Feb. 12, 1935. C. J. WERNER 1,991,037

SWITCH

Original Filed Feb. 18, 1932 2 Sheets-Sheet 1

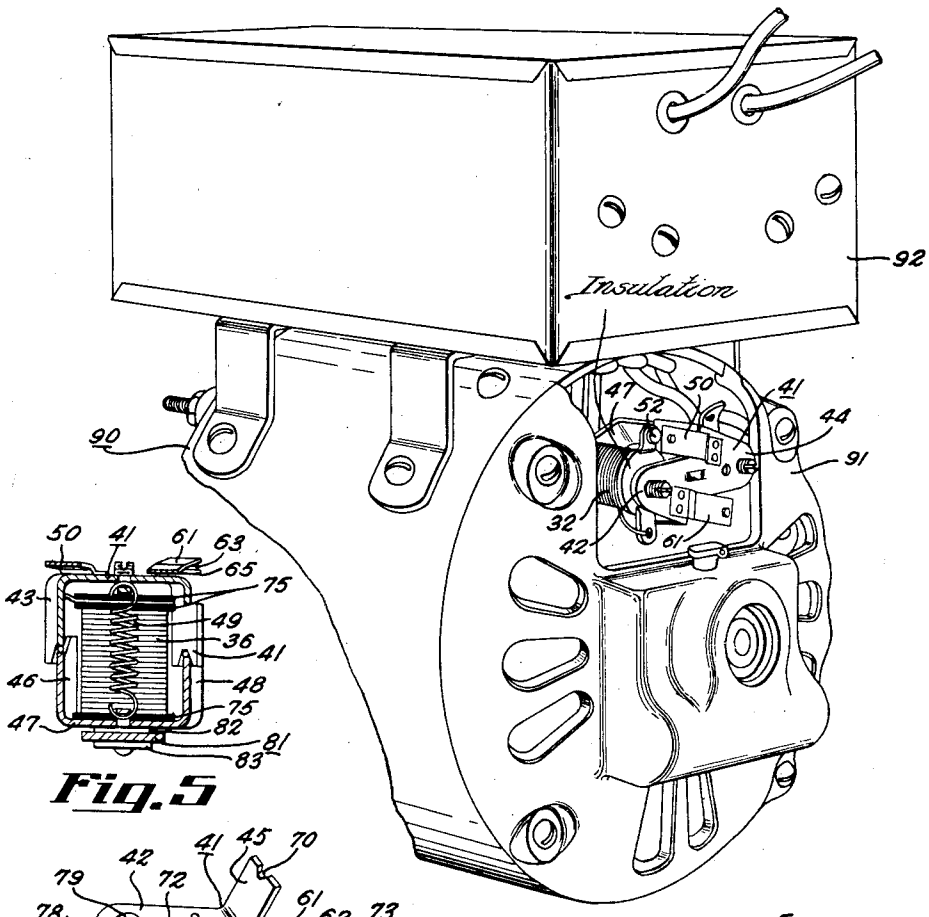


Fig. 1

Fig. 5

Fig. 4

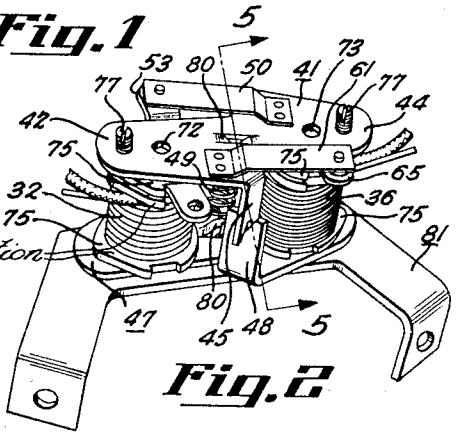


Fig. 2

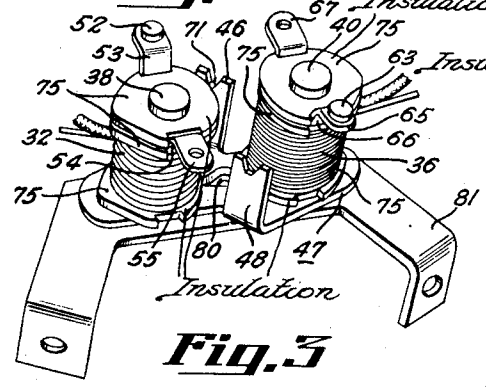


Fig. 3

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SWITCH

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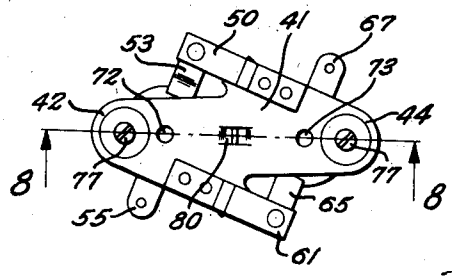


