

Jan. 29, 1963

W. LANDOW ET AL

3,076,074

MECHANICALLY LATCHED DEVICE

Filed Jan. 23, 1959

3 Sheets-Sheet 1

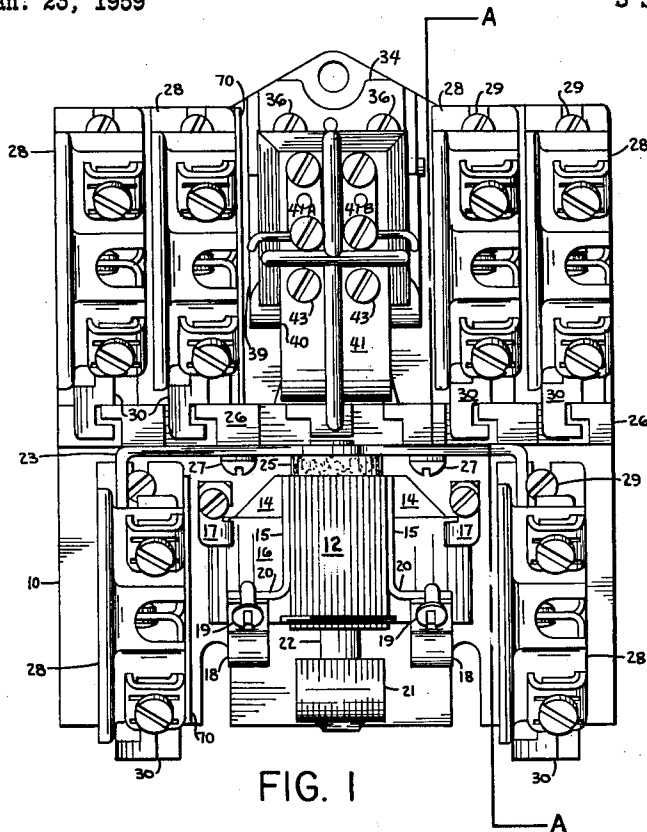


FIG. 1

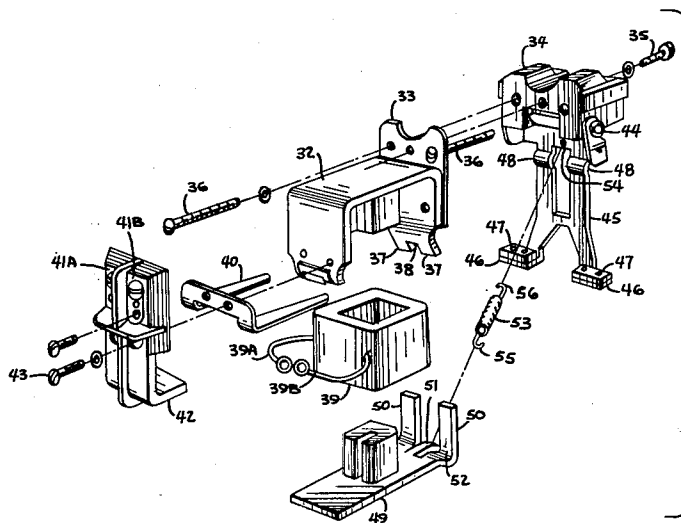


FIG. 2

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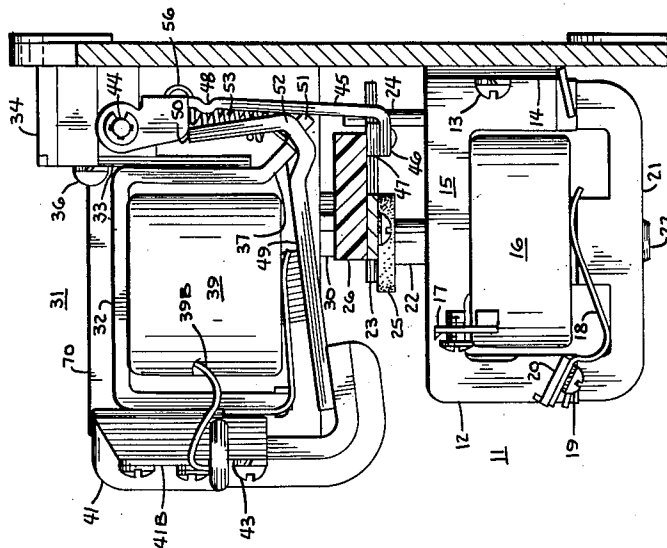


