Sept. 19, 1950 P. F. EARLY 2,522,815

MAGNETIC DEVICE FOR TRANSMITTING MOVEMENT THROUGH A SOLID WALL

Filed Jan. 17, 1947 3 Sheets-Sheet 1

Fig 1

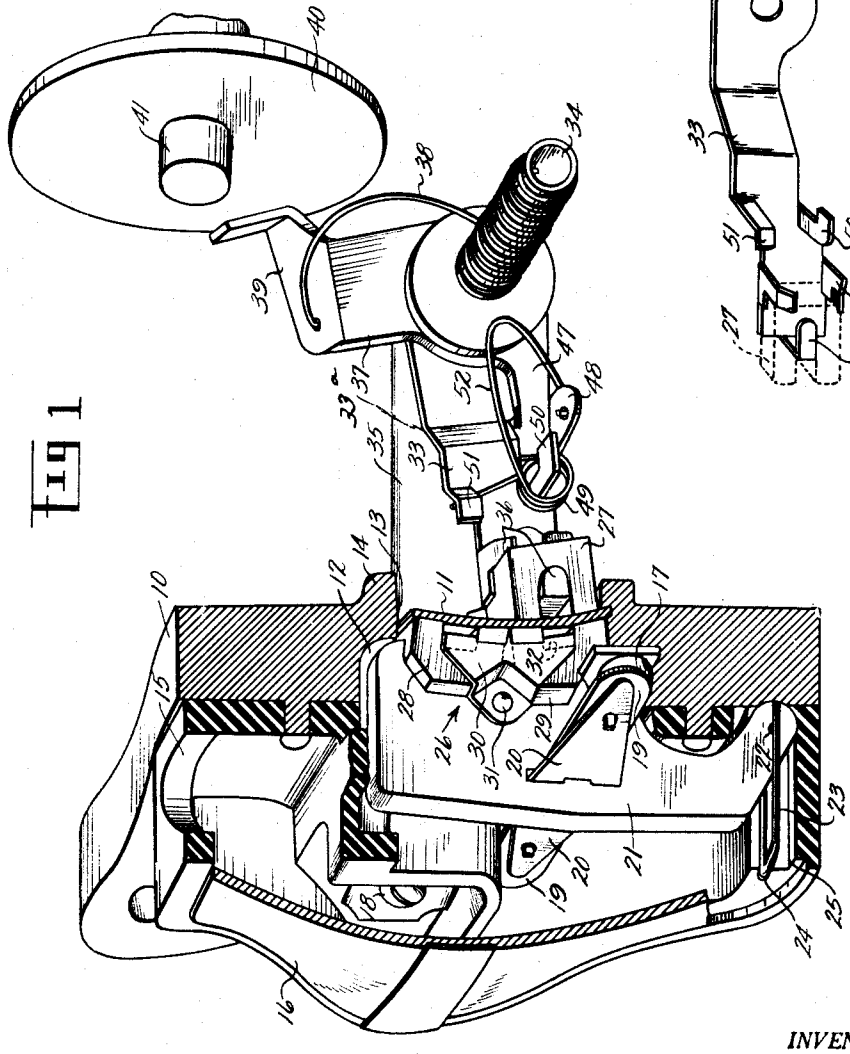


Fig 4

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Fig 5

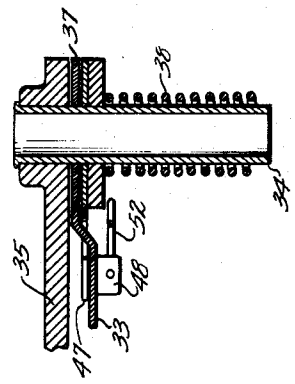
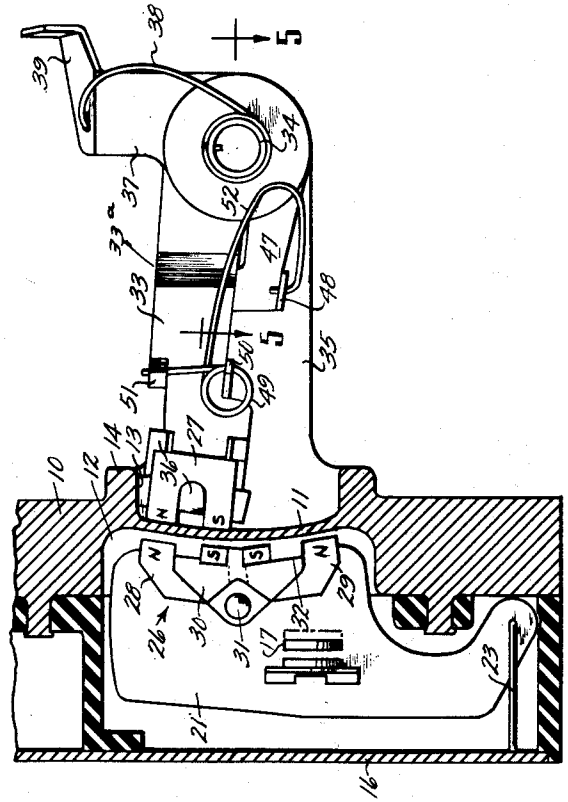


