June 9, 1964 J. WEISS 3,136,144

DRIVING MECHANISM

Filed Jan. 7, 1963 2 Sheets-Sheet 1

Fig. 1.

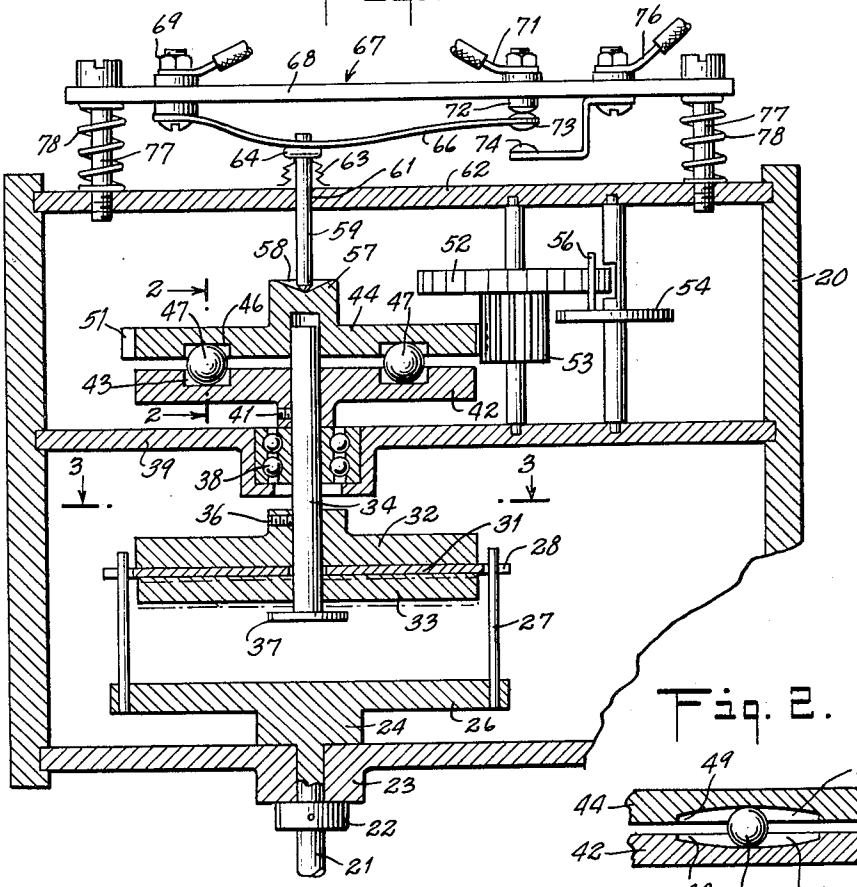



Fig. 2.



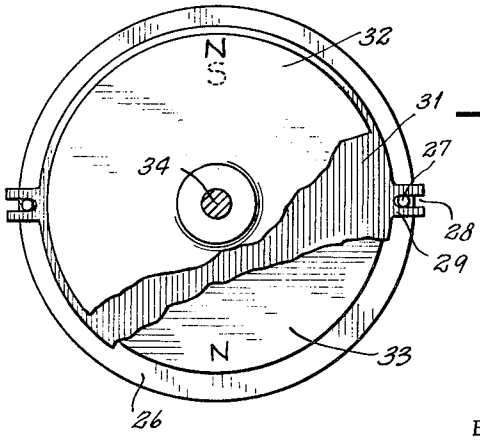




Fig. 3.

INVENTOR.
JOSEPH WEISS
BY Kraguiski & Nolan
ATTORNEYS

June 9, 1964 J. WEISS 3,136,144

DRIVING MECHANISM

Filed Jan. 7, 1963 2 Sheets-Sheet 2

Fig. 4.

