

April 7, 1942.

E. C. HOMER ET AL

2,278,654

INDUCTOR ALTERNATOR

Filed Dec. 9, 1938

2 Sheets-Sheet 1

FIG. 1

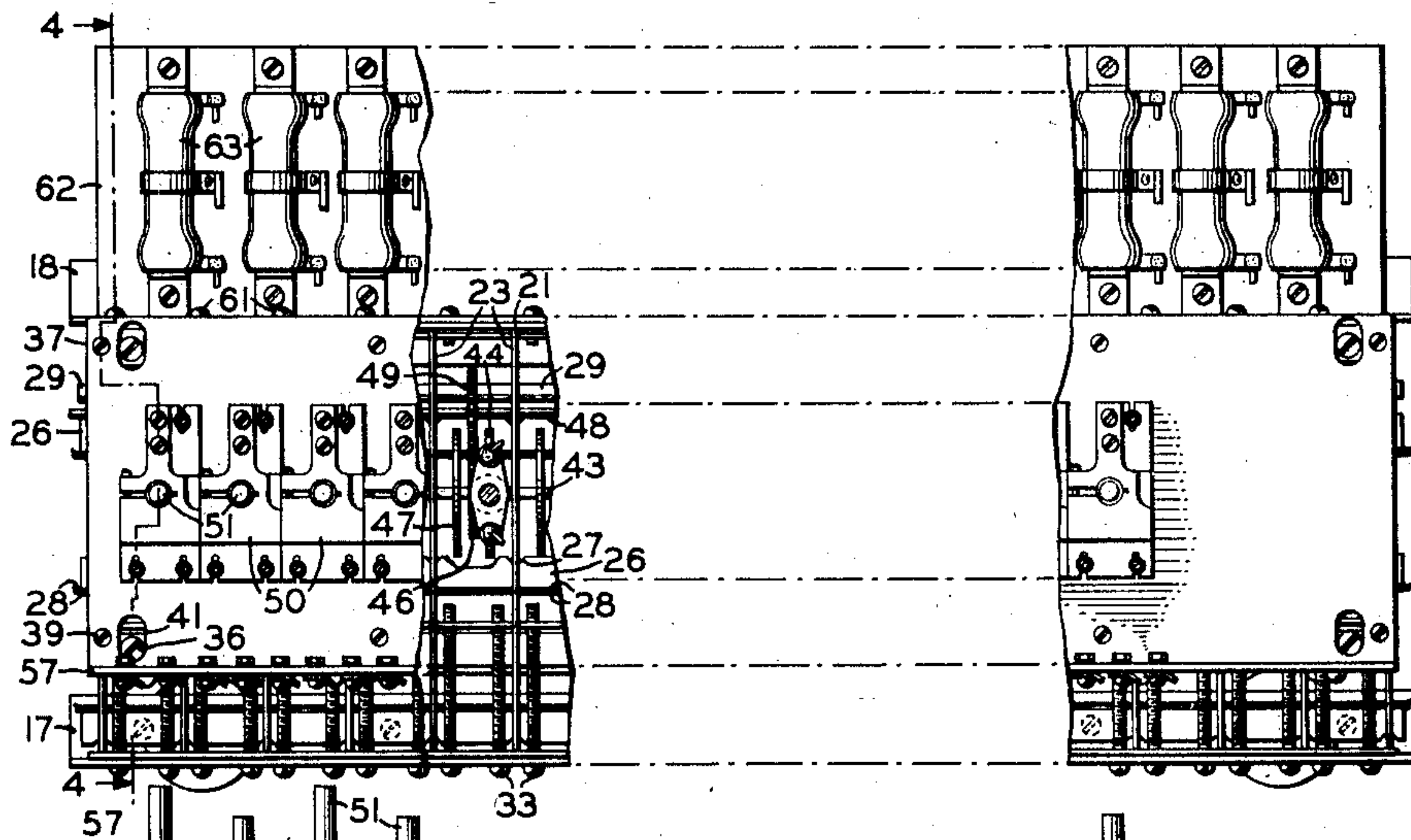


FIG. 2

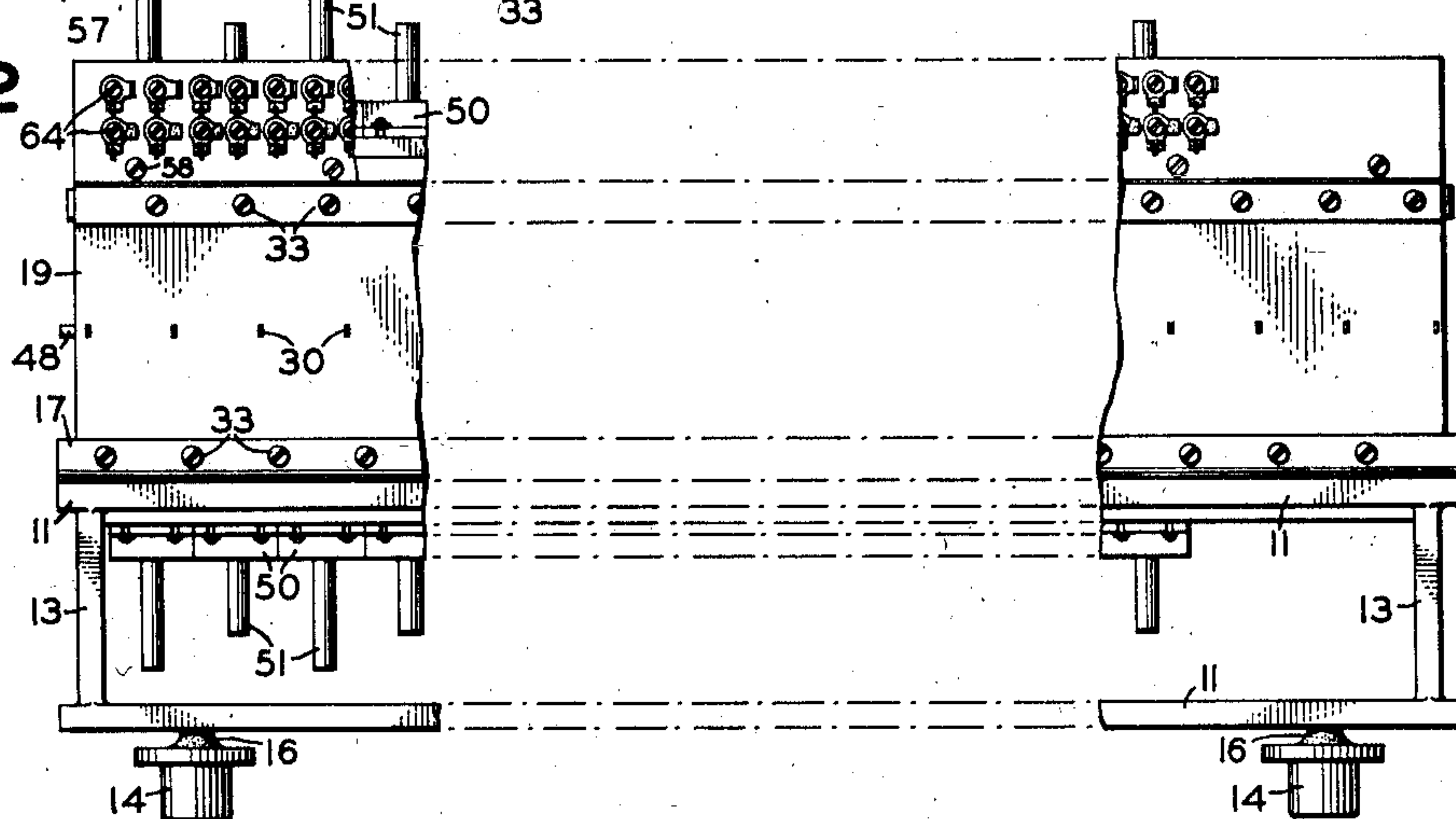


