

Feb. 12, 1935.

R. L. NYBURG

1,990,665

DRIVE MECHANISM

Filed June 16, 1930

2 Sheets-Sheet 1

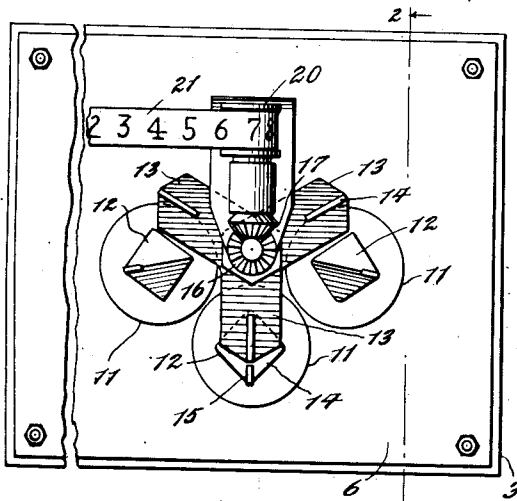


Fig. 1.

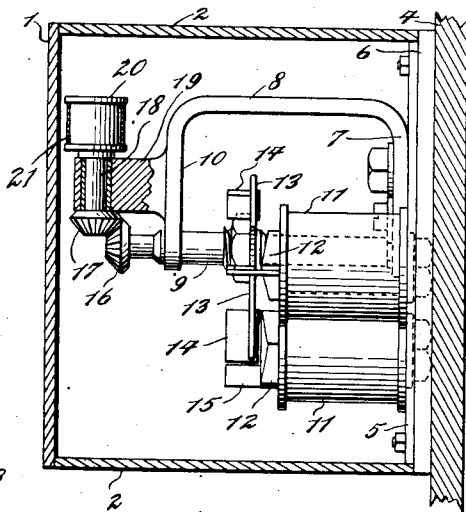


Fig. 2.

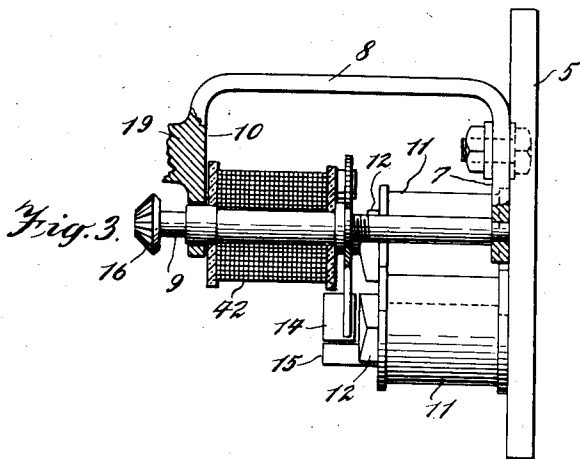


Fig. 3.

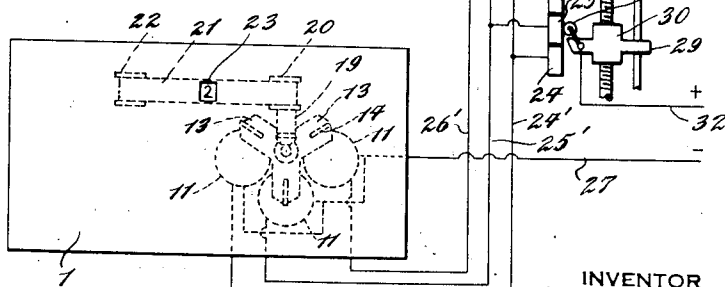


Fig. 7.

