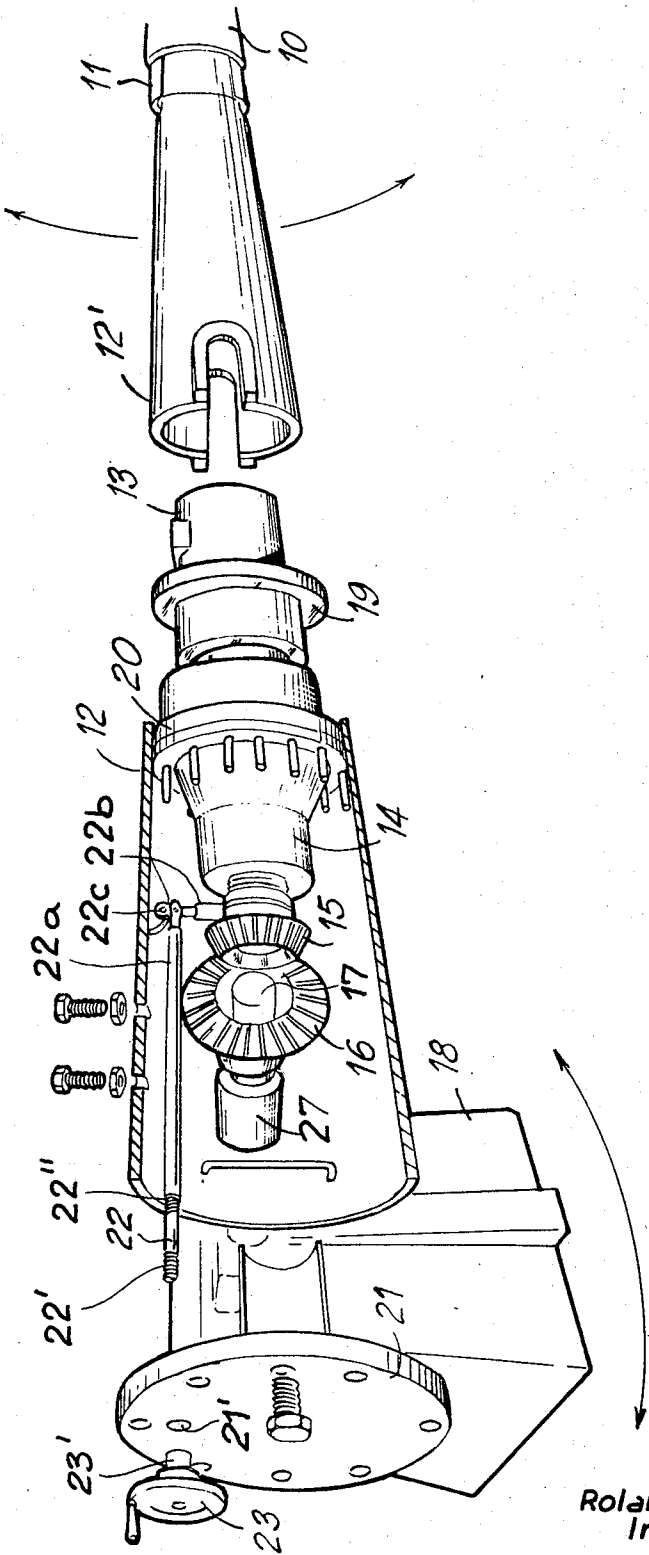
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STABILIZER FOR ELEVATABLE WORKING STATION

Filed Dec. 2, 1968

4 Sheets-Sheet 1

Fig. 1.