FIG. 3

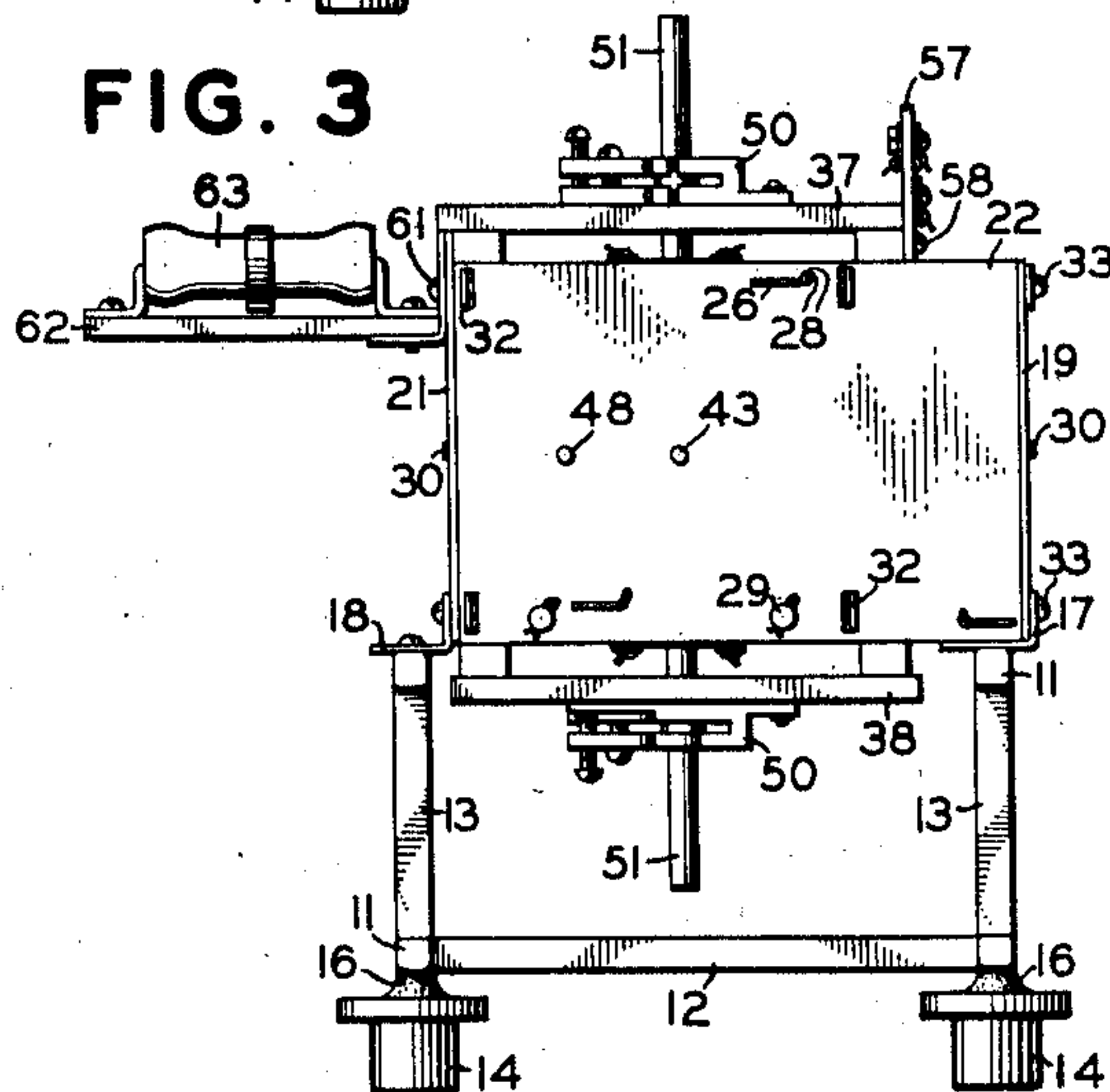
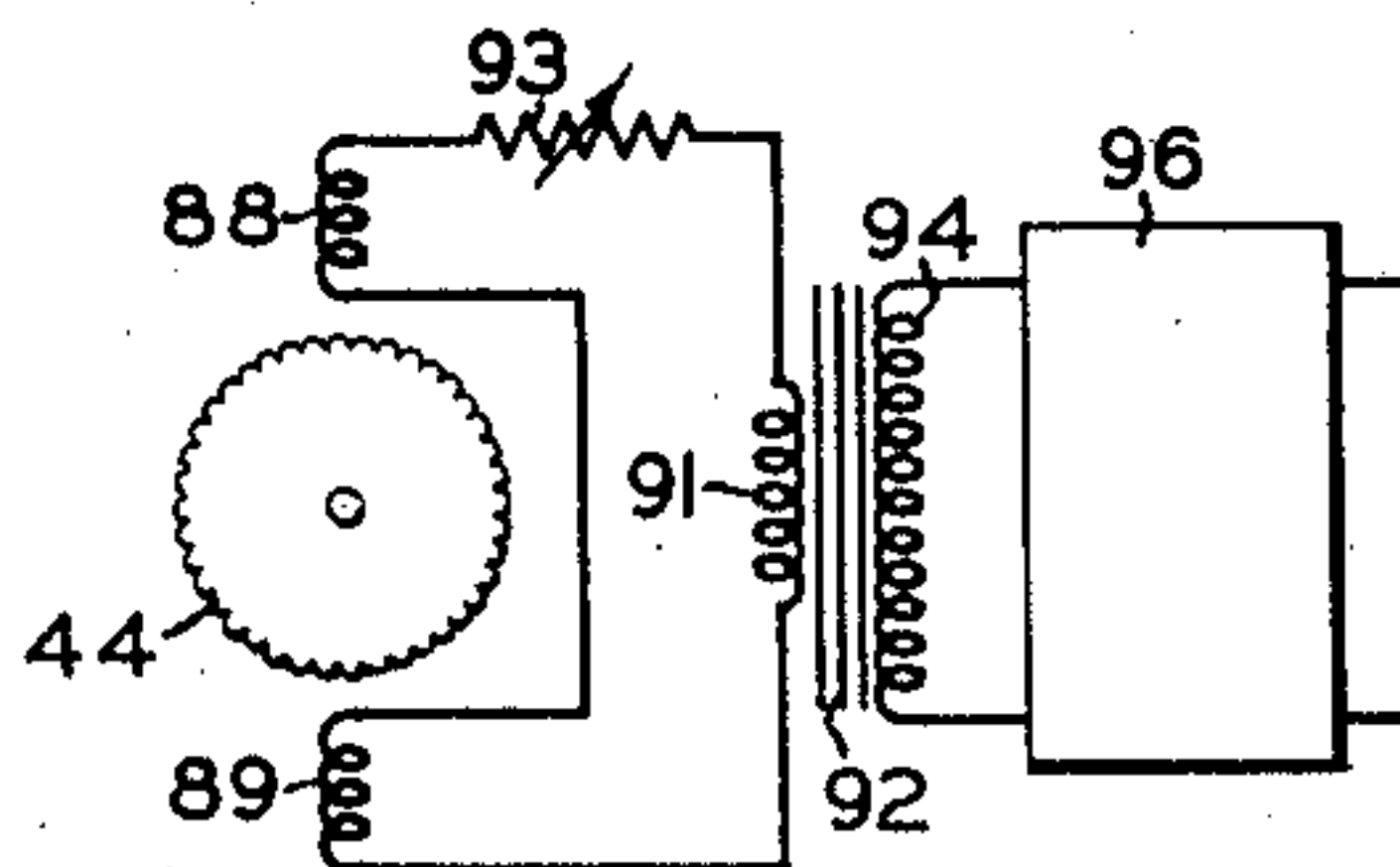


