Aug. 10, 1937. J. B. WORTH 2,089,320

ELECTROMAGNETIC SWITCHING DEVICE

Filed Sept. 18, 1935

FIG. 6

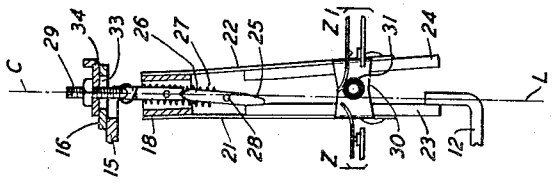


FIG. 5

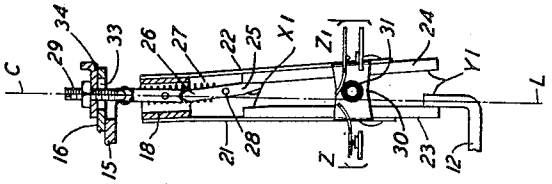


FIG. 4

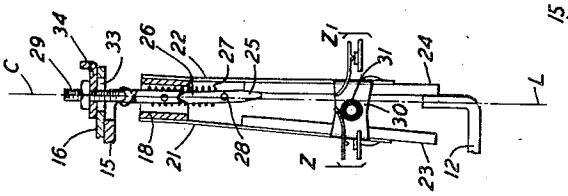


FIG. 3

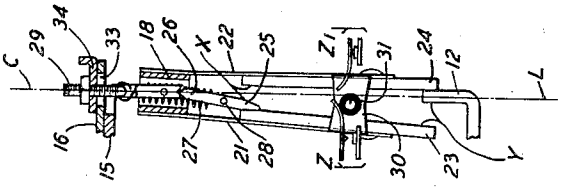


FIG. 2

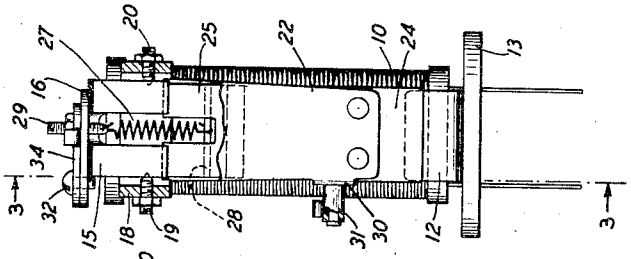


FIG. 1

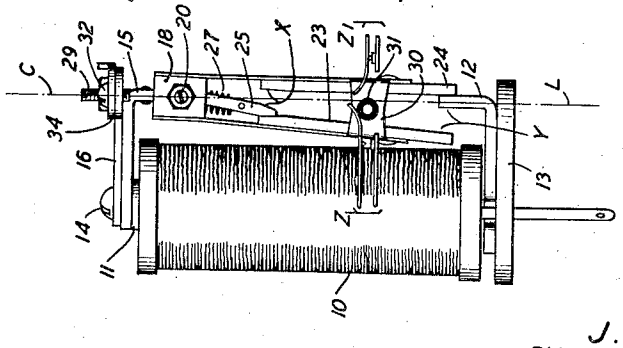
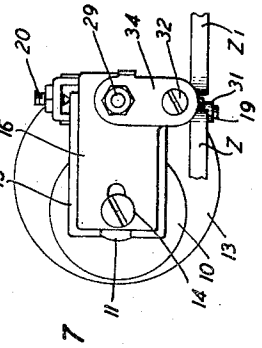


FIG. 7



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ELECTROMAGNETIC SWITCHING DEVICE

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Application September 18, 1935, Serial No. 41,029

5 Claims. (Cl. 200—87)

This invention relates to switching devices and its object is to provide a switching device in which sets of oppositely disposed contacts are operated independently in response to successive energization of a motor magnet.

According to the invention the core of an electromagnet is fitted at both ends with angle-shaped pieces one of which serves to pivot a bracket of non-magnetic material and an armature on closely adjacent centers. The bracket is provided with means for mounting pole-pieces diverging toward and in attractable relation with the angle-piece at the other end of the core to form with the armature a system of air-gaps of different lengths whereby consecutive energization of the magnet attracts the armature toward one of the oppositely disposed pole-pieces against the resistance of a spring hooked to its supporting angle-piece and to the armature in the manner of a toggle mechanism. The tensioning and release of such a spring is effective to move the bracket and the pole-pieces carried thereby against the angle-shaped pole-piece at the other end of the core and thereby preparing another magnetic path for the armature when a magnet is deenergized, means carried by the bracket being provided for actuating a plurality of oppositely disposed switching means independently in response to the consecutive operation of the magnet.