FIG. 4

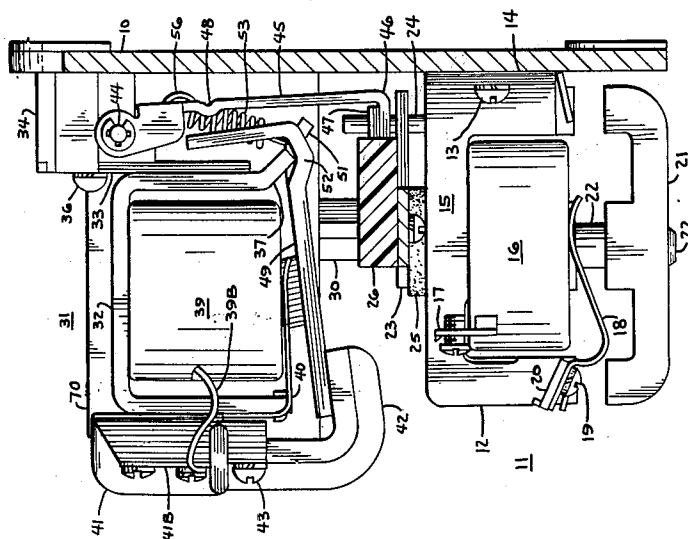


FIG. 3

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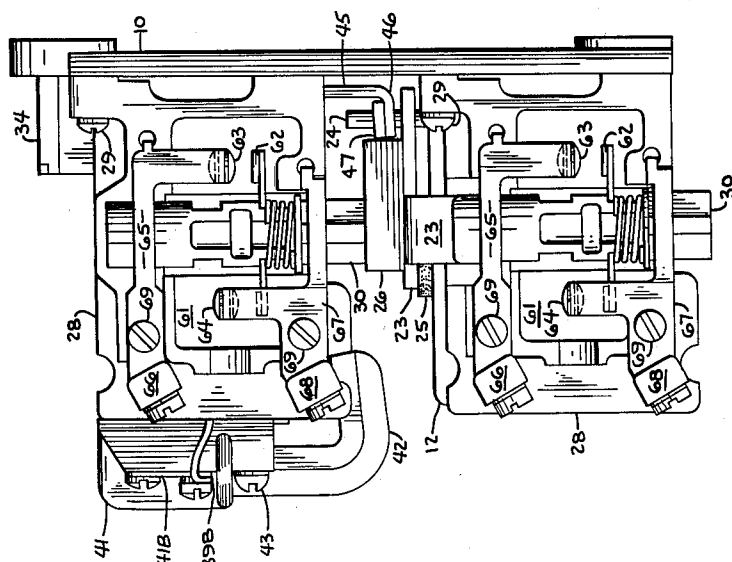


FIG. 6

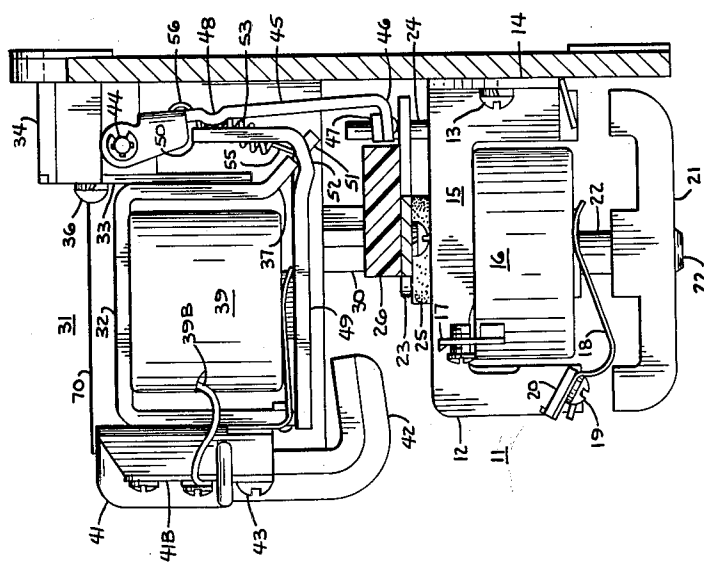


FIG. 5

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3,076,074

MECHANICALLY LATCHED DEVICE

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12 Claims. (Cl. 200-98)

Our invention relates to electromagnetically operated circuit controlling devices and more particularly to devices having contacts that are operated by a first electromagnet and which are retained in their operated position by a mechanical latch, and where the mechanical latch is operable by a second electromagnet to release the contacts.