FIG. 9



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FIG. 4

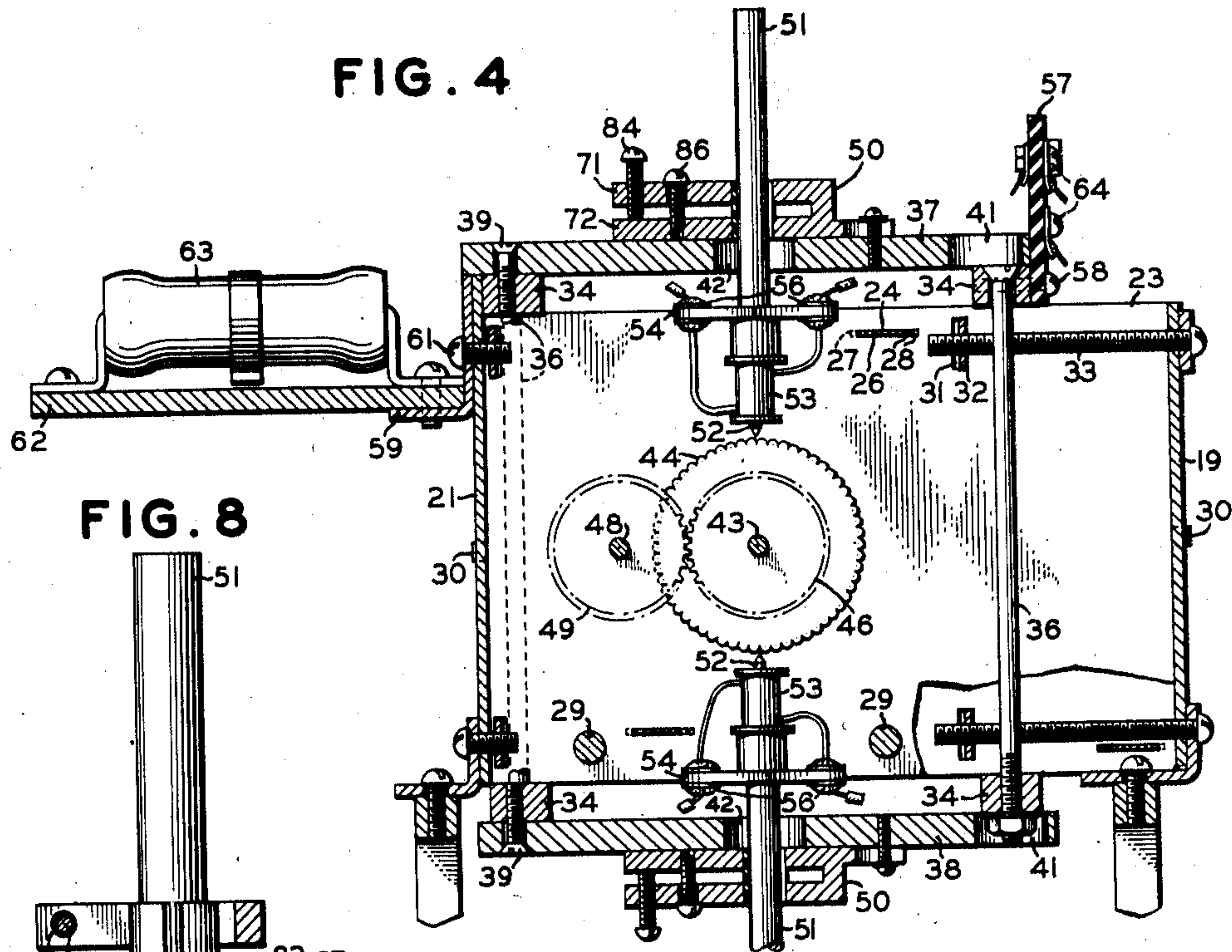


FIG. 8

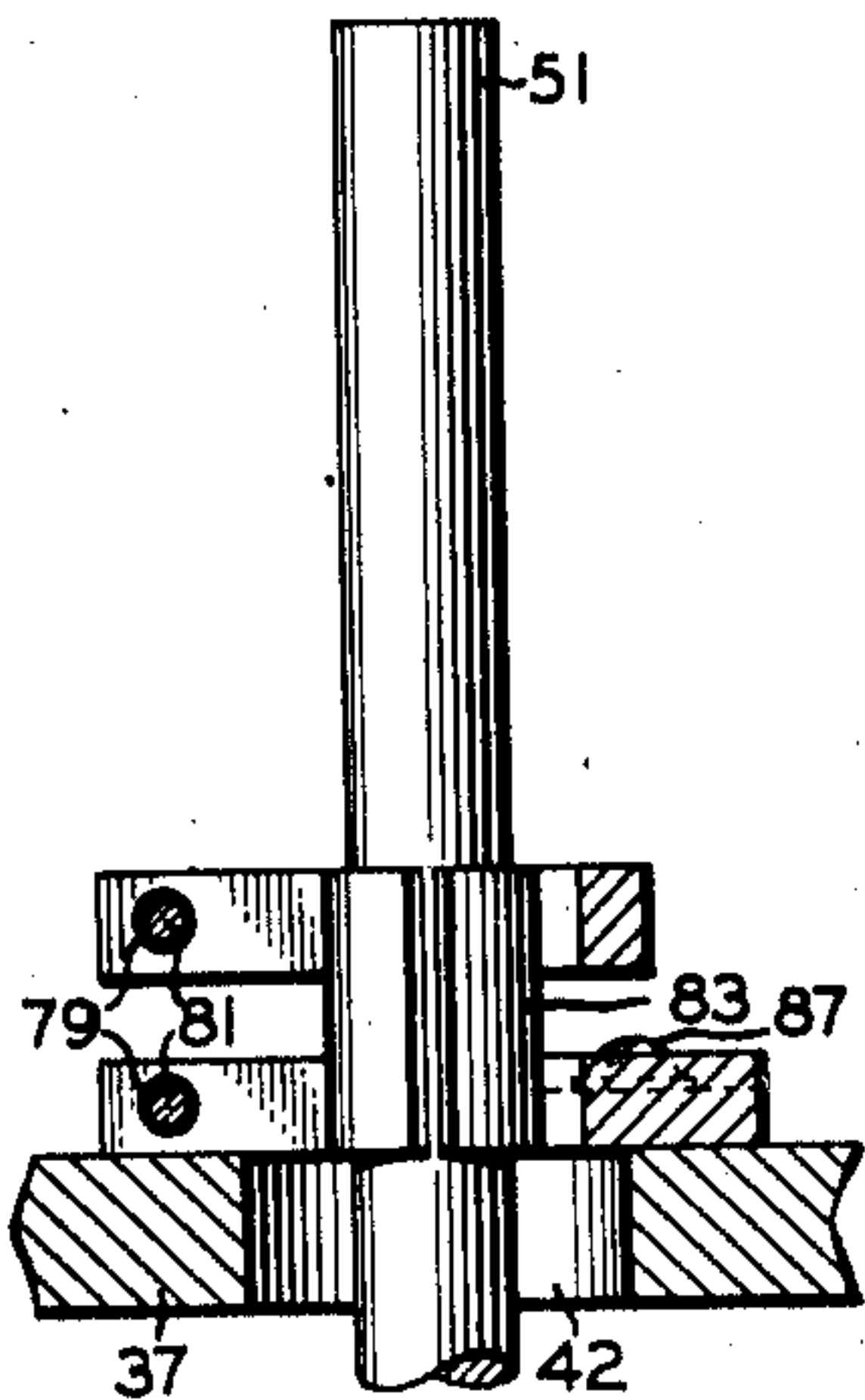


FIG. 5

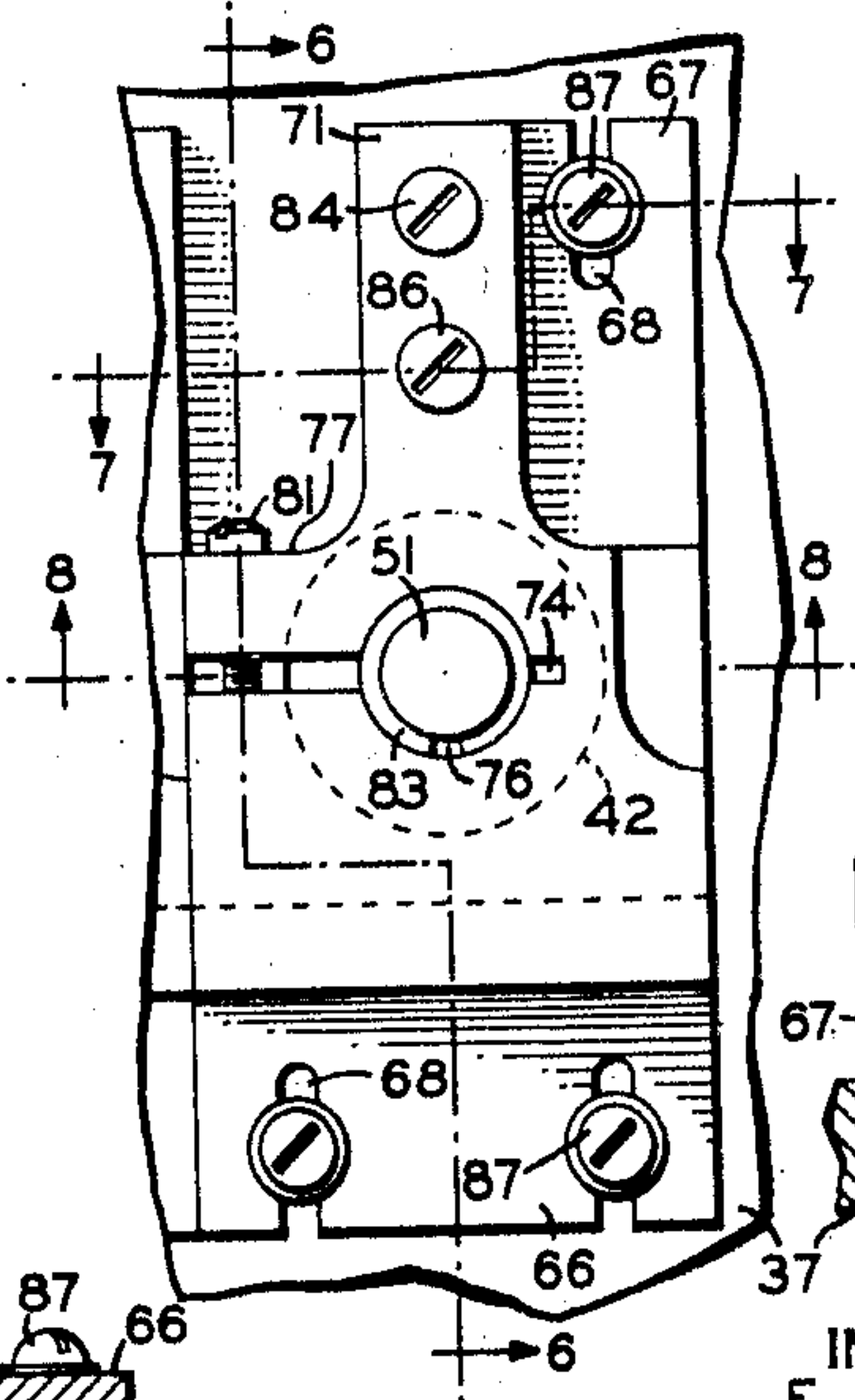


FIG. 7

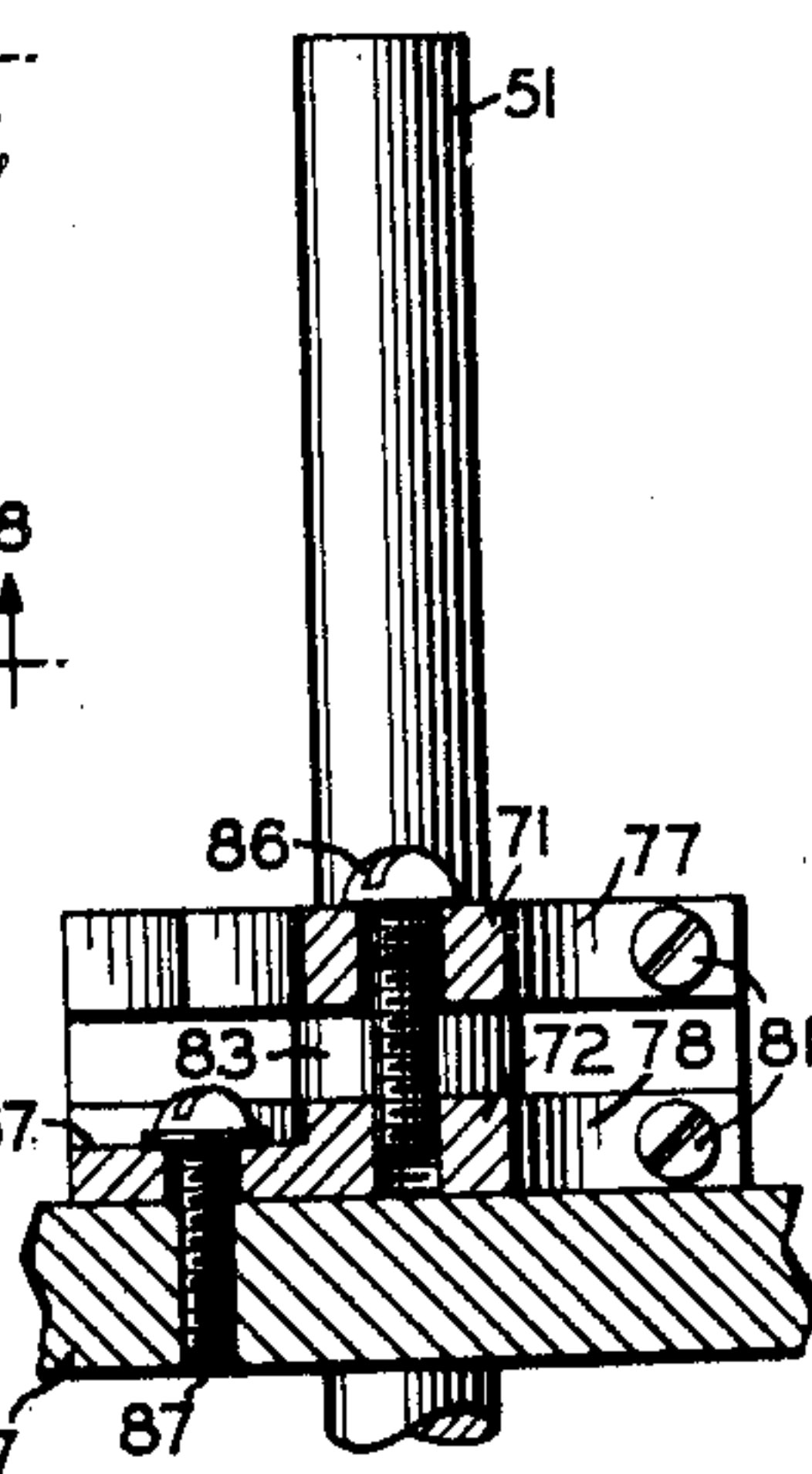
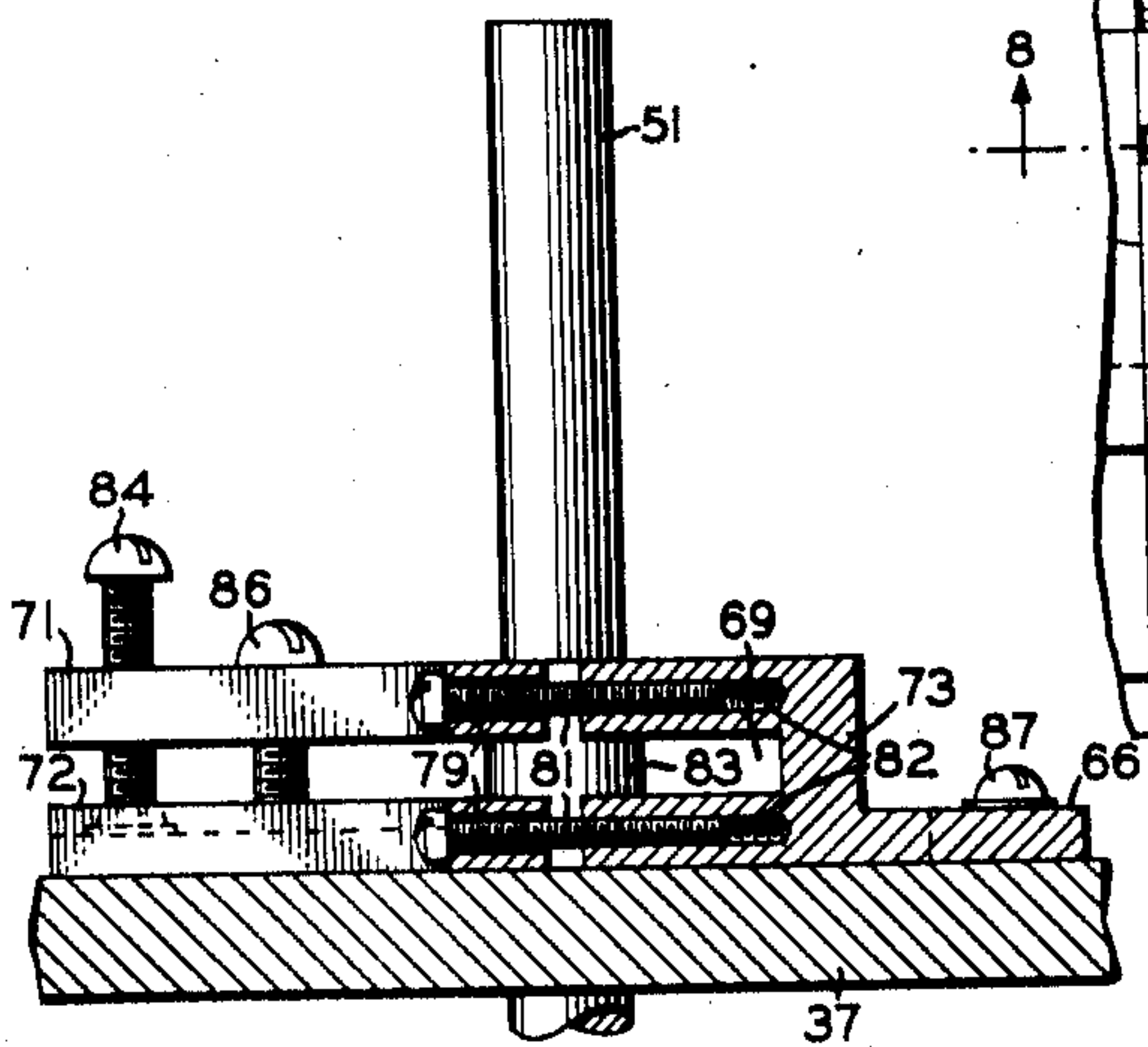


FIG. 6



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INDUCTOR ALTERNATOR

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Application December 9, 1938, Serial No. 244,744

2 Claims. (Cl. 171-252)

This invention relates to alternating current generators and has particular reference to the type of generator known as an inductor alternator.

The invention has for an object the provision of means for preventing variations in the generator voltage caused by the eccentric rotation of the toothed inductor or rotor.

Another object of the invention is to provide, in a multi-frequency generator, individual adjustable supports for a plurality of armatures or stator elements whereby the generated voltages may be closely controlled both in amplitude and in phase.

Despite the most precise methods practicable in centering a toothed rotor on a shaft, the minimum air gap between the rotor and the armature tooth or pole piece may vary as the rotor is turned thereby producing a variation of the voltage generated in the armature which is known as rotational modulation. By means of the present invention such fluctuations are eliminated or, in any case, substantially reduced. Such a result is effected by employing two armatures diametrically disposed with reference to the rotor and suitably coupled to an amplifying device. Each armature is supported by an individual adjustable device whereby the average air gap between the armature pole pieces and the rotor may be adjusted to a constant value and the armatures properly phased with reference to one another.