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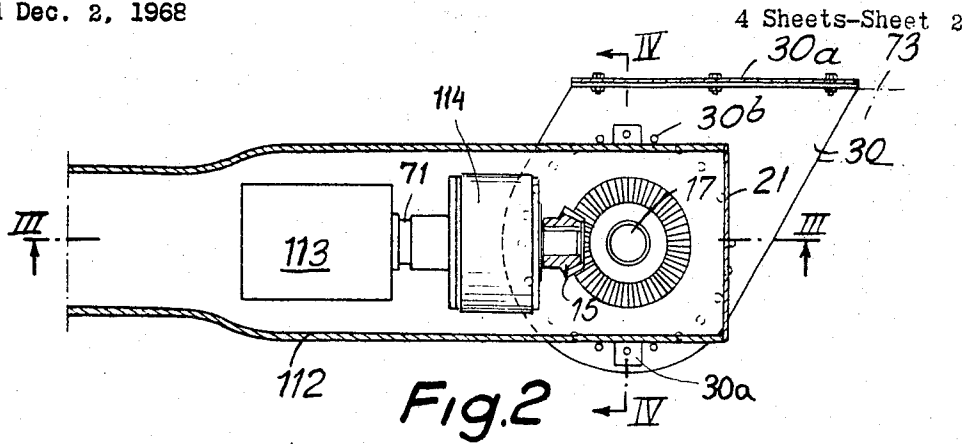
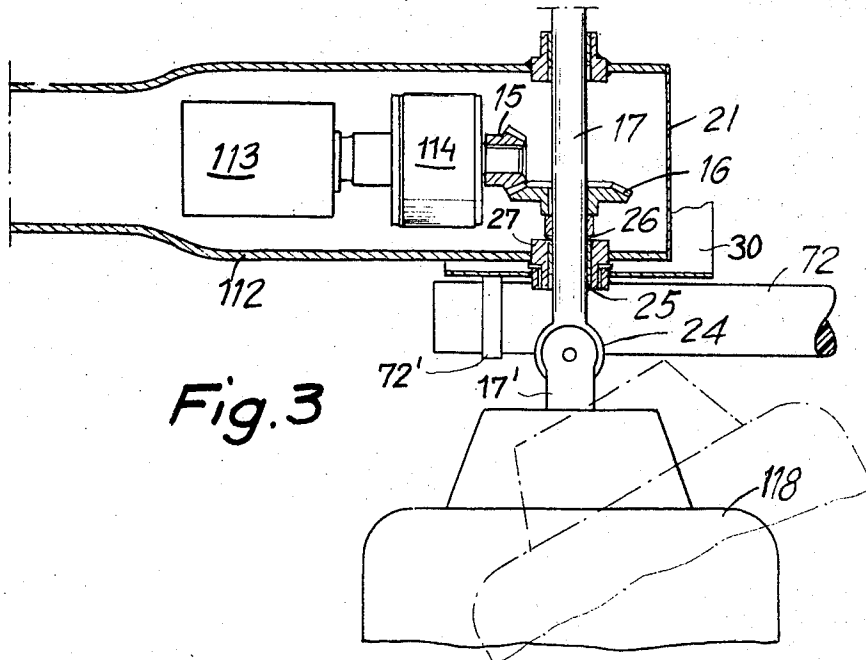
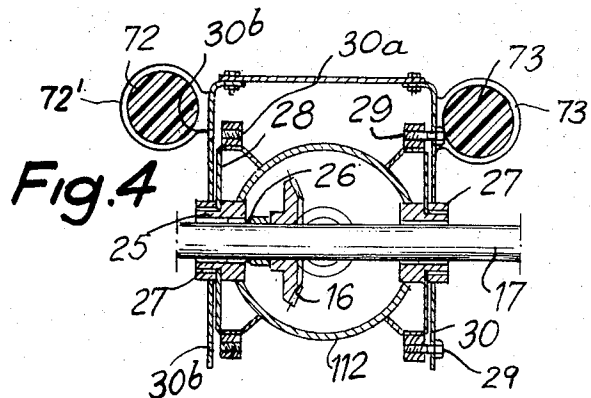
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Fig. 6