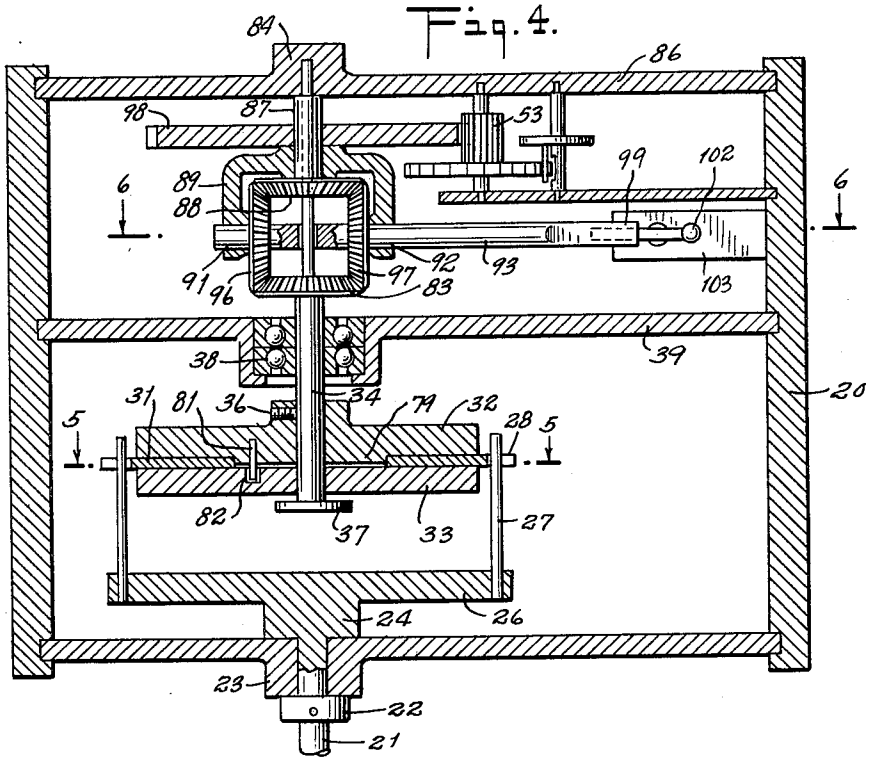



Fig. 5.

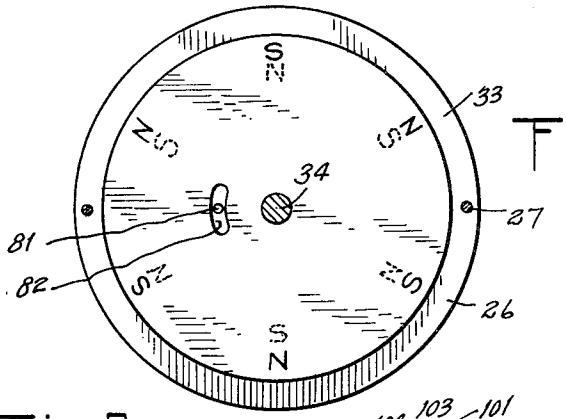
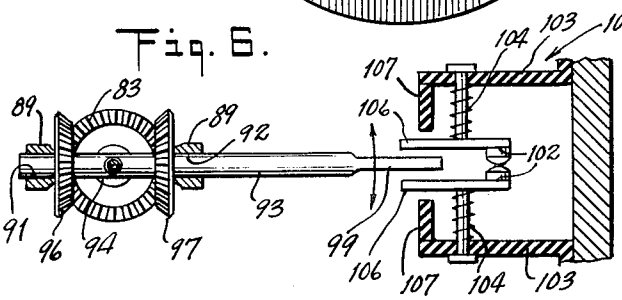



Fig. 6.




INVENTOR.
JOSEPH WEISS
BY Kraguinski & Nolan
ATTORNEYS

United States Patent Office 3,136,144 Patented June 9, 1964



3,136,144

# DRIVING MECHANISM

Joseph Weiss, 134 W. 93rd St., New York 25, N.Y.

Filed Jan. 7, 1963, Ser. No. 249,679
4 Claims. (Cl. 64—30)

The present invention relates to driving mechanisms and, more particularly, to driving mechanisms for governors, which driving mechanisms are an improvement over those shown in my prior United States Patent No. 2,603,731.

A primary object of the invention is to provide a slip type of drive which is magnetically controlled.

A feature of the invention resides in sandwiching between a pair of magnetic members having oppositely disposed north-south poles a driven non-magnetic member, whereby when the poles of the magnetic members are at maximum attraction, the three members rotate in synchronism; whereas when the poles of the magnetic members are at less than at maximum attraction, slip occurs between the driven member and one of the magnetic members.

Other features will be apparent from the following detailed description of the drawings wherein:

FIG. 1 is a central, sectional view of a governor and drive mechanism in accordance with one embodiment of the present invention;

FIG. 2 is a fragmentary sectional view taken along the line 2—2 of FIG. 1 in the direction of the arrows;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 is a central sectional view of a governor and drive mechanism in accordance with another embodiment of the invention;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4 in the direction of the arrows;

FIG. 6 is a fragmentary sectional view taken along the line 6—6 of FIG. 4 in the direction of the arrows, and showing the governor's electrical switch in greater detail.

