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ELECTRICAL APPARATUS

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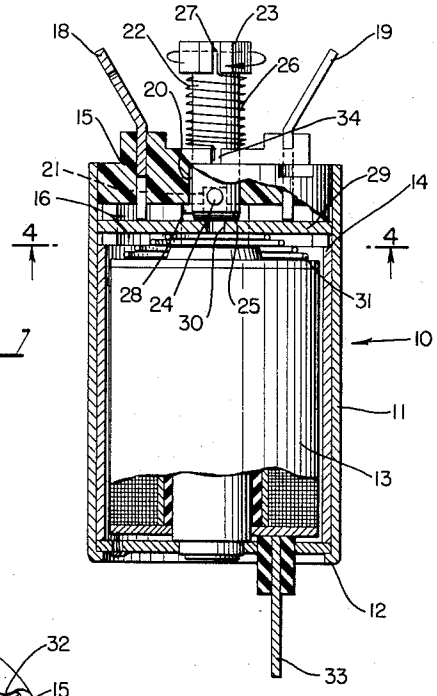


Fig. 1

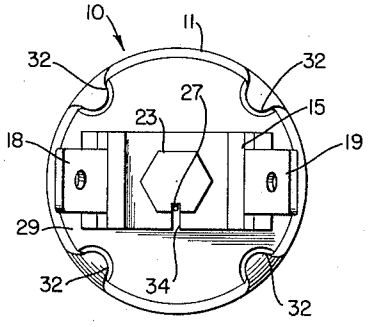


Fig. 2

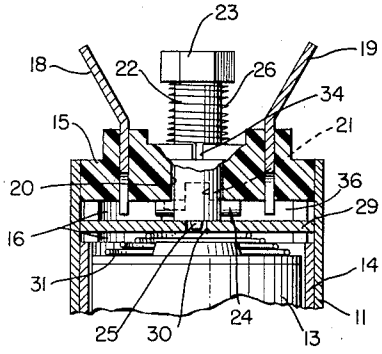


Fig. 3

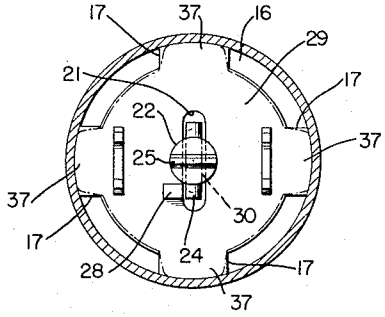


Fig. 4

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ELECTRICAL APPARATUS

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18 Claims. (Cl. 200—87)

This invention relates to electrical apparatus and more particularly to control means for a relay switch.

One of the objects of the present invention is to provide a novel device whereby the contactor of a normally automatic relay switch may be manually engaged and moved to an operating position upon the failure of the normal automatic operation.

Another object is to provide a novel device whereby the contactor of a normally automatic relay switch may be manually engaged and held in operating position and whereby the resumption of the normal automatic operation will simultaneously and automatically release the manually operated holding means.

Another object is to provide a novel device whereby the contactor of a normally automatic relay switch may be engaged and disengaged manually to move the contactor into and out of operating position upon the failure of the normal automatic operation.

Another object is to provide a novel device of the above character which will avoid the danger of a manual means being inadvertently left in engagement with the contactor of a relay switch.

Another object is to provide a novel control means and novel means for mounting the same in a relay switch.

A still further object is to provide a novel manual means for engaging the contactor on a relay switch which is simple in construction and which will automatically return from its operative to its inoperative position upon the resumption of the normal automatic operation of the relay switch.

The above and further objects and novel features of the present invention will more fully appear from the following detail description, when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views:

Fig. 1 is a side elevation, with parts broken away and partly in section, of a relay switch and control means therefor embodying one form of the invention.

Fig. 2 is a top view of the device shown in Fig. 1;

Fig. 3 is a side elevation, with parts broken away and partly in section, showing a relay switch with the control means in operative locked position; and

Fig. 4 is a transverse section taken substantially on the line 4—4 of Fig. 1.