Mechanically held devices, such as contactors and relays, are frequently used in electrical control circuits where it is necessary to maintain the continuity of the operating sequence even though a failure such as a loss of voltage may occur. They also are used in theaters, hospitals, schools and other locations where the normal operational hum of alternating current magnets is objectionable. In addition, they have many other varied applications and uses in the present machine tool, automation, and other types of electrical circuits.

These mechanically held devices are electromagnetically operated devices whose contacts are normally in their unoperated position and are caused to be operated by momentarily energizing the winding of a first electromagnet. The device is then held in its contact operated position by a mechanical latch. The contacts are returned to their normal position by momentarily energizing the winding of a second electromagnet which operates the mechanical latch and releases the contacts so they become unoperated.

When both windings of the device are de-energized, its contacts may be in either their operated or unoperated position, depending upon which of the two windings was last energized. If the first winding was the last energized, the contacts will be held in their operated position by the mechanical latch. But if the second winding was the last energized, the contacts will be in their unoperated position.

Heretofore, devices of this type have been constructed having a first electromagnet for operating the contacts that is located beneath them like a standard electric relay. The second electromagnet is located beneath the first electromagnet and the mechanical latch interconnecting the two electromagnets. When the first electromagnet is operated, it moves the contacts up to their operated position. The mechanical latch is arranged to engage and hold the first electromagnet in its operated position and thus also maintain the contacts operated. The second electromagnet when operated, releases the mechanical latch to free the first electromagnet so it and the contacts are returned to the unoperated position.

Such devices have the disadvantage in that should the connection between the contacts and the first electromagnet become severed, the contacts can become unoperated while the electromagnet is still held operated by the mechanical latch. In addition, some of the mechanical latches are arranged so that both electromagnets cannot be operated at the same time. If they are, it will cause one of the windings to burn out since its associated electromagnet is prevented from operating. Also, this type of construction requires that the device be of an increased overall height which increases the area required for mounting the devices.

The present invention is directed towards a mechanically held device having contacts which are moved up to their operated position by momentarily energizing a first

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electromagnet. The contacts are then held in this position by a mechanical latch independent of the first electromagnet. The mechanical latch is operable to free the contacts and allow them to drop and return to their unoperated position by the momentary energization of a second electromagnet.

One embodiment of our invention entails having a mounting plate for vertically mounting the two electromagnets thereon. The top electromagnet is the operator for the mechanical latch. The mechanical latch is located between its electromagnet operator and the mounting plate. The contact operating arm is located between the two electromagnets and fastened to the operating shaft of the bottom electromagnet. Individual contact units are independently fastened to the mounting plate at either side of the electromagnets and have movable contact carriers connected to the contact operating arm.

When the bottom electromagnet is momentarily energized, the contact operating arm is moved to its up position, where it is engaged and held by the mechanical latch. The contacts are thereby held in their operated position completely independent of whether the first electromagnet remains energized or is subsequently de-energized.

To make the device unoperated, the top electromagnet is energized. This moves the mechanical latch out of engagement with the contact operating arm so that it is free to drop to its down position making the contacts unoperated.

It is therefore the primary object of our invention to provide a mechanically held device which will perform in the aforescribed manner.

It is a further object of our invention to provide a mechanically held device having a mechanical latch which holds the contacts in their operated position.

Another object of our invention is to provide an improved mechanical latch for holding the contacts and an improved electromagnet operator for releasing it.

Still another object of our invention is to provide a mechanical latch and its electromagnet operator that can be readily added to existing electromagnetically operated electric relays without requiring any modifications.