The invention will be described by having reference to the accompanying drawings, of which:

Fig. 1 is a top view of an assembly comprising a plurality of generators;

Fig. 2 is a view in side elevation of the multi-frequency generator;

Fig. 3 is an end view of the generator;

Fig. 4 is a sectional view to an enlarged scale taken on the line 4-4 of Fig. 1;

Fig. 5 is a plan view to an enlarged scale of one of the adjustable armature supports;

Fig. 6 is a view taken on the line 6-6 of Fig. 5;

Fig. 7 is a view taken on the line 7-7 of Fig. 5;

Fig. 8 is a view taken on the line 8-8 of Fig. 5; and

Fig. 9 is a fragmentary circuit diagram showing one manner of coupling the generator to an amplifying device.

Having reference first to Figs. 1, 2 and 3, there is shown a skeleton framework for elevating the generator assembly and comprising four horizontal longitudinal members 11, a plurality of horizontal transverse members 12, and a plurality

of vertical members 13. The framework is supported by a plurality of feet 14 which are attached to the longitudinal members 11 by means of resilient material 16. Two angles 17 and 18 are supported on the upper horizontal longitudinal members 11 and extend the entire length of the assembly. The sides of the supporting structure for the generators are formed by the plates 19 and 21.

The housing for the generators is divided into a plurality of compartments which are formed by a series of spaced frame plates extending between the two side plates 19 and 21. Each of these plates such as the end plate 22 of Fig. 3 and one of the intermediate plates 23 of Fig. 4 has formed therein a plurality of horizontal slots such as the slot 24 of Fig. 4. A bar 26 extends through each of the slots 24 which are formed in the frame plates. Each bar 26 has formed in one edge thereof a series of spaced notches 27 (see also Fig. 1). The frame plates 23 are positioned so that the slots 24 formed therein are brought opposite the respective notches of the bar 26 which may then be moved toward the left as viewed in Fig. 4 thereby engaging each of the frame plates and holding them in fixed spaced relation. A plurality of wires or small rods 28 are inserted in the slots 24 along the unnotched edge of the bar 26 thereby locking it in its plate-engaging position. Each of the frame plates 23 is provided with a plurality of apertures through which rods 29 project and assist in keeping the plates in alignment. The plates 23 are also provided with ears or tabs 30 on opposite edges thereof which engage suitable slots formed in the side plates 19 and 21.

Each of the plates 23 is also provided with a plurality of vertical slots 31. Through each of these slots extends a bar 32 which is provided with a plurality of tapped holes. A screw 33 is inserted through the side plate 19 and threaded into one of the tapped holes in the bar 32 whereby the bar is drawn into firm engagement with the right hand edge of the slot 31 as viewed in Fig. 4. Four slots such as 31 are formed in each of the frame plates 23 and suitable screws are inserted from the sides of the supporting structure to engage tapped holes in each of the bars. The purpose of this construction is to securely fasten the ends of the frame plates 23 to the side plates 19 and 21 so as to preclude any tendency for the plates to buckle.

The top and bottom edges of the frame plates 23 are clamped between four longitudinal members 34. These clamping members are fastened

together by means of a plurality of bolts 36 extending from the top member to the member located directly below. Top and bottom panels 37 and 38 respectively are mounted on the clamping members 34 by means of a plurality of screws 39. Each panel has formed therein a plurality of slots 41 providing access to the clamping bolts 36. Also formed in each of the panels are a plurality of circular openings 42 located adjacent the center line and extending longitudinally thereof.

Journalled in the frame plates 23 are a plurality of shafts 43, one for each compartment, on each of which is mounted a toothed rotor 44 of magnetic material. In order that each frame plate be adapted to journal opposite ends of adjacent shafts 43, each plate is provided with two bearings arranged one above the other. Alternate shafts are mounted respectively in upper and lower bearings so that they are staggered vertically in alternate compartments. Also mounted on each shaft 43 is a gear 46 and, preferably, a blank disc 47 of non-magnetic material to balance the rotor 44 (Fig. 1). A second shaft 48 is also journalled in the frame plates 23 and has mounted thereon a plurality of gears 49 each of which is arranged to mesh with one of the gears 46 attached to the shafts 43. The shaft 48 is rotated by any convenient means whereby a substantially uniform rate of rotation may be secured and, through the gearing provided therefor, drives the toothed rotors. A number of different frequencies may be generated by suitably arranging the gearing between the shaft 48 and the individual shafts 43 and by providing the rotors 44 with different numbers of teeth.

Attached to each of the panels 37 and 38 are a plurality of adjustable supports 50 by means of which a plurality of cylindrical permanent magnets 51 are mounted. Each permanent magnet 51 has an end thereof formed into a tooth or pole piece 52. A winding 53 is formed around the permanent magnet 51 adjacent the tooth 52 thereof. A strip of insulating material 54 is attached to each of the permanent magnets 51 adjacent the winding 53 and has affixed thereto a pair of terminals 56 to which the winding 53 is attached.

A terminal strip 57 is attached to one of the clamping members 34 by means of a plurality of screws 58. An angle 59 extending the length of the assembly is attached to one side 21 of the generator housing by means of a plurality of screws 61. An overhanging platform or shelf 62 is secured to the angle 59 and serves to mount a plurality of adjustable resistance units 63. Suitable connections between the resistance units 63 and the armature windings 53 are made by means of a plurality of terminals 64 mounted on the terminal strip 57.

The following description of an adjustable support 50 for one of the permanent magnets 51 is taken in connection with Figs. 5, 6, 7 and 8. Preferably the support 50 is constructed from a solid piece of material having a plurality of lugs 66 and 67, each of which is provided with slots 68 extending longitudinally of the support. A slot 69 is formed parallel to the top and bottom surfaces of the support and extends to a substantial depth so that there are formed two normally parallel spaced members 71 and 72 which are connected together adjacent one end thereof by a thickness of metal 73 sufficient to maintain these ends in a rigid fixed relation to one another. Each of the spaced members 71 and 72 is pro-

vided with a slot 74 which extends transversely of the members from one edge thereof to a point adjacent the opposite edge. The transverse slots formed in the spaced members are in substantial alignment. Each of the members 71 and 72 is provided with a circular opening 76 each of which is aligned with the other and has its center located on the transverse slot 74 adjacent the closed end thereof. The cross section of the spaced members 71 and 72 is materially reduced at the free ends thereof, thereby forming adjacent the transverse slot 74 shoulders 77 and 78 respectively. Between each of the shoulders 77 and 78 and its respective slot 74 is provided a hole 79 through which is inserted a screw 81 which is threaded into a suitably tapped hole 82 formed at the other side of the slot 74. It will be seen that by tightening the screws 81, the slots 74 tend to be narrowed, thereby exerting a clamping action on the cylindrical permanent magnet 51 which projects through the circular openings 76. In order to secure the maximum efficiency of the clamps thus formed, a split fibre bushing 83 is inserted in the circular opening 76 and substantially encircles the magnet 51.