The embodiment of the invention illustrated in the drawings, by way of example, is in the form of a device which is adapted to prevent the manual means employed to operate the control means of a relay switch from being inadvertently left in operating position. This type of device is especially useful, for example, in any circuit which utilizes a relay switch having an automatic control means together with manual means for alternatively operating the control means upon the failure of the automatic means and in which it is necessary, to avoid possible damage to equipment in the circuit, to make certain that the manual means is returned to its inoperative position upon the resumption of the automatic means. One common and practical use for this device is in conjunction with an ignition system for an outboard motor having a magneto circuit and in which it is desired to have the magneto circuit short-circuited when the outboard motor is not operating and to have the short-circuit removed when the outboard motor is operating.

Turning now to the drawings, there is shown in Fig. 1 the construction of a novel relay switch generally designated as **10**. Switch **10** has a casing **11** made, for example, of metal generally cylindrical in shape and having an axially inwardly bent flange **12** at the bottom portion thereof. Telescopically mounted within casing **11** and abutting flange **12** is an electromagnet **13** having a cylindrical casing **14**. Removably mounted on the top surface of electromagnet **13** is a spring **31**. A novel axially movable contact plate **29** is movably mounted within casing **11** and rests on the top of and is supported by spring **31**. A cap **15** is telescopically and fixedly mounted in the top portion of casing **11** and has in its bottom face an annular recessed area **36**, said recessed area being defined by integrally formed and downwardly projecting arcuately shaped leg portions **16** with slotted areas **17** defining the arcuate spaces between leg portions **16**. The bottom surfaces of leg portions **16** abut the top surface of electromagnet casing **14**. Terminals **18** and **19** are mounted in cap **15**, the lower end of each protruding into the top portion of the recessed area **36**. With cap **15** fixedly mounted in the top of casing **11**, the spring **31** is partially axially compressed and the novel contact plate **29** and spring **31** are contained within the recessed area **36**. Contact plate **29** has a diameter substantially the same as the diameter of the recessed area **36** and is provided with protrusions or ears **37** located on its outer peripheral edge. Ears **37** have a peripheral arcuate width substantially the same as the width of slots **17** so that when the cap **15** is mounted in the top of casing **11**, the ears **37** will be received in the slots **17** and allow the contact plate free axial movement within recessed area **36**.

When the electromagnet **13** in this novel relay switch is not energized, as shown in Fig. 1, the contact plate **29** will be urged upwardly against terminals **18** and **19** by spring **31** thus electrically connecting the same. Upon energization of the electromagnet the contact plate **29** will be magnetically pulled downwardly toward the electromagnet and against the axial compressive force of spring **31** thus breaking the electrical contact between terminals **18** and **19**. A manual means to engage the contact plate **29** and move the same downwardly to break electrical contact between terminals **18** and **19** is provided, whereby the device may be operated when the electromagnet immediately fails to become energized or becomes de-energized during operation. This invention embodies a novel manual means to engage and move the contact plate **29** downwardly.

The novel manual means for operating the contact plate **29** comprises a cap **15** having an aperture **20** and a recessed slotted area **21** transversely of its lower end. Positioned within aperture **20** is a plunger **22** having an enlarged portion **23** at its upper end and a pin **24** transversely mounted through its lower end. Pin **24** is of substantially the same length as the slot **21** and is adapted to be seated in the slot. A spring **26** surrounds the top portion of plunger **22** and has its upper end retained in slot **27** of head **23** and its lower end retained in slot **34** located in the upper surface of cap **15**. Spring **26**, as assembled on the top portion of plunger **22**, is partially axially compressed and also partially wound up to enable it to impose a torque on the plunger in a counterclockwise direction. The pre-tensioned spring **26** will