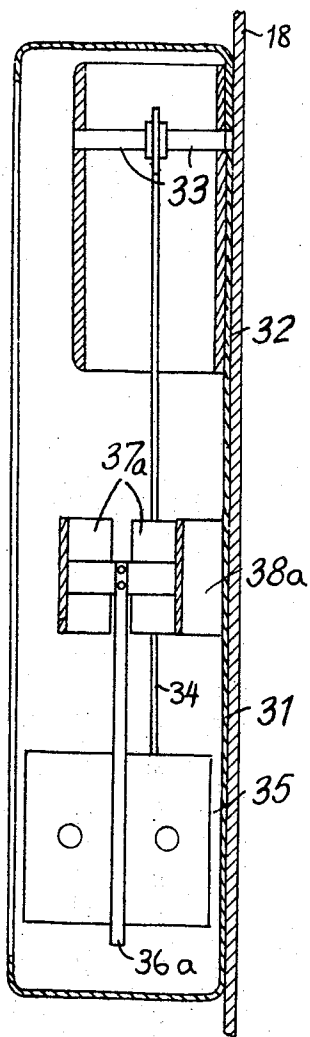
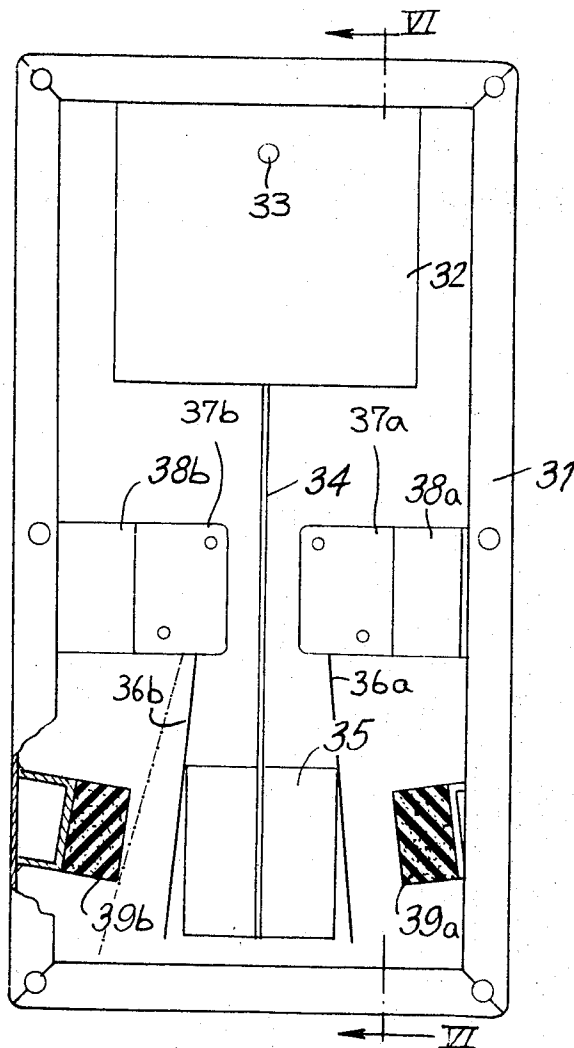