A still further object of our invention is to provide an improved mechanically held device which can be readily manufactured and assembled and which provides very reliable operation.

The above and other objects of my invention will be made apparent to those skilled in the art when taken in consideration with the following specification and the accompanying drawings in which:

FIGURE 1 is a front elevational view of an electromagnetically operated switch embodying the present invention.

FIGURE 2 is an exploded view of the mechanical latch and its electromagnetic operator.

FIGURE 3 is a sectional view of the switch as shown in FIGURE 1 taken on the plane A—A thereof with both electromagnets de-energized.

FIGURE 4 is a sectional view of the switch as shown in FIGURE 1 taken on the plane A—A thereof with the contact operating electromagnet energized and the electromagnet operator for the mechanical latch de-energized.

FIGURE 5 is a sectional view of the switch as shown in FIGURE 1 taken on the plane A—A thereof with the electromagnet operator for the mechanical latch energized and the contact operating electromagnet de-energized.

FIGURE 6 is a side elevational view of the switch as shown in FIGURE 1.

The electromagnetically operated switch described and illustrated herein, in order that a full disclosure may be

made of our invention as is required by law, embodies the same general construction and operating features as that described in the application of William Few et al., Serial No. 560,655, filed January 23, 1956, entitled Electric Relays and assigned to the instant assignee, now Patent No. 2,921,166.

With reference to the drawings, there is shown at 10 a mounting plate or base upon which the two electromagnets and the individual contact units are independently mounted.

The contact operating electromagnet is generally shown at 11 and is comprised of a downwardly open E-shaped core 12 (FIGURE 3) fastened to base 10 by means of screws 13—13 extending through ears 14—14 of side plates 15—15 located on both sides of core 12.

A winding 16 having terminals 17—17 is positioned around the center leg of core 12. Winding 16 is held in place by means of leaf springs 18—18. Leaf springs 18—18 are fastened by screws 19—19 to protruding ears 20—20 located on side plates 15—15.

An armature 21 is associated with core 12 and is suspended therefrom by means of an armature rod 22 which extends through a vertical bore in the center leg of core 12. When winding 16 is energized, armature 21 moves up to engage the bottom of core 12. The movement of armature 21 pushes armature rod 22 up ahead of it. The vertical bore is of a diameter to freely allow this reciprocable movement of armature rod 22 and yet guide it.

A traverse bar 23 is connected to the top of armature rod 22. Traverse bar 23 has a back extending projection with a hole located in it. The hole in the projection fits over a pin 24 located on the top of core 12 to prevent any rotation of armature rod 22 and armature 21. A fibre washer 25 is placed on armature rod 22 between traverse bar 23 and the top of core 12 to absorb the shock when they drop to their down position.

Above traverse bar 23 is mounted a contact operating arm 26 and secured thereto by screws 27—27. Operating arm 26 has a series of L-shaped slots formed in it that open out to its front and that are spaced along its length.

Individual contact units 28 are mounted to base 10 and secured thereto by means of screws 29. They are located generally above the L-shaped slots so that the notched end of a movable contact carrier 30 can slip into the L-shaped slots and form a loose mechanical connection thereto.

The individual contact units 28 consists of an insulating housing 60 having a centrally formed recess 61 therein opening to one side thereof (FIGURE 6). The movable contact carrier extends into and supports a movable contact 62 by suitable means within recess 61. A pair of stationary contacts 63 and 64 are also positioned within recess 61 for co-operation with movable contact 62.

Stationary contact 63 is connected by a conducting strap 65 to a terminal 66 located at the front of housing 60. Stationary contact 64 is connected by a conducting strap 67 to a terminal 68 that is also located at the front of housing 60. The conducting straps 65 and 66 are secured to housing 60 by means of screws 69—69.

For a more detailed description of the contact units, the movable contact barrier, and the connection formed with the L-shaped slots, reference should be made to the above mentioned application.

The mechanical latch and its operating electromagnet is generally shown at 31 (FIGURE 2) and is mounted on base 10 as an integral unit in the space normally occupied by the two center contact units when the device is used as an electric relay in the aforementioned application.