thus normally urge the plunger 22 upwardly until the pin 24 is fully seated in slot 21. In such position the plunger will be held from rotation by the interlocking of pin 24 and slot 21. To enable the plunger to be rotated it is first necessary to press it downwardly a sufficient distance to disengage pin 24 from slot 21. A rectangularly shaped key or lug 25 is integrally formed on and projects from the lower face of plunger 22 and is so positioned that its longest axis is 90° from the longest axis of pin 24. The shoulder portions of key 25 may be beveled as and for a purpose hereinafter to appear. A shoulder 28 is integrally formed on the lower surface of cap 15 adjacent one end of the recessed slot 21 and positioned within the path of rotation of pin 24. Shoulder 28 has a thickness less than the distance that terminals 18 and 19 protrude into the recessed area 36 to avoid interfering with and preventing contact plate 29 from establishing electrical contact between terminals 18 and 19. One edge of shoulder 28 preferably is in alignment with the wall of recessed slot 21 to integrally form an extension thereof. Shoulder 28 thus formed will permit plunger 22, when it has been moved axially downwardly so that pin 24 is clear of slot 21, to rotate only in a clockwise direction which further winds up the spring and imposes a greater torque on the plunger in a counter-clockwise direction and further serves as a stop for the pin 24 when it rotates in a clockwise direction. Contact plate 29 has a rectangularly shaped aperture 30 adapted to receive the key 25 of plunger 22.

In its assembled relation, as shown in Fig. 1, the contact plate 29 is positioned within casing 11 in such a manner that the longest axis of aperture 30 is 90° in relation to the longest axis of key 25 on plunger 22 when the plunger is in its released or raised position. When the electromagnet is de-energized the contact plate 29 is normally urged against the ends of terminals 18 and 19. The plunger 22 in its inoperative position as shown in Fig. 1, is in upmost axial position and key 25 located at its lower end is in a higher horizontal plane than a horizontal plane passing through the ends of terminals 18 and 19 so as not to interfere with or prevent contact plate 29 from making a good electrical contact across the terminals. In such positions the key 25 of plunger 22 and aperture 30 of contact plate 29 are out of register with each other so that upon the downward movement of plunger 22 the key 25 will not register with slot 30 but will abut the top surface of contact plate 29 and will be positioned across slot 30. Plunger 22 to be rotated, as described above, has to be pressed downwardly a sufficient distance to allow pin 24 to be disengaged from slot 21. This downward axial movement will move contact plate 29 axially downward a sufficient distance to break the electrical contact between terminals 18 and 19. The rotation of plunger 22 is limited to a clockwise direction by shoulder 28 as described above and upon clockwise rotation of the plunger its key 25 becomes aligned and interlocked with slot 30 of contact plate 29 and prevents return rotation of the plunger. The interlocking is positively accomplished by the constant upward axial force exerted on contact plate 29 by spring 31 which forces aperture 30 and key 25 into interlocking engagement as soon as they come into register with each other.

The axial downward movement and clockwise rotation of plunger 22 not only axially compresses spring 26 but places the spring under a still greater tension in a clockwise direction. When the plunger is freed from its interlocked position with contact plate 29 it will forceably be rotated counter-clockwise and simultaneously will be under an axial upward force due to the tensioning and compressing of spring 26 so that as pin 24 of the plunger rotates into alignment with slot 21 it will be seated in the slot thus instantly returning the plunger to its raised position as shown in Fig. 1.

When plunger 22 and contact plate 29 are moved downwardly and locked together as shown in Fig. 3, the contact plate 29 is moved less than its possible normal downward travel which is exerted when being pulled by the force of electromagnet 13. Also, when plunger 22 and contact plate 29 are in this downward locked position electromagnet 13 is not energized. However, upon the energization of the electromagnet the contact plate 29 will be pulled downwardly a still further distance. This further downward movement of the contact plate will disengage key 25 on the plunger from aperture 30 in the contact plate thus releasing the plunger and allowing it to be immediately returned to its released or raised position as described above and shown in Fig. 1. Applicants' invention thus provides a manual control for a contact plate which will enable the contact plate to be operated without depending upon the functioning of the electromagnet and at the same time the manual control will automatically be returned to its inactive position when the electromagnet is energized. The function of the plunger 22 may be utilized either when the electromagnet 13 has not initially been energized or when during operation the electromagnet becomes de-energized.

Should it become necessary to use the above described novel manual means to operate the contact plate 29 and should it be impossible to supply energy to electromagnet 13 to disengage the manual means from the contact plate, then alternative means may be provided to disengage key 25 of the plunger from the aperture 30 in the contact plate 29 to allow the contact plate to return to its inoperative position without interference from the plunger. One such means resides in the bevelled shoulders of key 25 whereby a slight rotational pressure manually applied to the head of plunger 22 will be sufficient to cause key 25 to become disengaged from aperture 30 in the contact plate. Alternatively, it may be desirable to have the shoulders of key 25 not bevelled in which case means operable through the top of cap 15 may be provided whereby a slight downward pressure may be applied to the top surface of contact plate 29 of sufficient magnitude to disengage key 25 from aperture 30.