Referring now to the drawings, particularly to FIGS. 1, 2 and 3 thereof, there is shown one embodiment of a drive mechanism of my invention for use with a governor comprising a casing or housing 20 provided at its base with a shaft 21, which is driven from a suitable source (not shown). The shaft 21 is provided adjacent its upper end with an adjustable collar 22 for abutting a bearing 23 and at its upper end the shaft 21 terminates in a hub 24 of a driving member 26, having rigidly disposed around its periphery lower ends of a pair of upstanding pins 27, the upper ends of which pins are loosely disposed in slots 28 provided in ears 29 of an annulus or disc 31, of non-magnetic material, as more readily seen in FIG. 3. The interior surface areas, both upper and lower, of disc 31 are sandwiched between surface areas of upper and lower coupling magnets 32 and 33, respectively, which are carried by a shaft 34. The upper coupling magnet 32 may be rigidly secured to the shaft 34 by a press fit or, as shown, by a set screw 36 or it may be loosely splined to the shaft for permitting axial movement thereof.

Clutch disc 31 is loosely disposed around shaft 34, as is lower coupling magnet 33 which is capable of moving both axially and rotarially on shaft 34. Lower coupling magnet 33 is adapted to be urged towards the upper coupling magnet 32, when the north and south poles are opposite each other to produce the required magnetic field, the force or strength of which has been predetermined. The amount of axial movement of coupling magnet 33 on shaft 34 can be limited, if desired, by a flange 37 secured to the lower end of shaft 34.

Each of the upper and lower coupling magnets 32 and 33, respectively, has a pair of north and south poles disposed 180° apart. These magnets are arranged on the shaft 34 in such a manner that the north pole of one magnet is opposite the south pole of the other magnet, so that the intertwining magnetomotive forces of the magnets attract each to the other and, consequently, secure the disc 31 therebetween. Since the lower magnet 33 is freely movable axially and around the shaft 34, its north and south poles will be attracted to the respective south and north poles of the upper magnet 32.



It is thus seen that the rotation of shaft 21 is transmitted through driving member 26, pins 27, a clutch disc 31 and clutch coupling magnets 32 and 33. The amount of torque that will be transmitted is determined by the following factors, namely, strength of the magnetic fields of magnets 32 and 33, frictional coefficients of the clutch disc 31 and magnet couplings 32 and 33, thickness of clutch disc 31, and amount of surface area engaged.

Shaft 34 is rotatably supported by a bearing or conventional anti-friction bearings 38, preferably double in number to provide greater stability by permitting free rotation of the shaft while at the same time preventing axial and/or side movement of the shaft 34. A cross member 39, secured to the housing 20, carries the bearings 38. Above the cross member 39 is affixed to shaft 34, as by a set screw 41, a round disc 42 having on its upper surface a plurality of circumferentially spaced tapered cam recesses 43, as is more clearly evident in FIG. 2. Cooperating with cam disc 42 is another round disc 44 which is loosely mounted at the upper free end of shaft 34 and which is provided at its under surface with circumferentially spaced tapered cam recesses 46, similar to cam recesses 43 of the lower cam disc 42. Interposed between the recesses 43 and 46 are shown balls 47 which are retained within the recesses by shoulders 48 and 49, respectively.

Upper cam disc 44 is provided with peripheral teeth 51 for driving conventional escapement mechanism comprising a star wheel 52 driven by a pinion 53 in mesh with the teeth 51 of the upper cam disc 44, and a flutter wheel 54 carrying spaced pins 56 engaged by the star wheel 52. This escapement mechanism resists and retards rotation of the upper cam disc 44 in the conventional manner.

Upper cam disc 44 is also provided with a centrally disposed cap 57 having at its upper surface a tapered recess 58, concentric with shaft 34, for receiving a point of a pin 59 to reduce frictional resistance. The pin 59 is slidable in a bearing 61 formed in a top wall 62 of the housing 20 and its upper end is encased in an insulating boot 63, accordion shaped, to engage a protuberance 64 on a blade spring 66, which is part of a switch assembly 67. This switch assembly comprises a non-conductive base plate 68, a terminal 69 disposed on the base plate 68 having one end of the blade spring 66 electrically connected thereto, and a terminal 71 disposed on the base plate 68 having a contact 72 normally engaged by the free end of the blade spring 66. The blade spring 66 is of the conventional and well known over-center spring employed in snap type electrical switches. When the upper cam disc 44 rises and applies an upward predetermined force to the pin 59, the blade spring 66 transfers its terminal 73 from contact 72 to a contact 74 of a terminal 76.

In order to adjust the force normally exerted by the blade spring 66 on pin 59 without opening the switch 67, the base plate 68 is slidably mounted on screws 77 threadedly secured in the top wall 62 of the housing 20. A spring 78 coiled about each of the screws 77 urges the base plate 68 away from the housing top wall, so that the base plate pressure is set by the degree of penetration of the screws 77 into the housing top plate.