Fig. 6

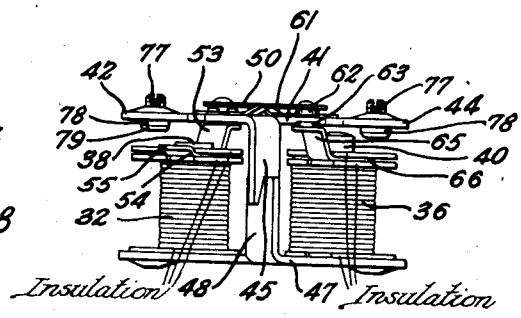


Fig. 7

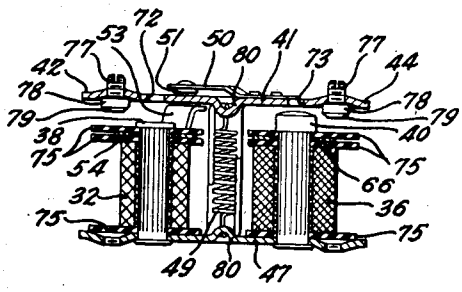


Fig. 8

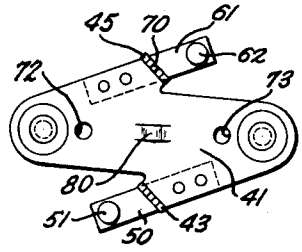


Fig. 10

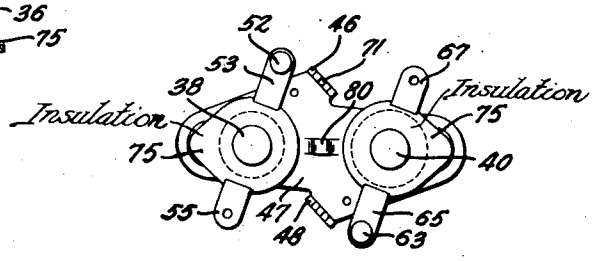


Fig. 9

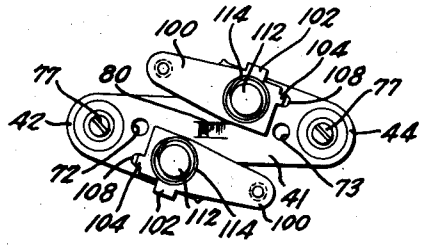


Fig. 11

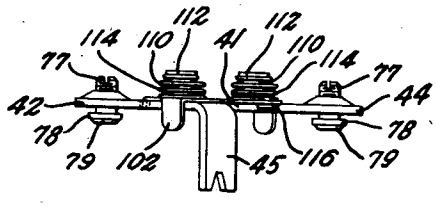


Fig. 12

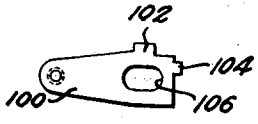


Fig. 13

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UNITED STATES PATENT OFFICE

1,991,037

SWITCH

Calvin J. Werner, Dayton, Ohio, assignor, by mesne assignments, to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Original application February 18, 1932, Serial No. 593,753. Divided and this application November 11, 1932, Serial No. 642,158

21 Claims. (Cl. 200—87)

This invention relates to a switch and particularly to an improved switch structure for controlling electrical circuits.

It is one of the objects of the present invention to provide a simple, reliable device which can be produced at relatively low cost, for controlling the starting and running circuits of alternating current motors operating on single phase current.

Another object of this invention is to provide an improved switch structure provided with antifriction bearings for the movable elements thereof.

Another object of this invention is to provide a switch that permits a wiping movement between the contacts as they engage and disengage. This feature is desirable for preventing or combating accumulation of dirt or foreign matter between the contacting surfaces of the contacts.

Another object of this invention is to provide an electromagnetic switch that is adapted to use with either direct or alternating current and may easily be made to meet the requirements for its particular use.