The electromagnet is comprised of a downwardly opened E-shaped core 32 having a bracket 33 attached to its rear leg. A spacing block 34 is secured to bracket 33 by means of a screw 55 extending through it and threading into bracket 33. This assembly comprising

bracket 33, core 32 and spacing block 34 is secured to base 10 by screws 36—36.

The bottom portion of the rear leg of core 32 has two slightly out-turned ears 37—37 formed on it. Ears 37—37 are separated by a slot 38.

A winding 39 is positioned around the middle leg of core 32 and is held in place by means of a U-shaped leaf spring 40. An L-shaped terminal block 41 having an in-turned bottom leg is secured to the front leg of core 32 by means of screws 43—43 threading into it. The leads 39A and 39B from winding 39 are connected to terminals 41A and 41B respectively to serve as a convenient place for connecting the energizing circuit to winding 39.

Hingedly suspended from spacing block 34 by means of pin 44 is an A-shaped latch member 45 which has in-turned ears 46—46 at the bottom of its two legs. Ears 46—46 have pads 47—47, preferably made of nylon, secured on them. These ears 46—46 and pads 47—47 extend under the contact operating arm 26 to hold it in its operated position, once moved there. Located near the top of the A-shaped latching members 45, are protrusions 48—48 formed in each leg.

Electromagnet 31 has a T-shaped armature 49 having at its rear, two up-turned ears 50—50 and a down-turned center ear 51. A radius 52—52 is formed by ears 50—50 and it is in radius 52—52 where armature 49 is pivoted about the bottom edge of ears 37—37. This provides a knife edge pivot for armature 49 to greatly minimize any friction occurring at this point. A portion of down-turned ear 51 fits into slot 38 on the rear leg of core 32.

Armature 49 is held against this pivot point by means of a spring 53. Spring 53 has a hook 55 formed at one end and another hook 56 at the other end. Hook 55 is connected around down-turned ear 51 behind the pivot point and hook 56 is connected into a hole 54 located near the top of A-shaped latch member 45. Armature 49 is restrained from pivoting too far forward by the inside surface of leg 42 of L-shaped terminal block 41.

Spring 53 serves the dual purpose of yieldably biasing armature 49 in its open position and yieldably biasing latch member 45 to its latched position.

When winding 39 is energized, the front end of armature 49 is attracted to the front leg of core 32. This movement swings the two up-turned ears 47—47 rearward so that they strike the two protrusions 48—48 on the vertical legs of A-shaped latch member 45 to move it rearward.

A barrier 70 of electrical insulating material is placed between electromagnet operators 11 and 31 and the contact unit 28 having the adjacent open side.

Operation

FIGURE 3 illustrates the mechanically held device in its unoperated position with both windings 16 and 39 de-energized. When in this position, armature 21 is away from core 15 so that traverse bar 23, contact operating arm 26 and the movable contact carriers 30 are all in their down or unoperated positions. As before stated, when the movable contact carriers 30 are in their unoperated position, movable contact 62 is away from stationary contacts 63 and 64.

The front end of armature 49 is pivoted away from core 32 due to the force of gravity and the bias of spring 53 and rests on the inner surface of leg 42. With armature 49 in this position, its ears 50—50 are rotated away from protrusions 48—48 allowing latch member 45 to be pulled forward under the bias of spring 53. The forward rotation of latch member 45 is stopped by nylon pads 47—47 on ears 46—46 abutting against the rear side of contact operating arm 26.

To operate the device, winding 16 is momentarily energized causing armature 21 to move up and engage the bottom of core 12 (FIGURE 4). This moves armature rod 22, traverse bar 23, contact operating arm 26, and the movable contact carriers 30 to their up posi-

tion. When the movable contact carriers 30 are in their up positions, movable contact 62 engages with stationary contacts 63 and 64 to close the electrical circuit connected to its terminals 66 and 68.

As soon as contact operating arm 26 reaches a point in its upward travel where nylon pads 47—47 no longer abut against its rear side, latch member 45 will rotate in the forward direction due to the bias of spring 53. The forward rotation is stopped when latch member 45 abuts against the bottom portion of ears 50—50, at which point ears 46—46 and nylon pads 47—47 are located directly under contact operating arm 26. Winding 16 can then be de-energized and the contacts will remain operated since contact operating arm 26 is held in its up position by latch member 45. Armature 21, armature rod 22, and traverse bar 23 are free to drop since they are no longer held up by the electromagnet's action. However, since all of these members are mechanically connected, they will likewise be held in their up position by latch member 45.