Fig 2



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Filed Jan. 17, 1947 3 Sheets-Sheet 3

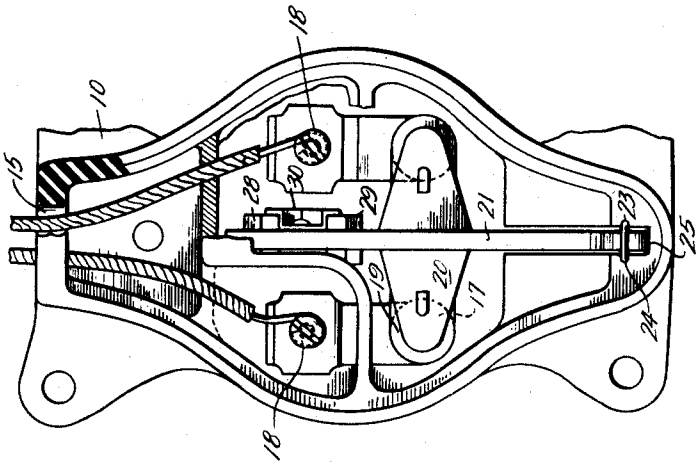


Fig 3

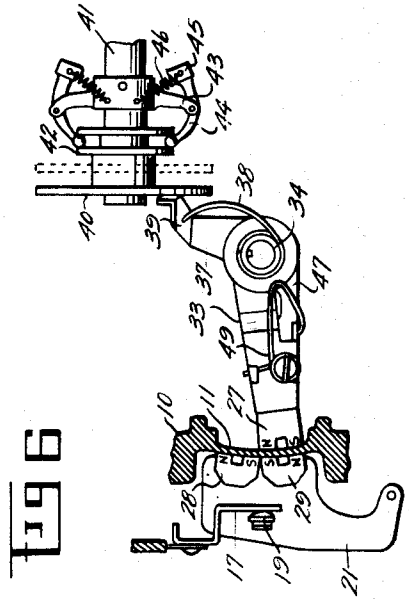


Fig 6

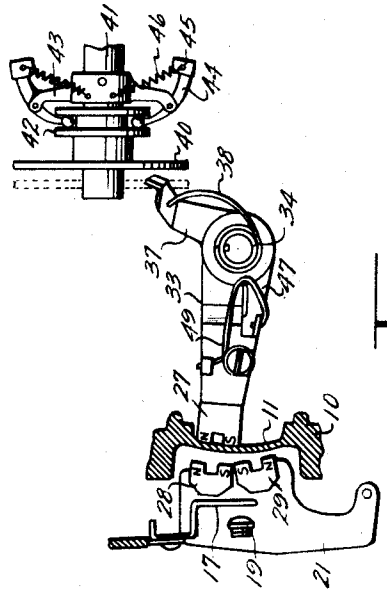


Fig 7

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UNITED STATES PATENT OFFICE

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MAGNETIC DEVICE FOR TRANSMITTING MOVEMENT THROUGH A SOLID WALL

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Application January 17, 1947, Serial No. 722,685

8 Claims. (Cl. 200—80)

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This invention relates to a magnetic device for transmitting movement through a solid wall.

One object of the invention is to provide a device in which the movement of a structure on one side of a continuous wall may be controlled by the movement of a magnet on the other side of said wall.

A further object of the invention is to provide such a device in which the movement of a magnet in a sealed casing will control the operation of a switch mounted exteriorally of said casing.

A further object of the invention is to provide such a device with simple efficient means for reversing the polarity of a magnetic structure on one side of a continuous wall with relation to a magnetic structure on the other side of said wall.

A further object of the invention is to provide such a device which, as a whole, is simple in construction and reliable in operation.

Other objects of the invention may appear as the device is described in detail.