While the embodiment shown in the drawings and described above contemplates the use of a normally "closed" relay switch, the invention may be equally applicable to a normally "open" relay switch. In a normally "open" relay switch the terminals 18 and 19 would be positioned below the contact plate 29 within the recessed area 36. In such a switch, the contact plate 29 would normally be urged upwardly against the top of recessed area 36 by spring 31 and away from electrical contact with the terminals. Upon energization of the electromagnet, the contact plate would be magnetically pulled downwardly and into electrical contact with the terminals. Upon the failure of the electromagnet to become energized, either initially or during operation, the plunger 22, operating in the same manner as described above in the "closed" relay switch, enables the contact plate to be manually moved downwardly to establish an electrical connection between the terminals. The plunger 22 and contact plate 29 are interlocked in this downward position in the same manner as in the "closed" relay switch. The interlocking prevents return rotation of the plunger. The energization of the electromagnet after the plunger and contact plate are interlocked will cause the contact plate to be magnetically moved downwardly a still further distance whereby the key 25 of the plunger becomes disengaged from the aperture 30 of the contact plate thus releasing the plunger and allowing it to automatically return to its raised position. The terminals 18 and 19 may be resiliently mounted within recessed area 36 to allow the contact plate to establish electrical contact with the terminals in its first downward position exerted by the downward movement of plunger 22 and to maintain the electrical connection between the contact plate and the terminals while the contact plate is moved still further downwardly upon

energization of the electromagnet to cause the contact plate and the plunger to become disengaged. The downward movement of contact plate **29** and the resilient terminals need only be enough to permit the key **25** to become disengaged from slot **30** in the contact plate to release the plunger and allow it to return to its raised position.

Cap **15** may be retained in casing **11** by any of several conventional means such as depressing dimples **32** in the upper peripheral edge of casing **11** into the upper peripheral surface of the cap.

Although only a single embodiment of the invention is illustrated in the accompanying drawings, it is to be expressly understood that the invention is not limited thereto. For example, this same type of relay switch which may be used to control the magneto circuit in an outboard motor ignition system, may be used as well in many other environments. The shoulder portions on the plunger key **25** need not be bevelled and its longest axis may be something other than 90° in relation to the longest axis of pin **28**. Moreover, in assembled inactive relationship of the plunger and the contact plate the angular relationship between the longest axis of key **25** and the longest axis of slot **30** may be something other than 90° as long as the two members are not aligned and in register with each other. Furthermore, the ears **37** of contact plate **29** and slots **17** of cap **15** may be fewer or greater in number and of different shapes than shown, if desired. Various other changes may also be made in the design and arrangement of the parts illustrated, as well as in the materials suggested without departing from the spirit and scope of the invention, as the same will now be understood by those in the art.

What is claimed is:

1. A switch comprising a plurality of contacts, a contactor movable with respect to the contacts between a first terminal position in which it bridges the contacts and a second terminal position in which it is removed from the contacts, resilient means urging the contactor toward one terminal position, power means which when energized overcomes the resilient means and moves the contactor toward its other terminal position, and manually operated latch means selectively to retain the contactor in said other terminal position or to permit the resilient means to move the contactor toward said one terminal position, the latch means comprising means automatically releasing the latch upon energization of the power means.

2. A switch as defined in claim 1, wherein the contactor is mounted for reciprocation between its terminal positions.

3. A switch comprising a plurality of contacts, a contactor movable with respect to the contacts between a first terminal position in which it bridges the contacts and a second terminal position in which it is removed from the contacts, the contactor being mounted for reciprocation between its terminal positions, resilient means urging the contactor toward one terminal position, power means which when energized overcomes the resilient means and moves the contactor toward its other terminal position, and manually operated latch means selectively to retain the contactor in said other terminal position or to permit the resilient means to move the contactor toward said one terminal position, the latch means being reciprocable into an outer engagement with the contactor, and resilient means urging the latch means toward its inoperative position wherein it is out of engagement with the contactor.