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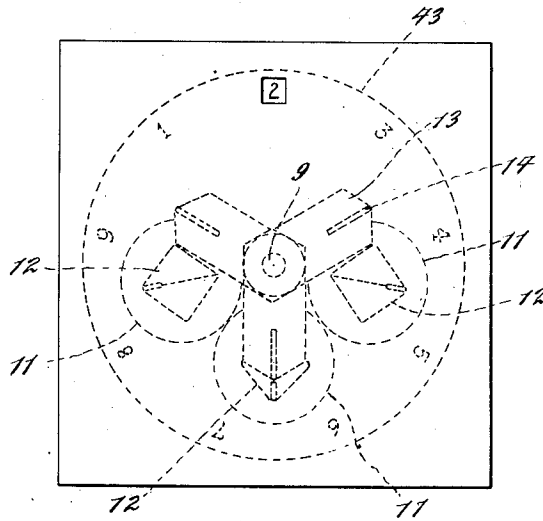
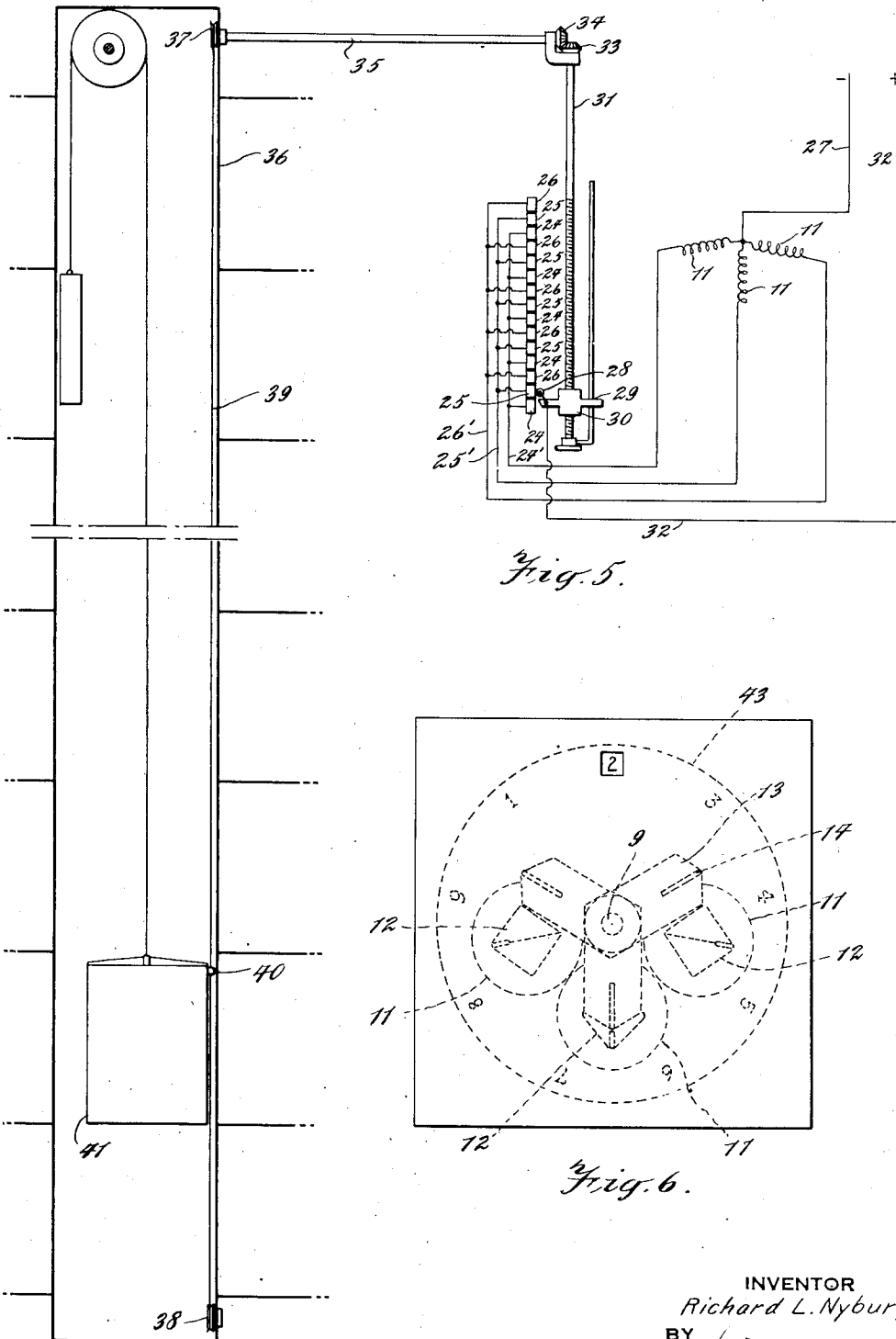
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2 Sheets-Sheet 2



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DRIVE MECHANISM

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Application June 16, 1930, Serial No. 461,297

3 Claims. (Cl. 172-239)

My invention relates to a progressive, reversible drive. It embodies a member or controller adapted to be driven and a follower device. Broadly the invention is independent of specific application but it has particular advantages in constructions employing a controller located at a distance from the follower.