In the accompanying drawings Fig. 1 is a perspective view, partly in section, of a magnetic device embodying the invention; Fig. 2 is a side elevation of such a device, partly in section; Fig. 3 is a rear view of said device with the back wall removed; Fig. 4 is a detail view of the supporting arm for one of the magnets; Fig. 5 is a section taken on the line 5—5 of Fig. 2; Fig. 6 is a schematic view showing the magnets in switch closing position; and Fig. 7 is a similar view showing the magnets in switch opening positions.

In these drawings I have illustrated one embodiment of the invention and have shown the same as designed primarily for use with an electric motor mounted in a sealed casing, as is customary in electric refrigerators and the like, to operate an external switch to control the starting circuit of the motor. It is to be understood, however, that the device may take various forms and may be utilized for various purposes.

The motor and its enclosing casing may be of the usual or any suitable construction, and I have not illustrated the same except for the member 10 which constitutes at least a portion of one wall of the casing and through which the magnets operate. The wall member 10 is preferably of non-magnetic material, such as brass or plastic material, and includes a part 11 of reduced thickness which is interposed between the magnets, as will be hereinafter described, and is hereinafter referred to as the wall. In the present

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construction the wall 11 is formed by providing in the outer side of the member 10 a recess 12 and in the inner side of that member a recess 13, the combined depth of the two recesses being such as to impart the desired thickness to the wall 11. In the present instance the depth of the recess 13 is increased by a boss 14 extending about the same.

Mounted on the outer side of the wall member 10 is a housing 15 in which is mounted the switch or other device to be controlled. In the present instance the switch comprises fixed contact members 17 which are connected through terminals 18 with the starting circuit of the motor. Cooperating with the fixed contacts are movable contacts 19 which in the present instance are in the nature of yieldable fingers electrically connected one with the other and carried by arms 20 mounted on a movable supporting structure. This supporting structure may take various forms and in the present instance comprises an upright arm 21 pivotally supported on the housing at its lower end and having a relatively wide upper portion adapted to enter the recess 12. To facilitate the insertion and removal of the contact supporting member 21 it is here shown as pivotally mounted on a pivot pin forming a part of a U-shaped member 23, one leg of said U-shaped member being bent transversely to form the pivot pin. The legs of the U-shaped member are supported in channels 24 formed in the side wall of a groove 25 in the bottom of the housing. Thus the apertured lower end of the supporting member 21 may be mounted on the member 23 and the latter then inserted in the channels 24 where it is firmly retained, as by the back wall of the housing.

Arranged on the outer side of the wall 11 and connected with the movable supporting structure 21 for movement thereby is a magnetic structure 26. Arranged on the opposite or inner side of the wall 11 is a second magnetic structure 27 which is movable with relation to the magnetic structure 26 to reverse the polarity thereof with relation to the magnetic structure 26, the arrangement being such that when the magnetic structure 27 is in one position the magnetic structure 26 will be attracted thereto and the switch closed, and when the magnetic structure 27 is in another position the magnetic structure 26 will be repelled and the switch opened. The magnetic structures may take various forms and may be supported in various ways. In the particular construction illustrated the magnetic structure 26 comprises two permanent magnets 28 and 29,

preferably U-shaped, and having their poles facing the outer surface of the wall 11. The two magnets are rigidly connected with the pivoted supporting member 21 for movement therewith. They may be connected with the supporting member in any suitable manner, as by a clip 30 secured to the supporting member 21. The magnets are arranged one above the other with their poles substantially in vertical alinement and with the positions of their poles reversed so that like poles of the two magnets, in the present instance the south poles, are adjacent one another.

The magnetic structure 27 comprises a single magnet, also a U-shape and having its poles facing and close to the inner surface of the wall 11. This magnet is supported for movement to a position opposed to the magnet 29 or to a position opposed to the magnet 28. In the present arrangement the magnet 27 is supported for vertical movement in a guideway formed by the recess 13 in the member 10. The north pole of the magnet 27 is arranged above the south pole and consequently when the magnet 27 is in opposed relation to the magnet 29 the north pole of each of said magnets will be opposite the south pole of the other magnet and the lines of force passing through the wall 11 will attract the magnet 29 toward the wall 11 and thus actuate the switch supporting member 21 to close the switch. When the magnet 27 is moved to its other or upper position its poles will be opposed to the corresponding poles of the magnet 28 and that magnet will, therefore, be repelled and the switch supporting member moved in a direction to open the switch.