In the disclosed embodiment of the present invention, two electromagnets operate upon a common pivoted lever, one magnet operating to pull the lever in one direction and the other magnet operating to pull the lever in the opposite direction. The common pivoted lever arm is so mounted that it operates on antifriction bearings. Also due to the means of mounting the lever, it moves somewhat laterally as the ends move about the pivot. Hence, the contacts that are carried by the lever move laterally with respect to the stationary contacts and a wiping movement between the contacts is produced upon engagement and disengagement of the contacts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of one form of the present invention is clearly shown.

This application is a division of my copending application No. 593,753.

In the drawings:

Fig. 1 is a perspective view of an electric motor equipped with an apparatus embodying the present invention.

Fig. 2 is a perspective view of an electromagnetic device for controlling an electrical circuit such as the starting and running circuit of a motor.

Fig. 3 is a perspective view of this device with the common operating lever removed.

Fig. 4 is a perspective view of the common operating lever shown in inverted position.

Fig. 5 is a fragmentary, sectional view substantially on the line 5—5 of Fig. 2.

Fig. 6 is a top view of the device.

Fig. 7 is a side elevation of the device.

Fig. 8 is a sectional view of the device substantially on the line 8—8 of Fig. 6.

Fig. 9 is a top view of the device with the common operating lever removed.

Fig. 10 is a bottom view of the common operating lever.

Fig. 11 is a top view of a common operating lever embodying a modified form of contact carrying members with means for urging the contact carrying members against or toward the lever.

Fig. 12 is a side view of the lever having the modified form of contact carrying member mounted thereon.

Fig. 13 is a plan view of one of the modified contact carrying members.

With particular reference to the drawings, electromagnet coils 32 and 36 surround cores 38 and 40 respectively, which cores cooperate with, and are in magnetic relation with, lever arms 42 and 44 respectively, of a common lever 41. The common lever 41 is provided with two bifurcated arms 43 and 45 which straddle respectively bifurcated arms 46 and 48 of a base 47. The lever 41 is maintained yieldingly either in a position inclined toward the core 40, or inclined toward the core 38, by a spring 49 that is connected to the lever 41 and the base 47, and so arranged that its center line of action moves to either side of a vertical center line. The vertical center line in the disclosed form of embodiment, substantially coincides with a center line of movement. The center line of action of the spring 49 then crosses the center line of movement and intersects the pivoted lever 41 accordingly as the lever is shifted to either of its inclined positions relative the cores 38 and 40.

The lever 41 carries a leaf spring conductor or resilient contact carrying member 50 which has a contact 51 mounted thereon and engageable with a contact 52 carried by an ear 53 extending from a bracket 54, which bracket also carries an ear 55 to which connections may be made. The lever 41 also carries a leaf spring

conductor or contact carrying member 61 that has a contact 62 mounted thereon which is in cooperative relation, and engageable with a stationary contact 63. The contact 63 is mounted upon an ear 65 of a bracket 66 which also has an ear 67 to which connections may be made.

By utilizing the construction illustrated, a double magnet relay is so arranged that its armature lever 41 and its base 47 are made of like stampings of sheet metal. The leg or arm 45 of the lever 41 is provided with a notch into which a ball 70 is secured, and which is received by the leg or arm 48 of the base 47. Likewise, the leg or arm 46 of the base 47 is provided with a notch into which a ball 71 is secured. In the form of embodiment shown, the planes of the legs or arms on the base or lever are substantially parallel, and these planes form an acute angle with the longitudinal axis of the lever. The balls 70 and 71 thus provide anti-friction bearings for the movement of the legs 43 and 45 of the lever 41. In other words, the construction provides pairs of legs having bifurcated ends which straddle one another, each pair of legs comprising a leg supporting the armature lever 41 and a leg extending upwardly from the base 47. The anti-friction joint or bearing is provided between the members of each pair of legs by a ball which is secured in a notch in one of the members of the pair.

The base 47 supports the cores 37 and 40, the lower ends of which fit into holes provided in the base 47. Since the lever 41 is a counterpart of the base 47, holes 72 and 73 are provided therein but serve no purpose as far as the lever 41 is concerned; but, where the piece is used to provide the base 47, the holes 72 and 73 receive the cores 38 and 40 respectively. Each of the cores 38 and 40 carries three similar insulation pieces 75. Between the lowermost piece 75 and the intermediate piece 75 is located a magnet winding which the pieces 75 insulate from the adjacent metallic parts. Between the uppermost piece 75 and the intermediate piece 75 is located one of the brackets 54 or 66. The arms 42 and 44 of the lever 41 each carry an adjustable screw 77, the lower end of which terminates in the head 78 carrying a pad 79 of felt, cork, or other suitable material which strikes against the uppermost insulation piece 75. The screws 77 thus form stops to arrest motion of the lever 41 in one direction. By turning the screws 77 the extent of approach of either of the lever arms 42 or 44 to the cores 38 or 40 respectively, can be adjusted. Each of the parts 41 and 47 is provided with an integrally formed tongue 80 to which an end of the spring 49 is attached.