Adjacent the free ends of the spaced members 71 and 72 is a screw 84 which is threaded into a hole formed in the member 71 and is arranged so that its end bears upon the inner surface of the member 72. Another screw 86 is inserted through a suitable hole formed in the member 71 and is threaded into a tapped hole formed in the member 72 in such a manner that the head thereof is brought into engagement with the outer surface of the member 71.

The magnet support 50 is attached to the panel 37 by means of a plurality of screws 87 in cooperation with the slots 68. It will be seen that with the magnet 51 clamped in the support 50 so that the pole piece 52 thereof is disposed adjacent the periphery of the toothed rotor 44, the pole piece 52 may be suitably oriented with respect to the teeth of the rotor by sliding the support 50 on the panel 37 through the limits fixed by the depth of the slots 68. Hence it will be apparent that, with the alternator arranged as shown in Fig. 4, the diametrically opposed armature members may be adjusted in the manner described so that the voltages generated therein will bear any desired phase relationship to one another. In the instant invention it is preferable that the generated voltages be exactly in phase. This is accomplished by adjusting the pole pieces 52 with respect to the teeth of the rotor 44 so that as the latter is rotated, corresponding flux changes occur simultaneously in the respective armature pole pieces.

In accordance with one of the aforesaid objects, the effect of rotational modulation is obviated by adjusting each of the pole pieces 52 so that as the rotor is turned the average air gap between the rotor teeth and the pole pieces remains constant. It is obvious that in order to accomplish this object a fine adjustment of these air gaps is necessary. The manner in which the air gap is adjusted is as follows: Normally the magnet 51 is held in position by being gripped by both of the clamps formed in the spaced members 71 and 72. When it is necessary to adjust the air gap, the screw 81 attached to the spaced member 72 is loosened, thereby releasing the clamp formed in this member. If an increase in the air gap is desired, the screw 84 is threaded into the hole in the member 71 and thus forces this member away from the base member 72. The

effect of this separation is transferred to the section of the member 71 embodying the clamp and hence the magnet 51 is carried away from the rotor 44, thereby increasing the air gap. Such an adjustment is made in relatively small steps. When the members 71 and 72 have been separated by a predetermined amount, the screw 81 associated with the base member 72 is tightened, causing the clamp associated therewith to grip the magnet 51 in a new position. The screw 81 associated with the member 71 may then be loosened, thereby releasing the magnet 51 from the clamp associated therewith. If now the screw 84 be backed off the member 71 will, because of the resiliency of the fixed link 73, be restored to its normal position relative to the base member 72. If further increase of the air gap be desired a repetition of the foregoing steps is all that is necessary.

A decrease in the air gap is made in substantially the same manner. The manipulation of the two clamps is the same as that previously described. In this case, however, the magnet 51 is moved toward the rotor 44 by threading the screw 86 into the base member 72. Because of the fact that the head of the screw 86 is engaged with the outer surface of the member 71, the result of the threading operation is the convergence of the two spaced members 71 and 72. It should be apparent that in performing either one of the above described air gap adjustments, whichever one of the screws 84 and 86 is not to be used in effecting the adjustment should be backed off sufficiently so that it does not interfere with the operation of the screw which is being used.

The air gap adjustments of the diametrically disposed armatures may be made in such a manner that even though the toothed rotor 44 does rotate eccentrically, the voltage which is generated in one of the armatures will be increasing at the same time that the voltage generated in the opposite armature is decreasing. If the output of these two armatures be suitably combined, it is apparent that the net result will be a substantially uniform voltage. The coupling of the generator armature to an amplifying device is shown in Fig. 9. The armatures 88 and 89 are shown connected in series relation and have the terminals thereof connected across the primary winding 91 of a transformer 92. A variable resistance 93 is connected in series with the output of the combined generators 88 and 89 for the purpose of effecting a refinement in the value of

the generated voltage. It has been found that because of the nature of the adjustments provided for controlling the air gap and phase relationships between the armatures and the toothed rotor that it is not always possible to secure the desired elimination of rotational modulation and at the same time secure the exact voltage value desired. By providing one of these variable resistors 93 with each of the generators a uniformity of the output of the respective generators may be obtained. The transformer 92 is provided with a secondary winding 94 in which are induced voltages substantially larger than those impressed upon the primary winding 91. The secondary winding 94 is connected to any conventional type of amplifying device 96 where substantially any desired degree of amplification may be obtained.

The nature of the invention may be ascertained from the foregoing detailed description of what is at present considered a preferred embodiment thereof. It is contemplated that the invention embrace all obviously equivalent forms embodying the principles thereof, and that it be subject to only such limitations as are imposed by the prior art or expressly set forth in the appended claims.

What is claimed is:

1. In an inductor alternator, a toothed rotor, two pickup coils each having a pole piece associated therewith, means for mounting said coils substantially diametrically with respect to said rotor, means for connecting said coils together to supply a constant potential circuit, and means to adjust one of said pole pieces radially and peripherally with respect to said rotor whereby the potentials generated in said coils are of like phase and of complementary magnitudes for all angular positions of said rotor.
2. In an alternator, a toothed rotor, two pickup coils each having a magnetic pole piece associated therewith and mounted substantially diametrically with respect to said rotor adjacent the periphery thereof, means for additively combining the potentials generated in said coils, and means for independently adjusting both of said pole pieces radially and peripherally with respect to said rotor to control the phase and magnitude of the generated potentials in a manner to eliminate the effect of rotational modulation in said combined generator output caused by eccentricity of the rotor.

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