The magnet 27 may be supported and actuated in any suitable manner, this depending in part upon the character of the device to be controlled. In the present instance the position of the magnet 27 is controlled in accordance with the speed of operation of a motor. As here shown the magnet 27 is mounted on an arm 33 which is pivotally mounted at one end on a shaft 34 supported by and rigid with a suitable supporting structure within the casing, such as a fixed arm carried by the wall member 10. At its other end the arm 33 is provided with a plurality of flexible fingers 36 adapted to be bent into supporting engagement with the magnet 27 in such a manner as to rigidly connect the latter with the arm 33. Connected with the arm 33 is a second arm 37 which extends at an angle to the arm 33 and is connected with the shaft 34 by a spring 38 which tends to move the magnet 27 to its upper or switch opening position. At its outer, in the present instance its upper, end the arm 37 is provided with a projecting part 39 adapted to be engaged by an actuating member 40 which when moved in one direction will move the magnet 27 to switch closing position and when moved in the other direction will release the magnet 27 for movement to switch opening position by the spring 38. In the present construction the actuating member 40 is controlled in accordance with the speed of rotation of the motor and the member 40 is in the nature of a disk slidably mounted on a motor driven shaft 41 and having connected therewith a grooved collar 42. Rigidly secured to the shaft 41 is a centrifugal device comprising substantially radial arms 43, on the outer ends of which are mounted levers 44. Each lever has at that end adjacent the actuating device a part extending into the groove of the collar 42, and the opposite end of each lever is weighted as shown at 45, the outward movement of the weighted ends of the lever being resisted by springs 46 which tend to move the disk 40 into engagement with the arm 37 and to actuate the latter. When the motor is idle or is operating at very low speed the centrifugal force thereon will be insufficient to overcome the action of the springs 46 and the actuating disk 40 will be retained in contact with the part 39 of the arm 37 and the latter will be held in a position to retain the magnet 27 in its lower or switch closing position. The disk will be retained in this position until the motor acquires normal operating speed at which time the weighted ends of the arms 44 will be thrown outwardly by centrifugal force and the actuating disk 40 retracted, thereby releasing the arm 37 and permitting the magnet 27 to be moved by the spring 38 to its upper or switch opening position.

It is preferable that the arm 37 should be yieldable with relation to the arm 33 so that excessive force exerted on the arm 37 will not cause breakage or other injury to any part. For this purpose the arms 33 and 37 are separate arms and are supported on the shaft 34 for relative pivotal movements. The arm 37 is provided with a part 47 which extends forwardly along the arm 33 beneath and in contact with the lower edge of an offset part 33*a* thereof, so that when the part 47 of the arm 37 is moved upwardly by the spring 38 the arm 33 will move therewith, but in the event of excessive pressure on the arm 37 or of undue resistance to the movement of the magnet the part 47 may move downwardly with relation to the arm 33. When the part 47 is moved downwardly by the disk the arm 33 and magnet 27 will move downwardly, by gravity or otherwise. The part 47 is held yieldably in engagement with the lower edge of the arm 33 by a spring 49 coiled about a finger 50 extending laterally from the arm 33. One end portion of the spring engages and is held against movement by a second finger 51 on the arm 33, and the other end of the spring has a U shaped bend 52, the outer leg of which is connected with a finger 48 secured to the part 47 and thus serves to yieldably hold the finger 48 in contact with the arm 33.

While I have shown and described one embodiment of my invention, I wish it to be understood that I do not desire to be limited to the details thereof, as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A device for controlling a part to be operated comprising two magnetic structures adapted to be supported on opposite sides of a non-magnetic wall with their poles facing the respective sides of said wall, one of said structures including two permanent magnets, means for supporting said magnets for movement in unison in a path transverse to the plane of said wall and for connecting the same with the part to be operated, the other of said structures comprising a single magnet movable in a path transverse to the paths of the first mentioned magnets alternately into opposed relation to the respective first mentioned magnets, the poles of the several magnets being so arranged with relation one to the other that one of the first mentioned magnets will be attracted by the said single magnet when the latter is opposed thereto and the other of said first mentioned magnets will be repelled by said single magnet when the

latter is opposed thereto, and means for actuating said magnets.

2. A device for controlling a part to be operated comprising two magnetic structures adapted to be supported in opposed relation on opposite sides of a non-magnetic wall, with their poles facing the respective sides of said wall, one of said structures including two permanent magnets arranged with the several poles thereof in a line substantially parallel with said wall and with like poles of the two pairs of poles adjacent one to the other, means for supporting said magnets for movement in unison toward and from said wall in a path transverse to the line of said poles and for connecting the same with said part to be operated, the other of said structures including a single permanent magnet movable into opposed relation to either of the first mentioned magnets, whereby the first mentioned magnetic structure will be attracted when said single magnet is in one position and will be repelled when said single magnet is in another position, and means for imparting said movement to said single magnet.