4. A switch as defined in claim 3, comprising detent means including interengaging means on the contactor and the confronting end of the latch means.

5. A switch as defined in claim 4, wherein the latch means when in operative position holds the contactor in a position somewhat short of its said other terminal position, and the interengaging means is so constructed and arranged that it is released upon energization of the power means and consequent movement of the contactor toward its said other terminal position.

6. A switch as defined in claim 5, wherein the latch means is a plunger rotatable about its axis of reciprocation, and comprising resilient means imposing a torque on the plunger in a first direction, and wherein the interengaging means on the plunger and contactor when operatively engaged hold the plunger from rotation against the action of the torque-imposing resilient means.

7. A switch as defined in claim 6, wherein the detent includes means retaining the plunger from axial movement toward said one terminal position of the contactor when the interengaging means on the plunger and contactor are operatively engaged, said plunger retaining means being so constructed and arranged as to allow axial movement of the plunger away from the contactor when the plunger has turned in said first direction into a predetermined position.

8. A switch as defined in claim 7, comprising stop means for preventing turning of the plunger in said first direction past said predetermined position.

9. A switch as defined in claim 1, wherein the contactor bridges the contacts when it is in its said one terminal position.

10. A switch as defined in claim 1, wherein the power means is an electromagnet.

11. A switch as defined in claim 1, wherein the resilient means normally urges the contactor toward said second terminal position and wherein the power means when energized moves said contactor toward said first terminal position.

12. A switch as defined in claim 1, wherein said latch means comprises means to manually release the latch.

13. A switch as defined in claim 5 wherein the contactor bridges the contacts when it is somewhat short of its other terminal position and continues to bridge the contacts as it moves toward and reaches said other terminal position.

14. In a switch the combination of a plurality of contacts, a contactor movable between a first terminal position in which it bridges the contacts and a second terminal position in which it is removed from the contacts, resilient means urging the contactor toward one terminal position, power means which when energized overcomes the resilient means and moves the contactor to its other terminal position, and manually operated latch means to engage and retain the contactor in a position somewhat short of its said other terminal position, and means to automatically disengage the latch and contactor upon energization of the power means.

15. In a switch the combination of a plurality of contacts, a contactor movable between a first terminal position in which it bridges the contacts and a second terminal position in which it is removed from the contacts, resilient means urging the contactor toward one terminal position, power means which when energized overcomes the resilient means and moves the contactor to its other terminal position and manually operated reciprocable latch means biased to be normally held out of engagement with the contactor, cooperable interengaging means on the latch means and the contactor whereby the latch and the contactor are engaged when the latch moves the contactor to a position somewhat short of its said other terminal position, and the cooperable interengaging means being so constructed and arranged as to become disengaged upon energization of the power means and the consequent movement of the contactor to its other terminal position.

16. A switch comprising a plurality of contacts, a contactor mounted for reciprocation between a first terminal position in which it bridges the contacts and a second terminal position in which it is removed from the contacts, resilient means urging the contactor toward the said first terminal position, power means which when energized overcomes the resilient means and moves the contactor

toward said second terminal position, and manually operated latch means to selectively retain the contactor in a position somewhat short of said second terminal position.

17. A switch comprising a plurality of contacts, a contactor mounted for reciprocation between a first terminal position in which it is removed from the contacts and a second terminal position in which it bridges the contacts, resilient means urging the contactor toward said first terminal position, power means which when energized overcomes the resilient means and moves the contactor into said second terminal position, and manually operated latch means to engage and retain the contactor in a position somewhat short of said second terminal position and to bridge said contacts.

18. A switch comprising a plurality of contacts, a contactor mounted for reciprocation between a first terminal position in which it is removed from the contacts and a second terminal position in which it bridges the contacts, resilient means urging the contactor toward said first terminal position, power means which when energized overcomes the resilient means and moves the contactor to said second terminal position to bridge the contacts, and manually operated latch means to engage and retain the contactor in a position somewhat short of said second terminal position and bridging said contacts, and means to automatically disengage the latch and contactor upon energization of the power means and the consequent movement of the contactor to said second terminal position.

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