Fig. 5



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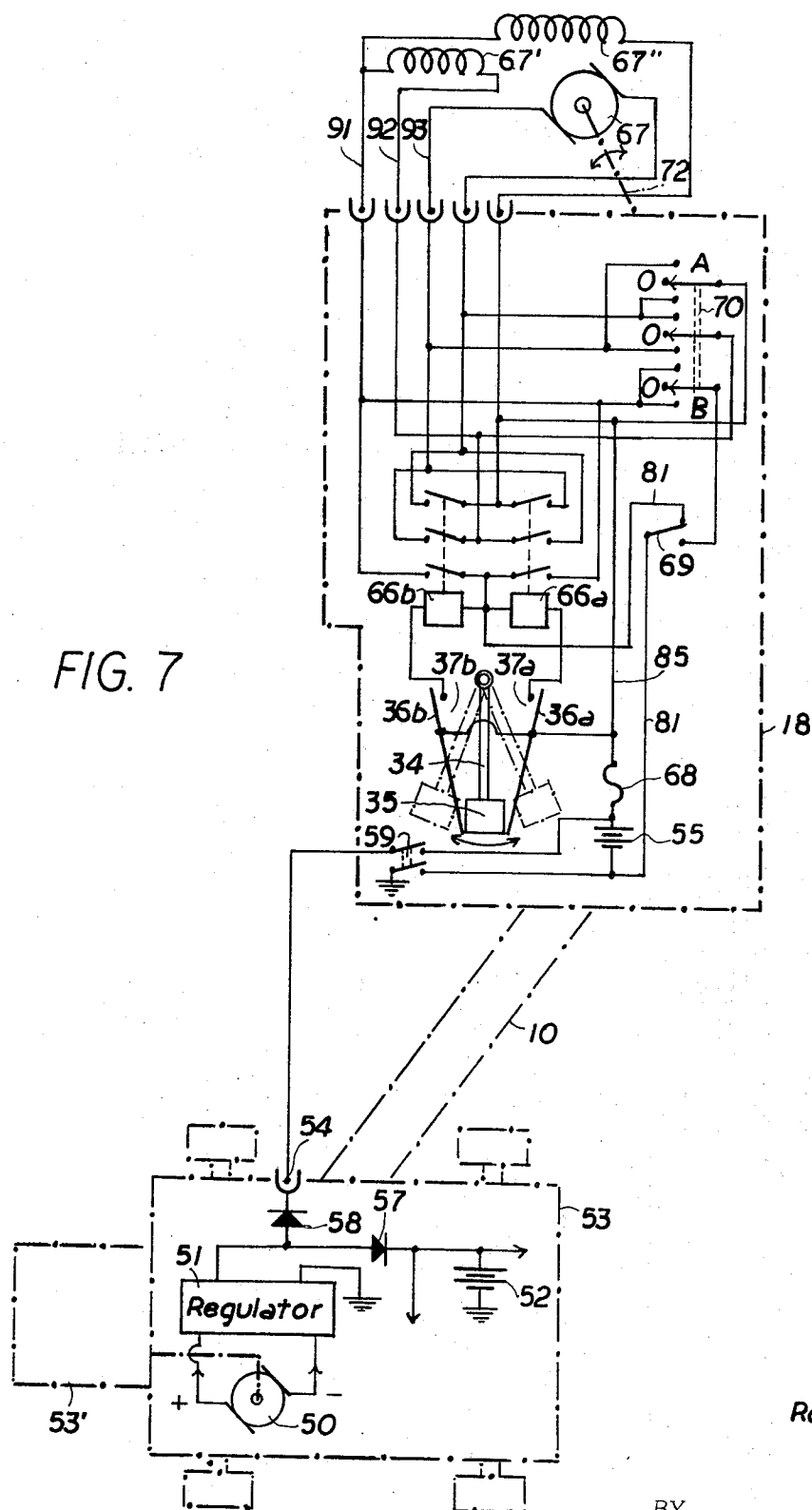
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4 Sheets-Sheet 4



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STABILIZER FOR ELEVATABLE WORKING STATION

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Filed Dec. 2, 1968, Ser. No. 780,457

Claims priority, application France, Dec. 1, 1967, 130,583

Int. Cl. B66f 9/06; E04g 1/15

U.S. Cl. 182—2

10 Claims

ABSTRACT OF THE DISCLOSURE

A vehicle-borne working station, pivotally mounted at the end of a tiltable mast for swinging in a vertical plane, carries a pendulum controlling a pair of limit switches which energize a motor, in response to deviation by more than a few degrees from a level position, for restoring the working station to that position.

My present invention relates to an elevatable working station, such as a cabin, basket or platform, pivotally mounted at the end of a tiltable mast which, as a rule, is carried on a truck or other vehicle (e.g. a fire engine) for transportation to and from a working site.

The working station may include a single operator's stand or stage, or a pair of such stands symmetrically disposed on opposite sides of the mast head, the stand or stands being carried on a horizontal shaft so as to be swingable in a vertical plane for substantial maintenance of a level position. If gravity is relied upon for this purpose, the stand may sway in response to wind, vehicular motion and/or movements of the operator so that stability will be impaired. It has, therefore, already been proposed (see, for example, French Pat. No. 1,430,080) to provide positive stabilizing means for holding the stand or stands in a level position while enabling the relative position between the working station and the mast to be varied as the angle of elevation is changed. These prior stabilizers, using chain drives or similar mechanical transmissions within the shaft, are relatively cumbersome; also, they must be operated to reposition the working station even in the case of minor changes in elevation.

