Aug. 21, 1956 G. M. EULER 2,760,014

SWITCH STRUCTURE

Filed May 19, 1953

Fig. 1.

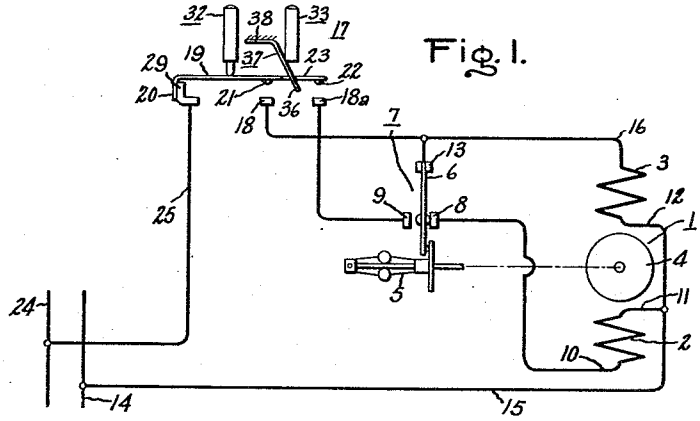


Fig. 2.

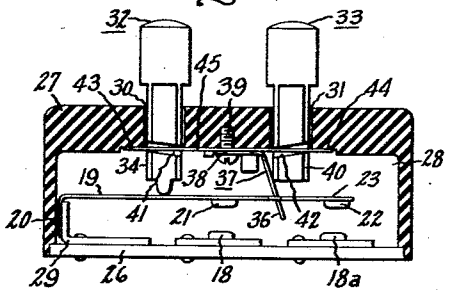


Fig. 3.

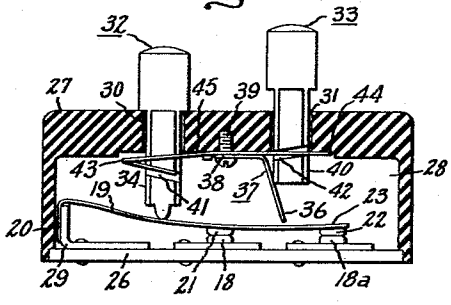


Fig. 4.

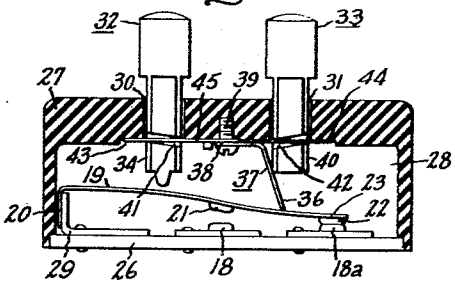
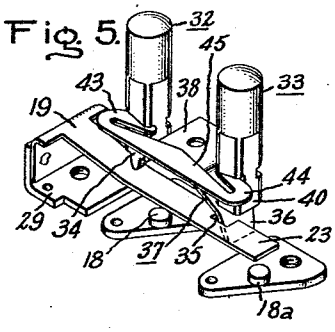


Fig. 5.



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United States Patent Office 2,760,014 Patented Aug. 21, 1956

2,760,014

SWITCH STRUCTURE

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Application May 19, 1953, Serial No. 355,921

11 Claims. (Cl. 200—5)

This invention relates to switch structures and more particularly to a switch construction suitable for use as a starting and stopping switch for single phase alternating current motors.

There are certain applications for a switch which upon initial actuation will momentarily close two pairs of contacts with one of the pairs of contacts being latched closed and the other pair opening when the manual actuating force is removed. The mechanism must further provide for manually releasing the latched pair of contacts. Such a switch may be used for example in connection with a single phase alternating current motor having a speed responsive switch associated therewith. The switch is connected so that the momentarily closed pair of contacts connect the running winding for energization across a supply line with the starting winding being connected across the running winding through the speed responsive switch. The latched pair of contacts may be connected to another normally open contact of the speed responsive switch so that the starting and running windings are initially energized through the momentarily closed pair of contacts, the starting winding being deenergized by operation of the speed responsive switch which then connects the running winding for energization through the latched pair of contacts. Subsequent stalling of the motor causing the speed responsive switch to move back to its starting position will not result in again starting the motor since the momentarily closed pair of contacts are open. In order to restart the motor therefore it is necessary to manually actuate the unlatching means and to again actuate the contact closing means.