In operation, the torque load at the periphery of the upper disc 44 is set in relation to the angle of the cam

recesses 43, 46 and to the resistance of the escapement mechanism, as well as to the amount of force exerted on the disc 44 by the blade spring 66. This is the torque load that can be transmitted to the escapement mechanism before the balls 47 reach the end of their travel in their opposing cam recesses 43, 46. These factors determine the speed at which cam disc 42 must rotate before the pin 59 will be raised to actuate the switch 67. Thus, if both discs 42 and 44 are rotated in synchronism, for example, at eight revolutions per minute (8 r.p.m.) of the shaft 34, the switch 67 remains inoperative and in its normal position, as shown in FIG. 1.

However, in the event the speed of the shaft 34 is increased, the disc 42 then tends to rotate faster than the upper disc 44 to thereby displace the balls 47, so that as the balls roll along the tapered surfaces of the recesses 43, 46 towards the shoulders 48 and 49, respectively (see FIG. 2), the upper disc 44 and, in turn, the pin 59 are raised to actuate blade spring 66 and thus to operate switch 67. When the rotation of the disc 42 falls below the speed of rotation for which the upper disc 44 is set, the balls 47 return to the low points of their respective recesses 43, 46 and thereby permit reclosure of the switch 67.

Should the torque load, as measured at the periphery of the disc 44 exceed its permissible amount, for example, one inch ounce torque, slip will occur between the driving clutch disc 31 and the driven couplings 32, 33 and thereby maintain the torque load at the periphery of the disc 44 within the predetermined limit. During operation of the mechanism, when such overload occurs, the retarding force of the escapement mechanism at the periphery of disc 44 is transmitted back to upper coupling 32 through the shaft 34, to reduce its speed of rotation, whereby coupling 32 drops out of synchronism with clutch disc 31. The difference of speed between coupling 32 and disc 31 causes a rotary displacement of lower coupling 33 away from its normal position in its magnetic relationship with upper coupling 32, as respects their poles for attraction, and when this occurs, coupling 33 is axially, although imperceptibly, displaced away from coupling magnet 32. This decreases the frictional engagement between clutch disc 31 and the couplings 32 and 33. There is thus produced a slip between the clutch disc 31 and the couplings 32 and 33, whereby only sufficient magnetic attraction and frictional contact therebetween is permitted to transmit the predetermined amount of torque load.

Should the torque load drop to a point below its predetermined maximum amount, the attraction of coupling magnets 32 and 33 will increase, that is, the original magnetic attraction will be resumed as the north-south poles thereof register and will thereby overcome the now weakened disengaging force acting on upper coupling 32 and permit the lower coupling 33 to be returned to its normal position with respect to upper coupling 32. Accordingly, the clutch disc 31 is again in full frictional engagement with couplings 32 and 33.

In FIGS. 4, 5 and 6 is shown another embodiment comprising a casing or housing 20 with driving shaft 21, driving member 26 and pins 27 disposed in slots 28 of clutch disc 31 which has its interior surface area sandwiched between surface areas of clutch coupling magnets 32 and 33, carried by shaft 34, the upper coupling 32 being rigidly secured to the shaft 34 by a set screw 36. Clutch disc 31 is shown loosely disposed around a lower shoulder 79 of upper coupling 32. The depth or thickness of shoulder 79 is less than that of disc 31. As in FIG. 1, shaft 34 includes a flange 37 for limiting axial travel of the lower coupling 33.

Upper coupling 32, see FIGS. 5 and 6, has projecting downwardly from it a pin 81 which is movable in a slot 82 formed in lower coupling 33. The pin 81 and slot 82 are utilized where it is desirable to control and/or limit the amount of disengagement and thus the amount of frictional slip between clutch disc 31 and upper clutch coupling 32. The amount of angular disalignment between the north-south poles of couplings 32 and 33 may thus be controlled to regulate the amount that the magnetic lines of force of the poles couplings 32 and 33 are permitted to move out of alignment with respect to each other. This also prevents the possibility of couplings 32 and 33, at any time, becoming completely out of magnetic attraction with each other and thus prevents the like poles thereof from opposing each other and forcing the couplings apart.



Referring again to FIG. 5 there is shown lower coupling 33 with a plurality of magnetic poles, namely six, instead of the conventional two poles (north and south). In its normal position, lower coupling 33 has its north and south poles in alignment with the south and north poles, respectively, of upper coupling 32 for maximum attraction between the couplings, as is readily evident from FIG. 5, where the poles on lower coupling 33 are shown in full and those on upper coupling 32, in dotted lines.