It is, therefore, the general object of my present invention to provide a stabilizer for an operator's stand or stage of the character described which avoids the aforementioned inconveniences.

A more particular object is to provide means for allowing a mast-borne operator's stand to find its own level, by gravity, within a narrow angular range but causing automatic and positive compensatory adjustment upon an excursion exceeding that range.

These objects are realized, pursuant to my present invention, by the provision of a pendulum carried by the shaft of the operator's stand for registering deviations from a level position, a pair of limit switches—preferably of the micro-sensitive type—being disposed on opposite sides of the pendulum for operation thereby to control a drive motor in a sense tending to restore the pendulum to a centered position corresponding to leveling of the stand.

I have found that such a system operates most satisfactorily if the swing range of the pendulum is on the order of $\pm 5^\circ$ and if the transmission ratio between the drive motor and the stage shaft is such as to let the stage rotate at a rate of a fraction of a revolution per minute whenever a compensating adjustment is necessary.

The drive motor and associated speed-reducing means

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of such a system may be accommodated in a tubular extension of the supporting mast, thereby eliminating the need for a mechanical transmission within the mast proper.

The above and other features of my invention will become more fully apparent from the following detailed description given with reference to the accompanying drawing in which:

FIG. 1 is an exploded perspective view, partly in section and somewhat diagrammatical, of a stabilizer according to the invention;

FIG. 2 is an axial sectional view of a stabilizer similar to that shown in FIG. 1;

FIG. 3 is a sectional view taken on the line III—III of FIG. 2;

FIG. 4 is a cross-sectional view taken on the line IV—IV of FIG. 2;

FIG. 5 is an elevational view of a pendulum switch forming part of the stabilizer of the preceding figures;

FIG. 6 is a cross-sectional view taken on the line VI—VI of FIG. 5; and

FIG. 7 is a circuit diagram relating to the system of the preceding figures.

In FIG. 1 I have illustrated at 10 the free end of a mast provided with a collar 11 which receives a two-part tubular extension 12, 12' accommodating a drive motor 13; a peripheral flange 19 on the motor housing fits between the tube sections 12 and 12' which may be secured to each other in any convenient way not further illustrated. Motor 13 is rigid with a base 20 which supports a speed reducer 14, e.g. of the planetary-gear type, whose output shaft carries a bevel gear 15 in mesh with another, larger bevel gear 16 on a transverse shaft 18. An operator's stand or stage 18, which may be symmetrically duplicated on the opposite side of tube 12, is fastened to the shaft 17 so as to be swingable about the horizontal axis thereof shaft 17 is journaled in a bearing 27 of tube 12 and, advantageously, also includes a swivel joint 24 (FIG. 3) enabling limited rotation of the stage 18 in a substantially horizontal plane including the axis of shaft 27. Such swiveling motion may be controlled by the operator aboard the stage 18 via a level not shown.

A rod 22 extending in a generally axial direction within tube 12 passes through a front plate 21 thereof and is connected via screw threads 21' with a handwheel 23 having an internally threaded stem 23' seated in a hole 21'. Rod 22 coacts with a tubular extension 22a which it threadedly engages at 22" so that rotation of wheel 23 in one direction or the other lengthens or shortens the linkage 22, 22a. The other end of rod 22a is hinged to a lever 22b having a fixed fulcrum 22c on the inner tube wall; the free end of lever 22b fits between the teeth of bevel gear 15 so as to prevent its rotation when the wheel 23 is turned into a locking position, e.g. during transportation to and from a working site.