It is desirable that a switch device having the above described characteristics be simple, inexpensive and readily assembled and disassembled and it is further desirable that the device be compact permitting mounting on a domestic appliance such as an electric lawn mower.

It is therefore an object of this invention to provide a switch structure incorporating the desirable features set forth above.

In accordance with this invention, a pair of spaced stationary contacts are provided and a flexible member is also provided having one end fixed. A pair of spaced movable contacts are mounted on the flexible member adjacent its free end and respectively cooperate with the stationary contacts to form a first and second pair of contacts. The flexible member is normally arranged so that both pairs of contacts are open. First manually actuated means are provided arranged to engage the flexible member thereby biasing the same to close both pairs of contacts. Latching means are provided arranged to engage the flexible member thereby holding one of the pairs of contacts closed after operation of the first actuating means. The flexible member is arranged so that the other pair of contacts opens when it is no longer engaged by the first actuating means while the first pair of contacts is held closed by the latching means. A second manually actuated means is provided arranged to move the latching means out of engagement with the flexible member thereby permitting the same to return to its normal position opening the first pair of contacts. Resilient means may be provided biasing the first and second manually actuated means out of engagement with the flexible member and latching means respectively.

In the drawing, Fig. 1 is a schematic illustration of the improved switch structure of this invention showing the connections with a single phase alternating current motor;

Fig. 2 is a side elevational view, partly in section, illustrating the improved switch of this invention with both pairs of contacts open;

Fig. 3 is a side elevational view, partly in section, illustrating the switch of Fig. 2 with both pairs of contacts closed;

Fig. 4 is a side elevational view, partly in section, illustrating the switch in the latched position; and

Fig. 5 is a fragmentary view in perspective further illustrating the components of the improved switch of this invention.

Referring now to Fig. 1, there is shown a single phase alternating current motor **1** having a starting winding **2** and a running winding **3**. Motor **1**, which may be a squirrel cage induction motor, is provided with a suitable rotor member **4** to which a suitable speed responsive device, such as centrifugal mechanism **5** is connected. Centrifugal mechanism **5** is arranged to actuate a movable contact carrying member **6** of switch **7**. Switch **7** has stationary contacts **8** and **9** and a terminal **13** connected to its movable element **6**. One end **10** of starting winding **2** is connected to stationary contact **8** of switch **7** while its other end **11** is connected to end **12** of running winding **3**. Winding ends **11** and **12** are adapted to be connected to one side **14** of a suitable source of alternating current (not shown) by a line **15**. The other side **16** of running winding **3** is connected to terminal **13** of switch **7**.

In order to provide for starting and stopping the motor **1**, a suitable switch, generally identified as **17**, is provided having a pair of spaced stationary contacts **18** and **18***a*. Contact **18** is connected to terminal **13** of switch **7** while contact **18***a* is similarly connected to stationary contact **9** of switch **7**. It will be readily seen that movable element **6** of switch **7** contacts stationary contact **8** when the motor **1** is at a standstill and moves opening its connection with stationary contact **8** and forming a connection with stationary contact **9** responsive to actuation by centrifugal mechanism **5** at a predetermined rotational speed of rotor **4**. Switch **17** includes an elongated flexible member **19**, preferably formed of suitable resilient metal, having its end **20** fixed and having movable contacts **21** and **22** mounted adjacent its free end **23**. Movable contacts **21** and **22** respectively cooperate with stationary contacts **18** and **18***a*. Flexible element **19** is adapted to be connected to the other side **24** of the source of alternating current by a line **25**.