Step-by-step, progressive, reversible drives have many and varied uses, such for instance as remote control for radios, floor landing indicators for elevator systems, etc.

In constructions employing a progressive, reversible drive, where the control member and the driven member are sufficiently close and relatively stationary, drives entirely mechanical are commonly used. Drives entirely mechanical have also been used for floor landing indicators for elevator systems, but in this connection they are expensive and unreliable.

Where the control member is located at a distance from the driven member, drives completely electrical have been used, and combination electrical and mechanical drives have also been used.

The completely electrical drive requires a separate control wire extending between the follower and the control member for each step in the drive. Thus, if there are twenty steps in the drive, there must be twenty control wires extending between the control member and the follower. The employment of large numbers of circuits or wires complicates the mechanism and adds materially to its expense, and consequently prohibits such installations for all practical purposes.

To overcome this objectionable multiplicity of circuits for a remotely controlled electrical step-by-step progressive drive, the combination mechanical and electrical drives have been devised. These drives in general consist of a control member which intermittently energizes electromagnetic means. The impulses received by the electromagnetic means is transformed into a reciprocating mechanical movement which is utilized to progressively advance a follower in accordance with the number of impulses received. These combination mechanical and electrical drives are slow to respond and require constant attention in order to maintain the delicate mechanical parts in operative condition.

By my invention I am enabled to construct a completely electrical, step-by-step, progressive, reversible drive in which the number of control wires extending between the controller and the follower is independent of the number of steps in the drive. I employ a construction in which the follower comprises a fixed and a movable

part, the movable part being operatively related to the fixed part. Electromagnets are associated with one of the parts in the follower for causing electromagnetic attractions between the fixed and movable parts. A plurality of armatures adapted to cooperate with the electromagnets are associated with the other of the parts in the follower. The armatures and the electromagnets are so related that when one of the armatures is attracted to a magnet, another of the armatures is within the range of other of the magnets in advance of and behind the magnets relative to the direction of movement of the movable part. A controller, which may be located at a distance from the drive device, is provided for progressively energizing the electromagnets in the follower device.

Specifically, I provide a follower in which the movable part is rotatably mounted. Arranged around the movable part and secured to the fixed part, there are a plurality of electromagnets angularly disposed with respect to each other. A plurality of radial armatures are secured to the movable part and are adapted to cooperate with the electromagnets. The relation of the angular disposition of the electromagnets with respect to adjacent magnets and the angular disposition of successive armatures is such that in all positions of the movable member, an armature is within the range of influence of a magnet behind the next succeeding magnet to be energized for the continued forward movement of the controller in the same direction, and the same armature or another of the armatures is within the range of and in advance of the next succeeding electromagnet to be energized by the reverse movement of the controller. Although various combinations may be utilized to accomplish this relation of armatures and electromagnets, I have found that the most satisfactory combination is that in which the armatures are successively angularly disposed through equal angles and in which there are three electromagnets, the angle between adjacent electromagnets being equal and related to the angle between successive armatures in the ratio of two to three.

In one embodiment I have used three magnets, each magnet being disposed with respect to the adjacent magnet through an angle of 80°. With this construction, I use three armatures which are uniformly distributed about the rotatable member, that is, being successively angularly disposed through angles of 120°.

Associated with this follower there is a control member which consists of three or more fixed

contacts and a movable contact. If there are more than three contacts, the contacts are connected in groups, each group containing three contacts and the corresponding contacts of the various groups being connected in multiple. A contact of each group of contacts is connected to one side of an electromagnet in the follower, the other side of the electromagnets being connected in common to one side of a power supply line. The movable contact which is adapted to make an electrical contact with the various fixed contacts in succession is connected to the other side of the power supply line. Thus, as the movable contact moves over the fixed contacts in succession, the electromagnets are successively energized and the rotatable member is progressively advanced.

An advantage of this construction is the fact that there is only one wire extending from the controller to the follower for each electromagnet irrespective of the number of steps in the controller.

Another advantage of this construction is the fact that any number of contacts may be included in the control device.