3. A device for controlling a part to be operated comprising two magnetic structures adapted to be supported in opposed relation on opposite sides of a non-magnetic wall, one of said structures including two permanent magnets arranged with the several poles thereof in a line substantially parallel with said wall and with like poles of the two pairs of poles adjacent one to the other, means for supporting said magnets for movements in unison toward and from said wall in a path transverse to the line of said poles and for connecting the same with said part to be operated, the other of said structures including a single permanent magnet movable in a path substantially parallel with the line of said poles of the first mentioned magnets into opposed relation to either of the first mentioned magnets, whereby the first mentioned magnetic structure will be attracted by said single magnet when the latter is in one position and will be repelled by said single magnet when the latter is in another position, a power driven device and means controlled by said device for imparting said movements to said single magnet.

4. A device for controlling the starting circuit of an electric motor of the type which is enclosed in a sealed housing with the starting switch mounted exteriorly of said housing, a magnetic structure supported on the outer side of a wall of said housing for movement toward and from said wall, means controlled by said movement of said magnetic structure for actuating said switch, a second magnetic structure supported on the inner side of said wall in opposed relation to said outer magnetic structure and movable either to a position to attract said other magnetic structure or to a position to repel the same, a motor driven shaft and means controlled by said shaft for imparting said movements to said magnetic structure.

5. A device for controlling the starting circuit of an electric motor of the type which is enclosed in a sealed housing with the starting switch mounted exteriorly of said housing, said device comprising two permanent magnets having oppositely arranged poles, means for supporting said magnets on the outer side of a wall of said housing for movement toward and from said wall and for operatively connecting said magnets with said switch, a permanent magnet on the inner side of said wall, actuating means

for moving said inner magnet to a position to attract one of said outer magnets or to a position to repel the other of said outer magnets, said actuating means including a pivoted member on which said inner magnet is supported, a rock arm connected with said pivoted member, a motor driven shaft, a centrifugal device carried by said shaft, and means controlled by said centrifugal device for moving said rock arm in one direction when said shaft is rotating at low speed and in the other direction when said shaft is rotating at relatively high speed.

6. A device for controlling the starting circuit of an electric motor of the type which is enclosed in a sealed housing with the starting switch mounted exteriorly of said housing, said device comprising two permanent magnets having oppositely arranged poles, means for supporting said magnets on the outer side of a wall of said housing for movement toward and from said wall and for operatively connecting said magnets with said switch, a permanent magnet on the inner side of said wall, actuating means for moving said inner magnet to a position to attract one of said outer magnets or to a position to repel the other of said other magnets, said actuating means including a pivoted member on which said inner magnet is supported, a rock arm connected with said pivoted member, said rock arm being yieldable with relation to said pivoted member, a motor driven shaft, a centrifugal device carried by said shaft, and means controlled by said centrifugal device for moving said rock arm in one direction when said shaft is rotating at low speed and in the other direction when said shaft is rotating at relatively high speed.

7. In a switch controlling device, a structure having a non-magnetic wall, a member pivotally mounted at one side of said wall for movement toward and from said wall, two permanent magnets supported on said member in a line extending lengthwise thereof and with their negative poles adjacent one to the other, a switch element connected with said member for movement therewith, a single permanent magnet supported on the other side of said wall for movement in a path parallel with the line of the first mentioned magnets and having its poles so arranged that in one position thereof its poles will be opposed to unlike poles of one of the first mentioned magnets and in another position thereof its poles will be opposed to like poles of the other of the first mentioned magnets, and means for imparting movement to said single magnet.

8. In a switch controlling device, a structure having a non-magnetic wall, a member pivotally mounted at one side of said wall for movement toward and from said wall, two permanent magnets supported on said member in a line extending lengthwise thereof and with their negative poles adjacent one to the other, a switch element connected with said member for movement therewith, a single permanent magnet supported on the other side of said wall for movement in a path parallel with the line of the first mentioned magnets and having its poles so arranged that in one position thereof its poles will be opposed to unlike poles of one of the first mentioned magnets and in another position thereof its poles will be opposed to like poles of the other of the first mentioned magnets, an arm supporting said single magnet and movable about a fixed axis, a second arm movable about said axis and yieldably

connected with the first mentioned arm, and means for moving said second arm about said axis.

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