Other features and advantages of the invention will appear from the following description and by the claims appended thereto, reference being made to the accompanying drawing in which:

Fig. 1 is a side assembly view showing one of the positions of the armature and that of the pole-pieces when the magnet is deenergized;

Fig. 2 is a front view shown with a number of operating parts in section;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2, the armature being shown in position corresponding to that of Fig. 1;

Fig. 4 is a sectional view showing the armature moved in one of its operated positions through the energization of the magnet;

Fig. 5 is a sectional view showing the position of the pole-pieces when the magnet is redeenergized;

Fig. 6 is a sectional view showing the armature and the pole-pieces in position when the magnet is renergized; and

Fig. 7 is a top view.

As shown in Figs. 1, 2 and 7 of the drawing, 10 indicates an electromagnet having a core 11 to the lower disposed end of which is secured as in any ordinary manner an angle-shaped pole-piece 12 and a base plate 13 and on the upper disposed end of core 11 is secured as by screw 14 an angle-shaped pole-piece 15 and a plate 16, the latter being of non-magnetic material. The angle-shaped pieces 12 and 15 which form part of the magnetic circuit are disposed with their sides opposite extending toward each other and preferably at equal distance from the longitudinal axis of the core 11.

On the free end of angle-piece 15 is mounted as on pivots 19 and 20 a bracket in the form of a rectangularly-shaped head member 18 on the longitudinal sides of which are mounted the plates 21 and 22 diverging from their pivotal point and formed with a bridge portion 30 for mounting a stud 31 of insulating material provided for actuating the sets of contact springs Z and Z_1 in a manner that will be hereinafter described in detail.

The plates 21 and 22 like their suporting head member 18 are made of non-magnetic material and serve for mounting the pole-pieces 23 and 24 in attractable relation with the two opposite sides of the vertically extending portion of angle-piece 12, and with the opposite sides of an armature 25, the latter having a knife-edge pivot 26 engaging an inverted V-shaped groove in the free end of angle-piece 15 and is retained in adjusted position on this angle-piece by a spring 27 hooked at one end on a pin 28 extending across the armature 25, as shown in Fig. 2, and at its other end to a screw 29 passing through a clearance hole in the plate 16, this screw being provided with an adjustable nut 30 for adjusting the tension of spring 27.

A plate 34 is mounted on the plate 16, the latter having a slot 33, shown in Figs. 3, 4, 5, and 6, for permitting the pivotal movement of plate 34 around its fastening screw 32 for adjustably positioning the screw 29 in axial alignment with respect to the knife edge pivot of armature 26, the center of pin 28 and the center of the upwardly extending portion of angle-piece 12 which correspond to the line of maximum tension of spring 27, the function of which being to continue the movement of the armature 25 and pole-pieces 23 and 24 toward the opposite sides of the angle-pieces 12 upon consecutive operation of the magnet and thereby operating the sets of contacts Z and Z_1 depending upon the direction of movement of the armature 25.

A typical example of a two-way switching operation is as follows:

As shown in Figs. 1, 2 and 3 and considering magnet 10 deenergized, the spring 27, connected to screw 29 and pin 28 in the manner of a toggle mechanism, is effective to hold the armature 25 against the pole-piece 23 and thereby the pole-piece 24 against the right side of the upwardly extending portion of angle-piece 12, thus holding the sets of contacts Z in the open position. The space or air-gap between the armature 25 and the pole-

piece **24** at the point x, due to the diverging relation of the pole-pieces **23** and **24**, is considerably less than the air-gap between the pole-piece **23** and the left side of the upwardly extending portion of angle-piece **12** at the point y so that the energization of the magnet will cause the armature **25** to engage the pole-piece **24** under the effect of both the magnet and the tension of spring **27** upon the passing of this armature beyond the point of maximum tension of spring **27**, that is, to the right side of the center line CL, the pole-piece **24** remaining attracted to the angle-piece **12** and the set of contacts Z operated as indicated in Fig. 4. Upon the deenergization of magnet **10**, the tension of spring **27** acting on the armature **25** causes the pivotal movement of this armature and the pole-pieces **23** and **24** from the position shown in Fig. 4 to a point wherein the pole-piece **23** engages the opposite side of the upwardly extending portion of angle-piece **12**, thus closing the set of contacts Z and opening the set of contacts Z_1, as shown in Fig. 5, wherein the air-gap or space between the pole-piece **23** and the armature of the point x_1 is considerably less than the distance between the pole-piece **24** and the angle-piece **12** at the point y_1 with the result that a second energization of magnet **10** will cause the armature **25** to move against the pole-piece **23** as indicated in Fig. 6 for returning the pole-pieces **23** and **24** to the position indicated in Figs. 1 and 2 upon the deenergization of the magnet and thereby reopening the contacts Z and closing the contact Z_1, such operations being continued upon the successive energization of the magnet.