Other features and advantages of my invention will be apparent from the following detailed description of the embodiment illustrated in the drawings in which:

Fig. 1 is an enlarged fragmentary elevation of an indicator constructed in accordance with my invention;

Fig. 2 is a sectional end elevation of the same taken on the line 2—2 of Fig. 1;

Fig. 3 is a modification of the construction shown in Figs. 1 and 2;

Fig. 4 is a plan of an indicator as shown in Fig. 1, the indicator being coupled, diagrammatically, to a control device;

Fig. 5 is a diagrammatic illustration of the drive of my invention as applied in an elevator system; and

Fig. 6 is a plan of a slightly modified form of floor landing indicator.

Although, broadly, my invention is independent of any specific application I have, for the purpose of making the invention more readily understood by those skilled in the art, illustrated it in the form of a device for indicating the position of an elevator car in a shaftway.

The indicator shown in the drawings comprises a cabinet having a face plate 1 and side and end walls 2 and 3 respectively. The cabinet is adapted to be secured to a wall 4 of the elevator car, the superintendent's office or any place where such an indicator is desired. Within the indicator cabinet a frame member 5 is secured to the bottom 6 thereof. The frame member 5 is made of metal and preferably of a metal which is a good magnetic conductor. To the frame member, there is secured one arm 7 of a yoke 8 between the arms of which a shaft 9 is rotatably mounted, the end of the shaft extending through the free arm 10 of the yoke. That portion of the shaft which is journaled in the arms of the yoke is preferably made of metal which is a non-conductor of magnetic lines of force, such for instance as brass. If the shaft is made entirely of magnetically conductive material, it is likely to become magnetically locked and will not rotate freely in the bearings. Around this shaft, there are three electromagnets 11, the centers of which lie on the circumference of a circle concentric with the shaft. The magnets are secured to the frame member 5 and are provided with soft-iron

cores 12. The angular distance between adjacent magnets is 80°. To the shaft, there is secured three armatures 13 successively angularly displaced about the shaft through angles of 120°. The ends of the armatures are tapered longitudinally thereof and veins 14 are provided at the end of the armatures and located centrally thereof. Similar veins 15 are provided on the cores of the electromagnets, the veins 14 on the armatures being adapted to be brought into alignment with the veins 15 on the electromagnets. The opposed edges of these veins 14 and 15 are narrow and concentrate the magnetic flux so that the veins are brought into alignment and the armatures centered over the electromagnets when attracted thereto.

The arrangement of the electromagnets and the armatures on the shafts as above described is such that when one of the armatures is attracted to an electromagnet and held thereby, one or both of the other armatures are angularly displaced from the other electromagnets through an angle of 40°, in advance of one of the magnets and behind the other of the magnets in the direction of rotation of the shaft. Thus, depending upon which magnet is next energized, the shaft will continue in the same direction of rotation or its direction of rotation will be reversed. As seen in Fig. 1 the lower armature is in alignment with the lower electromagnet and the other armatures are angularly displaced from the electromagnets through angles of 40°. Assuming that the shaft 9 was rotated to the left into the position shown, the armature to the left is in advance of the electromagnet adjacent thereto and the armature to the right is behind the other electromagnet relative to the direction of rotation of the shaft. Thus it will be seen that if the electromagnet to the right is next energized, the shaft will continue to move to the left, and if the electromagnet to the left is next energized, the shaft will be rotated to the right. The shaft is, of course, rotated through an angle of 40° for each step in the drive.

On the end of the shaft 9 extending through the free arm 10 of the yoke there is secured a beveled gear 16. The beveled gear 16 meshes with another beveled gear 17 secured on the end of a short shaft 18 journaled in and extending through a bearing bracket 19 formed on the free arm 10 of the yoke 8. On the opposite end of the short shaft 18, a pulley 20 is secured. A belt 21 having numbers printed thereon extends over the pulley 20 and an idler pulley 22 which holds the belt parallel to and in close proximity to the inner surface of the face plate 1 of the cabinet of the indicator. In the face plate, there is an opening 23 through which the belt may be seen, the opening being of such dimensions that only one number on the belt can be seen at a time. In this way, rotation of the shaft changes the numbers behind the opening in the face plate.