The mechanically held device can remain in this, its contact operated position, indefinitely without requiring the use of any power. Also, any subsequent energization and de-energization of winding 16 will not effect any change in the devices' condition.

When it is desired to cause the contacts to become unoperated again, it is necessary to momentarily energize winding 39. This causes the front end of armature 49 to be attracted to core 32. Since armature 49 is pivotally rotated about the bottom edge of ears 37—37 at radius 52—52, its ears 50—50 are rotated backward. During this rotative movement, ears 50—50 engage with protrusions 48—48 on latch member 45 and push it rearward for the remaining portion of the rotative movement.

It is to be noted that during the rotative movement of armature 49 towards core 32, ear 51 is rotated downward. With end 53 of spring 53 fastened to ear 51, this rotative downward movement increases the tension in spring 53. Also, the rearward movement of latch member 45 also increases the tension in spring 53 because of end 56 being hooked in hole 54. Since the increase in tension due to these two actions is in a direction to keep the device latched and against the rotative movement of armature 49, the device is prevented from becoming accidentally unlatched due to conditions of severe shock, vibration and so forth.

The rearward movement of latch member 45 causes it to be rotated about pin 44 so its ears 46—46 and pads 47—47 are swung out from under contact operating arm 26. Contact operating arm 26 is no longer latched and is free to drop to its down position which it does due to the force of gravity. The movable contact carriers 30 move to their down position along with contact operating arm 26 and cause the movable contacts 62 to move away from stationary contacts 63 and 64. Armature 21, armature rod 22 and traverse arm 23 also move at the same time to their down positions.

Winding 39 is then de-energized and armature 49 returns to its down position due to gravity and the bias of spring 53. This rotates ears 50—50 away from protrusions 48—48 allowing latch member 45 to rotate forward under the bias of spring 53. The forward rotation of latch member 45 is stopped when ears 46—46 and pads 47—47 strike the rear of contact operating arm 26.

Although we have described our invention with a certain degree of particularity, it is understood that the above disclosure has been made only by way of example, as is required by law, and that many changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of our invention as hereinafter claimed.

We claim as our invention:

1. A mechanically held electromagnetically operated device comprising; a base; a plurality of individual con-

tact units independently secured to said base each having co-operating movable and stationary contacts therein; a contact operating arm connected to simultaneously move all of said movable contacts to their operated and unoperated positions; a first electromagnet secured to said base to effect movement of said contact operating arm and when energized to move said movable contacts to their operated positions; a latch mechanism secured to said base and biased to engage said contact operating arm when said movable contacts are in their operated position and to maintain them operated upon subsequent de-energization of said first electromagnet; a second electromagnet secured to said base and associated with said latch mechanism to be effective, when energized, to move said latch mechanism against its bias and to release said contact operating arm and thereby allow said contact operating arm to return said movable contacts to their unoperated position.

2. A mechanically held electromagnetically operated device comprising; a base; a plurality of individual contact units independently secured on said base, each of said contact units having co-operating movable and stationary contacts; a contact operating arm connected to simultaneously move all of said movable contacts to their operated and unoperated positions; a first electromagnet secured on said base to effect movement of said contact operating arm to put said movable contacts in their operated position when energized; a latch mechanism secured to the base biased to engage said contact operating arm when said movable contacts are in their operated position and to maintain them operated upon subsequent de-energization of said first electromagnet; a second electromagnet secured to said base over said latch mechanism, said second electromagnet effective to move said latch mechanism against the bias when energized, to release said contact operating arm and allow it to return said movable contacts to their unoperated position.

3. A mechanically held electromagnetically operated device as described in claim 1 where said second electromagnet comprises; a core and an energizing winding, an armature pivoted intermediate its ends at one side of said core, one end of said armature is moved to engage the other side of said core when the winding is energized causing the other end of said armature to engage and move the latch mechanism to release the contact operating arm allowing said movable contacts to return to their unoperated position.