In FIGS. 2-4 I have shown a slightly modified mast extension 112 accommodating a motor 113 with speed reducer 114, the output shaft of the motor being designated 71. Sleeve 27 is seen to include an antifriction bearing 25 (e.g. of the needle type) and is held spaced from pinion 16 by a collar 26. Guide 24 is shown as a hinged connection between shaft 17 and an extension 17' thereof. A modified stage 118 can thus be swiveled from a normal position in line with shaft 17, as illustrated in full lines in FIG. 3, into a swung-out position shown in dot-dash lines and another such position symmetrical thereto. Since the shaft 17 is permitted to rotate only by a few degrees, as will be explained in greater detail hereinafter, such swiveling motion always occurs in a substantially horizontal plane.

A yoke 30 spans the free end of tube 112 and is angularly adjustable with reference thereto by being swing-

ably journaled on shaft 17, a pair of lateral brackets 28 on tube 112 being provided with lugs having threaded bores 30a to receive mounting bolts 29 passing through one of several holes 30b on the side arms of the yoke. The latter supports, with the aid of fasteners schematically represented by straps 72', 73', a pair of poles 72, 73 of insulating material whose front ends (not shown) may be provided with hooks or grippers to engage a cable or some other object at a location remote from the stage 118. Thus, the poles 72 and 73 are representative of any tools rigid with the mast 10 (FIG. 1) that are manipulable by a change in the angle of elevation of the mast and/or by the movement of a vehicle (diagrammatically illustrated at 53 in FIG. 7) on which the mast is tiltably supported. The change in the angle of elevation of the mast may be brought about by an operator on the vehicle and/or a workman on the stage 118 with the aid of respective control panels which have not been illustrated but are shown, for example, in the aforementioned French patent.

Advantageously, the mast itself is made of electrically nonconductive material, such as a solid column of glass-fiber-reinforced synthetic resin.

As illustrated in FIGS. 5 and 6, a box 31 is carried on a vertical wall of stage 18 (or 118) and houses a mount 32 for a pendulum 34 which swings freely on a shaft 33 and is weighted at the bottom by a head 35. This head, preferably of nonconductive material, co-operates with a pair of switch armatures 36a, 36b disposed symmetrically on opposite sides thereof, these armatures representing elongate contact members of a pair of micro-sensitive switches 37a, 37b on bases 38a, 38b. Two resilient pads 39a and 39b, on the sides of the armatures which prevent closure of their contacts except in an inclined position of box 31 in which the weight 35 urges one or the other armature into a position beyond that illustrated in dot-dash lines for the armature 36b in FIG. 5. In practice, the angle of excursion at which the pendulum 34 actuates the limit switch 37a or 37b, in response to a corresponding tilt of box 31, may be approximately 5°.

Reference will now be made to FIG. 7 for a detailed description of the electrical circuits by which the limit switches 37a and 37b control the drive motor 13 (or 113) to stabilize the stage 18 (or 118). The motor, whose shaft 72 has been indicated in dot-dash lines, has an armature 67, a series field winding 67', and a shunt field winding 67'', being thus of the compound type. This motor is energizable via five conductors 91, 92, 93, 94, 95, plugged into corresponding jacks on stage 18, from a battery 55 aboard that stage which is connected, in series with a fuse 68, between two bus bars 81 (negative) and 85 (positive). Battery 55 can be charged, through a switch 59 and a jack 54 on vehicle 53, from the conventional generator 50 and regulator 51 of the vehicle by way of a diode 58; a second diode 57 leads from regulator 51 to another battery 52 representing the normal power supply of the vehicle, the two diodes 57 and 58 preventing the two batteries from draining each other. Generator 50 is driven in the usual manner from the engine 53' of the vehicle. Switch 59 is arranged to be open in the elevated or working position of mast 10 and to be closed only when the mast is lowered into its inoperative position to permit a recharging of battery 55.

In addition to pendulum 34, whose head 35 controls the armatures 36a, 36b of limit switches 37a, 37b, there are provided aboard the stage 18 a pair of manual switches 69, 70 and two relays 66a, 66b, the latter being energizable in the illustrated position of switch 69 upon closure of switch 37a or 37b, respectively. In the alternate position of switch 69, relays 66a and 66b are permanently de-energized and switch 70 may be moved from its illustrated neutral position O into an upper position A or a lower position B for operating the motor 67 in one sense or the other to swing the stage 18 in either direction.