As shown in Figs. 2 and 3, the base 47 is attached to a mounting bracket 81 and is insulated therefrom by insulating the plates 82 and 83 that are thus shown in Fig. 5. The bracket 81 provides a convenient means for attaching the double magnet relay to an end frame 91 of an electric motor 90 or any desirable mounting. The frame of the motor 90 supports a box 92 within which condensers or other parts utilized in the circuit may be placed.

With reference Figs. 11, 12 and 13, parts bearing reference numerals similar to those previously used are similar and perform similar functions. In this modification, contact carrying members 100 have lugs 102 formed on their sides, and lugs 104 formed on the ends. Lugs 102 and 104 are bent so as to project substantially perpendicularly to the surface of the contact carrying member. The contact carrying members 100 also have elongated apertures 106 therein, and are mounted on the lever 41 so that the lugs 102 rest along the sides of the lever, and the lugs 104 project into apertures 108 in the lever 41. The lugs 102 and 104 thus act as guides to hold the contact carrying member 100 in position. Studs 110 having head portions 112 project through the apertures 106 in the contact carrying members, and are secured to the lever 41. Springs or resilient members 114 are interposed between the head portions 112 of the studs 110 and the contact carrying members 100 so as to urge the contact carrying members against or toward the lever 41. Contacts 116 are carried by the ends of the contact carrying member, and the elongated apertures 106 permit movement of the contact carrying member, about the end opposite the contact, and against the urging force of the spring 114 when the contacts engage.

In the operation of the relay or switch, the electromagnet that is first energized attracts the side or lever arm of the lever 41 that is magnectically associated therewith to cause or effect a rocking movement of the lever 41 and consequent engagement of the contacts that are on the same side of the center line of movement as the energized electromagnet. The center line of action of the spring 49 then passes to the same side of the center line of movement and this aids the electromagnet in maintaining engagement of the contacts. The stop formed by the screw 77 and its pad 79 strikes the insulating piece 75 to arrest the motion of the lever arm toward the energized magnet. The resiliently mounted contact permits motion of the lever arm after the contacts have become engaged and until the stop arrests the motion of the lever arm, and also tends further to maintain engagement of the contacts. Since the fulcrum or pivotal mounting of the lever 41 is below the lever, there is a lateral as well as a vertical component to the motion imparted to the contact. This movement together with that permitted by the resilient mounting effects a wiping movement between the movable and stationary contacts during engagement and disengagement thereof which is desirable for removing particles of dirt or foreign matter from the surfaces of the contacts. The switch may be so designed that the second magnet, when energized will or will not attract the lever arm associated therewith against the urging force of the magnet first energized. When both electromagnets are deenergized, the switch remains in the position to which it was last operated by virtue of the action of the spring 49.

Connection is made with the movable contact switch preferably by making connection to the base 47, since by making connection in that manner the connecting wires do not offer impedance or restraint to the motion of the lever 41, and the legs, spring, lever and contact carrying members serve to complete the circuit to the movable contact. As previously explained, connections are made to the stationary contacts 52 and 63 by connecting the ears 55 and 67 respectively.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An electromagnetic switch, comprising in

combination, a base and a lever of substantially similar construction each having bifurcated arms thereon and an integrally formed tongue near the midpoints thereof, said lever having lever arms on either side of said bifurcated arms, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement, a spring connected to said tongues to urge said bifurcated arms into engagement, said spring also being adapted to cross said center line of movement and urge said lever toward the side to which the lever is rocked, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the ends of said lever arms, stationary contacts insulatingly secured to said electromagnets, contact carrying members secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means resiliently urging said contacts together, means including said electromagnets for causing engagement and disengagement of said contacts, adjustable stops for arresting rocking movement of said lever, and a bracket for mounting said switch.

2. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction each having bifurcated arms thereon and an integrally formed tongue near the midpoints thereof, said lever having lever arms on either side of said bifurcated arms, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement, a spring connected to said tongues to urge said bifurcated arms into engagement, said spring also being adapted to cross said center line of movement and urge said lever toward the side to which the lever is rocked, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the ends of said lever arms, stationary contacts insulatingly secured to said electromagnets, contact carrying members secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means resiliently urging said contacts together, means including said electromagnets for causing engagement and disengagement of said contacts and adjustable stops for arresting rocking movement of said lever.

3. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction each having bifurcated arms thereon and integrally formed tongues near the midpoints thereof, said lever having lever arms on two sides of said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement and so that said balls form anti-friction bearings, a spring connected to said tongues to urge said bifurcated arms into engagement, said spring also being adapted to cross said center line of movement and urge said lever toward the side to which the lever is rocked, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the ends of said lever arms, stationary contact supported by said electromagnets, contact carrying members secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means including said electromagnets for causing engagement and disengagement of said contacts, means causing a wiping movement between said contacts upon engagement and disengagement, and adjustable stops for arresting rocking movement of said lever.

4. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon and integrally formed tongues near the midpoints thereof, said lever having lever arms on two sides of said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement and so that said balls form anti-friction bearings, a spring connected to said tongues to urge said bifurcated arms into engagement, said spring also being adapted to cross said center line of movement and urge said lever toward the side to which the lever is rocked, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the ends of said lever arms, stationary contacts supported by said electromagnets, contact carrying members secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means including said electromagnets for causing engagement and disengagement of said contacts, means causing a wiping movement between said contacts upon engagement and disengagement and adjustable stops for arresting rocking movement of said lever.

5. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon and an integrally formed tongue near the midpoints thereof, said lever having lever arms on either side of said bifurcated arms, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement, a spring connected to said tongues to urge said bifurcated arms into engagement, said spring also being adapted to cross said center line of movement and urge said lever toward the side to which the lever is rocked, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the ends of said lever arms, stationary contacts insulatingly secured to said electromagnets, contact carrying members secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means resiliently urging said contacts together, means including said electromagnets for causing engagement and disengagement of said contacts, and adjustable stops.

6. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement and so that said balls form anti-friction bearings, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the end portions of said lever arms, stationary contacts fixedly mounted, contact carrying members secured to said lever and having contacts thereon

in alignment for engagement with said stationary contacts, means including said electromagnets for causing engagement and disengagement of said contacts, and adjustable stops for arresting rocking movement of said lever.

7. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement, electromagnets secured to said base near the ends thereof and having cores in magnetic relation with the end portions of said lever arms, stationary contacts fixedly mounted, contact carrying means secured to said lever and having contacts thereon in alignment for engagement with said stationary contacts, means including said electromagnets for actuating said lever to cause engagement and disengagement of said contacts, and adjustable stops for arresting rocking movement of said lever.

8. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, and bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement and so that said balls form anti-friction bearings, electromagnets secured to said base and having cores in magnetic relation with said lever arms, stationary contacts, movable contacts actuated by the rocking movement of said lever and in alignment for engagement with said stationary contacts, means including said electromagnets for effecting engagement and disengagement of said contacts, and adjustable stops for arresting rocking movement of said lever.

9. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, said bifurcated arms of said base and lever being engaged so as to permit rocking movement of said lever either side of a center line of movement, electromagnets secured to said base and having cores in magnetic relation with said lever arms, stationary contacts, movable contacts actuated by the rocking movement of said lever and in alignment for engagement with said stationary contacts, means including said electromagnets for effecting engagement and disengagement of said contacts, and adjustable stops for arresting rocking movement of said lever.

10. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having a lever arm extending from said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged so as to permit rocking movement of said lever and so that said balls form anti-friction bearings, an electromagnet secured to said base and having a core in magnetic relation with said lever arms, a stationary contact, a movable contact actuated by the rocking movement of said lever and in alignment for engagement with said stationary contact, means including said electromagnet for actuating said lever to effect engagement of said contacts, and an adjusting stop for arresting the rocking movement of said lever.

11. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having a lever arm extending from said bifurcated arms, said bifurcated arms of said base and lever being engaged so as to permit rocking movement of said lever, an electromagnet secured to said base and having a core in magnetic relation with said lever arm, a stationary contact, a movable contact actuated by the rocking movement of said lever and in alignment for engagement with said stationary contact, means including said electromagnet for actuating said lever to effect engagement of said contacts, and an adjustable stop for arresting the rocking movement of said lever.

12. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged to permit rocking movement of said lever either side of a center line of movement and so that said balls form anti-friction bearings, electromagnets secured to said base and having cores in magnetic relation with said lever arms, stationary contacts, movable contacts actuated by the rocking movement of said lever and in alignment for engagement with said stationary contacts, and means including said electromagnets for effecting engagement and disengagement of said contacts.

13. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having lever arms extending in more than one direction from said bifurcated arms, said bifurcated arms of said base and lever being engaged so as to permit rocking movement of said lever either side of a center line of movement, electromagnets secured to said base and having cores in magnetic relation with said lever arms, stationary contacts, movable contacts actuated by the rocking movement of said lever and in alignment for engagement with said stationary contacts, and means including said electromagnets for effecting engagement and disengagement of said contacts.

14. An electromagnetic switch, comprising in combination, a base and a lever each having bifurcated arms thereon, said lever having a lever arm extending from said bifurcated arms, a ball secured in the bifurcation of one of said arms on said lever and one of said arms on said base, said bifurcated arms of said base and lever being engaged so as to permit rocking movement of said lever and so that said balls form anti-friction bearings, an electromagnet secured to said base and having a core in magnetic relation with said lever arm, a stationary contact, a movable contact actuated by the rocking movement of said lever and in alignment for engagement with said stationary contact, and means including said electromagnet for actuat-

ing said lever to effect engagement of said contacts.

15. An electromagnetic switch, comprising in combination, a base and a lever of substantially similar construction, means providing a pivoted mounting for said lever to permit a rocking movement thereof, said lever having arms extending in more than one direction from said pivotal mounting, means providing an anti-friction ball bearing for said pivotal mounting so as to permit substantially free rocking motion of said lever either side of a center line of movement, resilient means urging said lever to the side of the center line of movement to which it is moved, electromagnets secured to said base and in magnetic relation with said arms, stationary contacts, movable contact actuated by the rocking movement of said lever and in alignment for engagement with said stationary contacts, means including said electromagnets for effecting engagement and disengagement of said contacts, and adjustable stops for arresting movement of said lever.

16. An electromagnetic switch, comprising in combination, a base and lever of substantially similar construction, means providing a pivotal mounting for said lever to permit movement thereof, said lever having arms extending from said pivotal mounting, electromagnets secured to said base and in magnetic relation with said arms, stationary contacts, movable contacts actuated by the movement of said lever and in alignment for engagement with said stationary contacts, means including said electromagnets for effecting engagement of said contacts, and adjustable stops for arresting movement of said lever.

17. In a switch, the combination including a base and lever of substantially similar construction, each having bifurcated arms thereon and integrally formed therewith, the plane of said arms forming an acute angle with the longitudinal axis of said lever, a ball held in one of the bifurcations in one of the arms on said lever, a second ball held in the bifurcations in a similar arm on said base, said bifurcated arms being engaged so that said bifurcations straddle, and one of said balls forms an anti-friction bearing at the junction of each arm on said base with an arm on said lever, and means for urging said arms into engagement.

18. In a switch, the combination comprising, a base and lever of substantially similar construction, each having bifurcated arms thereon and integrally formed therewith, the plane of said arms forming an acute angle with the longitudinal axis of said lever and said bifurcated arms being engaged so that the bifurcations straddle.

19. In a switch, the combination comprising, a base, a lever, said lever having bifurcated arms thereon, means on said base engaging the bifurcations in said arms and thereby providing a pivotal mounting for said lever, and means providing an anti-friction ball bearing at the pivot.

20. An electromagnetic switch comprising, in combination, a base and a lever of duplicate construction, said base and lever being pivotally attached to permit rocking movement of the lever, said lever having a lever arm extending from the pivotal mounting, an electromagnet mounted on the base and having a core in magnetic relation with the lever arm, a stationary contact, a movable contact actuated by the rocking movement of the lever and in alignment for engagement with the stationary contact, means including said electromagnet for actuating said lever to effect engagement of said contacts, and an adjustable stop for arresting the rocking movement of said lever.

21. An electromagnetic switch comprising, in combination, a base and a lever of duplicate construction and made of sheet metal, said base and lever being pivotally attached to permit rocking movement of the lever, said lever having a lever arm extending from the pivotal mounting, an electromagnet mounted on the base and having a core in magnetic relation with the lever arm, a stationary contact, a movable contact actuated by the rocking movement of the lever and in alignment for engagement with the stationary contact, and means including said electromagnet for actuating said lever to effect engagement of said contacts.

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