4. A mechanically held electromagnetically operated device as described in claim 3, having a spring connected between the armature and the latch mechanism to yieldably bias said latch mechanism toward the latched position and yieldably bias said armature away from the other side of the core.

5. A mechanically held electromagnetically operated device comprising; a first and second electromagnet vertically mounted on a base, each having a winding associated therewith; a plurality of individual contact units independently secured on said base and disposed at the sides of said electromagnets and having co-operating movable and stationary contacts; a contact operating arm between said first and second electromagnets and connected to simultaneously move all of said movable contacts to their operated and unoperated positions; said first electromagnet associated with said contact operating arm to cause said movable contacts to be moved to their operated positions upon energization of its winding; a latch mechanism secured to said base and biased to engage said contact operating arm when said movable contacts are moved to their operated position and maintain them operated upon de-energization of the winding for said first electromagnet; said second electromagnet arranged with said latch mechanism whereby upon energization of its winding, it moves said latch mechanism against the bias to unlatch said latch mechanism from said contact oper-

ating arm and allow said contact operating arm to return said movable contacts to their unoperated position.

6. A mechanically held electromagnetically operated device as described in claim 5 where the second electromagnet is mounted in front of the latch mechanism.

7. A mechanically held electromagnetically operated device comprising; a base; a first electromagnet mounted on said base; a latch mechanism mounted on said base vertically above said first electromagnet; a second electromagnet secured to said base over said latch mechanism; a plurality of individual contact units independently secured on said base adjacent to said second electromagnet and said latch mechanism, each of said contact units having co-operating movable and stationary contacts; a contact operating arm between said first and second electromagnets and connected for simultaneously moving said movable contacts to their operated and unoperated positions; said first electromagnet associated with said contact operating arm to effect movement of said movable contacts to their operated positions when energized, said latching mechanism biased to engage said contact operating arm and hold said movable contacts operated when said first electromagnet is de-energized; said second electromagnet effective when energized to disengage said latch mechanism from said contact operating arm and allow said movable contacts to return to their unoperated position.

8. A mechanically held electromagnetically operated device as described in claim 7 where each of the control units, the first electromagnet, and the second electromagnet and the latch mechanism are independently secured to the front of the base and can be separately removed therefrom.

9. A mechanically held electromagnetically operated device as described in claim 5 where each of the contact units, electromagnets, and the latch mechanism are independently and separately removable from the front of the base.

10. A mechanically held electromagnetically operated device comprising; a base; a first and second electromagnet secured to the base in spaced apart relation, each having a winding and an armature, the armatures being movable upon energization of the windings; a plurality of individual contact units, each having a housing with co-operating movable and stationary contacts, the movable contacts carried by a contact operating rod within the housing and said rod having a portion extending out of the housing; a contact operating arm connected to be moved by the armature of the first electromagnet between a first and second position; the individual contact units

separately secured to the base and arranged to have the rods engaged by the contact operating arm and moved thereby to operate the contacts; a latch mechanism secured to the base and biased to engage the contact operating arm when moved to its second position upon energization of the winding of the first electromagnet and hold it there upon subsequent de-energization of the winding; the latch mechanism also arranged to be moved against the bias by the armature of the second electromagnet when its winding is energized, to thereby release the contact operating arm and it returns to its first position.

11. A mechanically held electromagnetically operated device as described in claim 10 where the bias for the latch mechanism is supplied by a spring reacting between the latch mechanism and the armature of the second electromagnet to also bias the armature against movement to its latch tripping position.

12. A mechanically held electromagnetically operated device comprising; a base, a plurality of individual contact units independently secured to the front of said base, each having cooperating movable and stationary contacts therein; a contact operating arm for simultaneously moving all of said movable contacts to their operated and unoperated position; a first electromagnet secured to the front of said base for effecting movement of said contact operating arm; a latch mechanism secured to the front of said base for engaging said contact operating arm when moved to its contact operated position and hold it there independent of said first electromagnet; a second electromagnet secured to said base for moving said latch mechanism to release said contact operating arm and allow it to return said movable contacts to their unoperated position and whereby said individual contact units, said first electromagnet, and said latch mechanism and second electromagnet may be independently removed from the front of said base.

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