The automatic stabilizer including pendulum 34 operates as follows:

As long as pendulum 34 sways only within its ineffectual range of, say $\pm 5^\circ$, relays 66a and 66b are unoperated and motor 67 is not energized. If weight 35 swings to the right (dot-dash lines) to close the switch 37a, relay 66a operates in a circuit extending from the positive terminal of battery 55 via fuse 68 and bus bar 85 to switch armature 36a and thence, through the winding of the relay and a conductor 81', to negative bus bar 81 by way of switch 69. At the upper and middle ones of its three armatures, relay 66a connects lead 93 to lead 95 and lead 92 to lead 94, thereby completing the series circuit of motor armature 67 and field coil 67'; at the same time the bottom armature of this relay connects negative conductor 81' to lead 91 whereby, with lead 95 directly connected to bus bar 85, a circuit is completed for actuating the motor 13 in a direction designed to reorient the stage 18 so as to recenter the pendulum 34 between the two switch armatures 36a and 36b. Conversely, if switch 37b is closed by the weight 35, relay 36b operates in an analogous circuit and, at its upper two armatures, connects lead 92 to lead 93 as well as lead 94 to lead 95 while applying negative potential from conduit bar 81 to lead 91, thereby operating the motor in the opposite sense.

In the alternate position of switch 69, selector switch 70 duplicates the operation of relays 66a and 66b in its top and bottom positions A and B, respectively, upon being displaced from its neutral position O.

In a practical embodiment, the motor 13 (or 113) may have a power rating of 100 watts and an operating speed of 1500 r.p.m. when energized from a battery 55 of 24 volts. The step down ratio of speed reducer 14 (or 114) may be 1:2250, the overall speed reduction being then 1:4500 if the two bevel gears 15 and 16 have a tooth ratio of 1:2. The speed of shaft 17 is only one-third of a revolution per minute which is slow enough so as not to inconvenience the workman or crew aboard the stage.

I claim:

1. A stabilizer for an elevatable working station comprising, in combination with a tiltable mast, a substantially horizontal shaft at a free end of said mast and an operator's stand rigid with said shaft:

drive means coupled with said shaft for rotating said stand about the axis thereof;

pendulum means carried by said shaft for registering deviations of said stand from a level position;

and a pair of limit switches controlled by said pendulum means for operating said drive means, in response to deviations by a predetermined minimum angle from said level position, to rotate said shaft in a sense tending to restore said stand to said level position.

2. A stabilizer as defined in claim 1 wherein said angle is on the order of $\pm 5^\circ$.

3. A stabilizer as defined in claim 1 wherein said mast is provided with a tubular extension bearing said shaft and accommodating said drive means.

4. A stabilizer as defined in claim 3 wherein said extension is provided with a tool-carrying head traversed by said shaft and tiltable about said axis independently of said stand.

5. A stabilizer as defined in claim 3 wherein said drive means includes a motor with a speed reducer connected therewith and a step-down bevel-gear transmission between said speed reducer and said shaft.

6. A stabilizer as defined in claim 5 wherein the combined step-down ratio of said speed reducer and said transmission is such as to make said shaft turn at a fraction of a revolution per minute.

7. A stabilizer as defined in claim 3, further comprising coupling means between said shaft and said stand for enabling a limited swiveling of the latter in a substantially horizontal plane with reference to said extension.

8. A stabilizer as defined in claim 1 wherein said limit switches comprise a pair of elongate armatures, said

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pendulum means including a weight suspended between said armatures for alternate engagement therewith, each of said armatures being further provided with a resilient backstop remote from said weight.

9. A stabilizer as defined in claim 1 wherein said mast is mounted on a vehicle, further comprising propulsion means on said vehicle including a first battery, a power supply for said drive means including a second battery, and generator means on said vehicle driven by said propulsion means for charging both said batteries.

10. A stabilizer as defined in claim 9, further comprising manual switch means on said stand for controlling said drive means and switchover means on said stand selectively operable to connect said second battery to said

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drive means either by way of said limit switches or by way of said manual switch means.

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U.S. Cl. X.R.
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