Energization of the electromagnets is controlled by cooperating fixed contacts and a movable contact. The number of fixed contacts will depend upon the number of indications to be recorded by the indicator. In the illustrated embodiment fifteen fixed contacts are shown. These contacts are connected in groups of three, corresponding contacts being connected in multiple. As shown, contacts numbered 24 are connected to wire numbered 24', contacts 25 to wire numbered 25', and contacts numbered 26 to wire 26'. Wires 24', 25' and 26' are each connected to one side of an electromagnet 11 in the indicator, 75

the other side of the electromagnets being connected in common to the negative side of a power supply line by a wire 27. The movable contact 28 which is carried by a carriage 29 having a hub portion 30 threaded to receive a screw shaft 31 is adapted to successively energize the fixed contacts and is, therefore, connected to the positive side of the power supply line 32. The direction of movement of the indicator will, of course, depend upon the direction of movement of the screw shaft 31 which determines the direction in which the movable contact 28 moves over the fixed contacts.

In Fig. 5, the relation of the movable contact to an elevator is illustrated. The screw shaft 31 upon which the carriage 29 carrying the movable contact 28 is threaded has at its upper end a beveled gear 33. This gear meshes with another beveled gear 34 secured on one end of a shaft 35, the opposite end of which extends into the elevator shaftway 36. On the end of the shaft 35 within the elevator shaftway, there is secured a pulley 37. Another pulley 38 is rotatably mounted at the lower end of the shaftway and a belt 39 extends over these pulleys. The belt 39 is secured to a projection 40 provided on an elevator car 41 that is mounted in the shaftway. In this way, movement of the elevator car in the shaftway is transmitted to the belt 39 and rotates the pulleys 37 and 38 and consequently, the screw shaft 31 to move the carriage 29 threaded thereon up and down in unison with the car. The mechanism illustrated to show the connection between the elevator car in the shaftway and the movable contact is of course diagrammatic and represents the usual connection between the elevator car in the shaftway and a floor selector device. In fact, it is contemplated to place the fixed contacts on the floor selector panel and the movable contact on the carriage of the floor selector device when the progressive drive is used in conjunction with an elevator system to indicate the position of the elevator in the shaftway. Where the indicator is used with an elevator system that does not include a floor selector, a separate contact device will be employed.

In Fig. 3 there is shown a modified form of the follower device. In this form there is provided an extra electromagnet 42, the electromagnet being wound about the shaft in such a way that the armatures are given a magnetic polarity opposite to that of the core of the stationary electromagnets with which they cooperate. This arrangement serves to increase the force with which the armatures on the shaft are attracted to the electromagnet.

In Fig. 6 another modified form of indicator is shown. In this form a disc 43 is secured to the shaft, the disc being in close proximity and parallel to the face plate 1 of the indicator cabinet. The characters to be indicated are printed upon the disc and are successively brought into

alignment with an opening in the face plate of the cabinet. This form is applicable where a comparatively small number of characters are to be indicated.

From the above description it will be seen that the drive of my device is simple in construction and comparatively inexpensive to manufacture and install. It is also accurate and reliable and does not require much attention. Furthermore, the number of wires extending between the control device and the indicator is constant (in the embodiment shown, four in number) irrespective of the number of steps in the control device.

It is obvious that various changes may be made in the embodiment illustrated in the drawings and above particularly described within the principle and scope of my invention as expressed in the appended claims.

I claim:

1. A progressive, reversible drive comprising a fixed part and a movable part rotatably mounted with respect thereto, three electromagnets secured to the fixed part and arranged about the axis of the movable part, two of the magnets being angularly displaced through an angle of one hundred and sixty degrees and the third magnet being positioned on the bisector of the angle between the other two, three armatures secured to the movable part and adapted to cooperate with the electromagnets, said armatures being successively angularly displaced through angles of one hundred and twenty degrees, and means for progressively energizing the electromagnets.

2. A progressive reversible drive comprising a fixed part and a movable part, means mounting the movable part to rotate relative to the fixed part, a plurality of electromagnets mounted about the axis of rotation of the movable part comprising at least one group of three, two magnets of a group being spaced through an angle of 160° and the third magnet being positioned on the bisector of the angle between the other two, a plurality of armatures secured to the movable part and equally spaced about its axis of rotation, the number of armatures being a multiple of three and means for energizing the electromagnets progressively within a group.

3. A progressive, reversible drive comprising a fixed part and a movable part rotatably mounted with respect thereto, a plurality of armatures secured to the movable part and adapted to rotate therewith and being successively displaced about the axis of rotation through equal angles, and a plurality of electromagnets, one for each armature mounted about the axis of rotation of the movable part, the adjacent magnets on each side of one magnet being displaced therefrom through equal angles which angles are related to the angular displacement of successive armatures as two is to three.

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