Shaft 34, above cross member 39, has securely fastened to it, by a press fit or other suitable means, a bevel gear 83, above which the shaft 34 is reduced in diameter and terminates in a bearing 84 disposed in a top wall 86 of the housing 20. Loosely mounted about the reduced upper portion of shaft 34 is shown a sleeve 87 and rigidly fastened to this sleeve 87 is shown a bevel gear 88. Above gear 88 and loosely mounted about sleeve 87 is a yoke 89, which at its lower, spaced ends has openings 91 and 92 through which a transverse shaft 93 extends, shaft 93 being keyed or fastened by conventional means to yoke 89. Shaft 93, which intersects shaft 34, has a clearance hole 94, FIG. 6, to allow shaft 34, which is of lesser diameter, to pass through it. Rotatably mounted on shaft 93 are two oppositely spaced bevel gears 96 and 97, which are in mesh engagement with bevel gears 83 and 88. Also rigidly fastened to sleeve 87 above yoke 89 is a gear 98 which is in mesh engagement with the pinion 53 of the escapement mechanism.

Shaft 93 at its right end, as seen in FIGS. 4 and 6, has an electrical non-conductive rod 99 of insulating material extending therefrom which rod actuates a switch assembly 101. The shaft 93 may be wholly of non-conductive material. The switch assembly 101, see FIG. 6, comprises a pair of contacts 102, each slidably mounted on non-conductive supports 103 and urged towards and into contact with each other by a spring 104. The contacts 102 have spaced apart tips 106, between which the free end of the rod 99 is disposed, whereby the springs 104 serve to restrain the shaft 93 and, in turn, the yoke 89 against movement. Suitable stops 107 on the supports 103 limit the extent of movement of the switch contacts 102, the rod 99 and the shaft 93.

In this embodiment rotary motion is transmitted from shaft 21 in the same manner as in FIG. 1. Rotary motion from shaft 34 is then transferred to bevel gear 83 which rotates bevel gears 96 and 97 and which latter gears rotate bevel gear 88 and, in turn, gear 98 to drive the escapement mechanism. When such rotation takes place at a speed the escapement mechanism is capable of permitting, the shaft rod 99 remains at rest. However, should this speed exceed that permitted by the escapement mechanism, rotation of gear 98 and that of bevel gear 88 is held to a lesser speed than that of bevel gear 83. Likewise bevel gears 96 and 97, which are now restrained from rotating on shaft 93 in synchronism with bevel gear 83, tend to move on a horizontal plane with gear 83 in an arcuate path (see FIG. 6), carrying with them shaft 93 which causes rod 99 to actuate the switch 101. When rotation of bevel gear 83 ceases to rotate or drops to a low speed, the spring 104 acts on the contact 102 to reclose the switch and restore the rod 99, shaft 93 and yoke 89 to their normal neutral positions.

As various changes may be made in the form, construction, and arrangement of the parts herein, without depart-

ing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

1. A drive mechanism comprising a shaft, a driven non-magnetic member freely rotatable on said shaft, a magnetic member freely rotatable and axially movable on said shaft, and a second magnetic member rotatable with said shaft, said non-magnetic member being sandwiched between said magnetic members, each of said magnetic members having a north pole and a south pole spaced from each other, whereby when the north-south poles of the magnetic members are opposite each other the non-magnetic member is fixedly held therebetween and when the north-south poles of the magnetic members are not in exact alignment the non-magnetic member is less fixedly held to permit slip of the latter with respect to either of the magnetic members.

2. A drive mechanism comprising a shaft, a driven non-magnetic member freely rotatable on said shaft, a magnetic member freely rotatable and axially movable on said shaft, and a second magnetic member rotatable with said shaft, said non-magnetic member being sandwiched between said magnetic members, each of said magnetic members having a plurality of north poles and south poles spaced from each other, whereby when the north-south poles of the magnetic members are opposite each other the non-magnetic member is fixedly held therebetween and when the north-south poles of the magnetic members are not in exact alignment the non-magnetic member is less fixedly held to permit slip of the latter with respect to either of the magnetic members.

3. A drive mechanism in accordance with claim 2, wherein mechanical means are provided for limiting rotary displacement of said magnetic members with respect to each other.

4. A drive mechanism in accordance with claim 3, wherein said mechanical means are constituted by a co-operating pin and slot arrangement.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,300,778 | Cornwell | Nov. 3, 1942 |
| 2,603,731 | Weiss | July 15, 1952 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 525,316 | Canada | May 22, 1956 |