It will thus be seen that this device has the advantages of requiring only a single winding, and that no current is required to hold the relay in either position and does not involve polarizing, or directional current requirements. Furthermore since the armature and pole assembly are on the same axis for mechanical motion, there should be no friction between the faces of the armature and the pole assembly during travel.

It is understood that minor changes may be made to the invention without departing from the scope of the appended claims.

What is claimed is:

1. In a switching device, a magnet having a core, stationary pole-pieces secured at the ends of said core, a plurality of movable pole-pieces mounted on a common pivot on one of said stationary pole-pieces and extending in engageable relation with the other of said stationary pole-pieces, an armature pivoted on said one stationary pole-piece at a point adjacent the first-mentioned pivot and disposed in attractable relation with each of said movable pole-pieces, spring means automatically operable upon the deenergization of said magnet for causing said armature to move said movable pole-pieces one away from and the other into engaged relation with the last-mentioned stationary pole-piece, and a plurality of independently operable switching members actuated by said movable pole-pieces following successive operation of said magnet.

2. In a switching device, a plurality of switching means, a magnet having a core, a stationary pole-piece secured at each end of the core, a bracket of non-magnetic material and an armature pivotally mounted on one of said pole-pieces, a pair of pole-pieces carried by said bracket diverging from the pivotal center of said bracket in attractable relation with the stationary pole-piece at the other end of said core, said movable pole-pieces and said armature cooperating to form with the other of said stationary pole-pieces a system of air-gaps of different length for causing the movement of said armature in opposite direction in response to successive energization of said magnet, and spring means for moving said armature and said movable pole-pieces upon each deenergization of said magnet in position for alternately operating said switching means.

3. An electromagnet having a core, a pole-piece secured at each end of said core, each of said pole-pieces having a portion extending toward each other in line substantially parallel to the axis of the core, a bracket of non-magnetic material and an armature pivotally mounted on one of said pole-pieces, said bracket having a pair of arms diverging toward their free ends and a pole-piece carried by each of said arms and disposed in attractable relation with the pole-piece at the other end of the core, and spring means acting on said movable armature for changing the position of said movable pole-pieces relative to said stationary pole-piece upon the deenergization of the magnet for preparing another magnetic circuit for said armature and switching means actuated consecutively by the movement of said movable pole-pieces.

4. In a switching device, an electromagnet having a core, an angle-piece secured at each end of said core and having their projecting ends extending toward each other to form stationary pole-pieces, a bracket of non-magnetic material and an armature pivoted on one of said angle-pieces, a pair of arms carried by said bracket diverging from the pivotal center thereof, a pole-piece carried by each of said arms and disposed for alternatively engaging the sides of the other angle-piece and the sides of said armature and a spring for actuating said armature for operating said bracket for changing the position of said pole-pieces upon the deenergization of said magnet for preparing another magnetic path and thereby causing the movement of said armature in another direction upon each energization of said magnet and contact members actuated by the movement of said pivoted pole-pieces when operating under the tension of said spring.

5. An electromagnetically operated switching device comprising a plurality of independent operable contact members, a magnet having a core, a pole-piece secured at each end of said core, an armature and a bracket mounted on one of said pole-pieces, a pair of arms formed with said bracket diverging toward the pole-piece at the other end of the core, and a spring hooked to the first-mentioned pole-piece and to said armature, the line of maximum tension of said spring passing through the longitudinal axis of said armature and to a point between the arms of said bracket to form a toggle mechanism for automatically operating said armature for moving said bracket and said pole-pieces, one of said pole-pieces away from and the other toward the stationary pole-piece for preparing another magnetic path for said armature upon the deenergization of said magnet, and means operated upon each reversing movement of said armature under the tension of said spring for successively actuating said contact members.

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