Referring now to Figs. 2, 3, 4 and 5, it will be seen that stationary contacts **18** and **18***a* of switch **17** are mounted on a base member **26**, preferably formed of suitable insulating material. A cover member **27**, also preferably formed of suitable insulating material, is attached to base **26** and defines a cavity **28** therewith. Elongated flexible member **19** is arranged within cavity **28** and its end **20** is secured to and spaced from base member **26** by a mounting bracket **29**. A pair of spaced openings **30** and **31** are formed in the upper surface of cover **27** communicating with cavity **28** and a pair of manually actuated buttons **32** and **33** are respectively arranged therein. Button **32** has a portion **34** extending into cavity **28** and arranged to engage flexible member **19**. It will be seen by reference to Figs. 1 and 2 that flexible member **19** is normally positioned so that contacts **18** and **21**, and **18***a* and **22** are opened.

Elongated flexible member 19 has a notch 35 formed in its edge adjacent its end 23 and a downwardly projecting end 36 of latching member 37 is normally seated therein, as best shown in Figs. 2 and 5. Latching member 37, which is preferably formed of resilient metal, has its end 38 secured to the inner surface of the upper portion of cover member 27 and in any suitable manner, as by screw 39. Actuating button 33 has a portion 40 arranged within cavity 28 and engaging the side of end 36 of latching member 37. Extension portions 34 and 40 of buttons 32 and 33 have notches 41 and 42 respectively formed in their edges with ends 43 and 44 of spring 45 seated therein. The central portion of spring 44 is secured to the inner surface of the upper portion of cover member 27 by screw 39. It will be readily apparent that spring 44 normally biases buttons 33 and 33 upwardly to the position shown in Figs. 2 and 5.

In operation and with the motor initially at rest, switch 17 is in the position shown in Figs. 1, 2 and 5 with flexible member 19 normally arranged so that contacts 18 and 21, and 18*a* and 22 are open. In order to start the motor, button 32 is manually depressed against the bias of end 43 of spring 45, as shown in Fig. 3, causing its extension portion 34 to engage the upper surface of flexible member 19 thereby biasing it initially to close contacts 18 and 21, and 18*a* and 22. Reference to Fig. 1 will indicate that initial closing of contacts 18 and 21 sets up a first circuit from supply line 24 through line 25, flexible member 19, contacts 18 and 21, running winding 3, and line 15 to supply line 14. Another circuit is also established from contact 18 through movable element 6, and stationary contact 8 of switch 7 to starting winding 2 and line 15. The motor 1 will thus start and at a predetermined speed, which will be reached prior to release of manual pressure on button 32, centrifugal mechanism 5 will move element 6 of switch 7 from stationary contact 8 to stationary contact 9. This opens the circuit of starting winding 2 so that the motor is running only on the running winding 3 and a parallel circuit is established for running winding 3 through contacts 18*a* and 22 of switch 17 and stationary contact 9 of switch 7. It will be seen from Fig. 3 that biasing of the flexible member 19 by button 32 to close both pairs of contacts has released end 36 of latching member 37 from its engagement with notch 35 and due to its natural resilience, it moves slightly to the right, as viewed in Fig. 3.

When manual pressure on button 32 is released, the end 43 of spring 45 returns the button to its normal position so that flexible member 19 tends to return to its normal position of Fig. 2. However, end 36 of latching member 37 now engages the upper surface of flexible member 19 holding contacts 18*a* and 22 closed. The resilience of member 19 however opens contacts 18 and 21 as shown in Fig. 4. In this position, with contacts 18*a* and 22 closed, the circuit for the motor 1, as viewed in Fig. 1, is from supply line 24 through line 25, flexible member 19, contacts 18*a* and 22 of switch 17, contact 9 and movable element 6 of switch 7, running winding 3 and line 15 to supply line 14.

It will now be seen that in the event that motor 1 stalls, the resultant reduction in speed will cause centrifugal mechanism 5 to move movable element 6 away from stationary contact 9 of switch 7 thus opening the circuit of running winding 3, and making a connection with stationary contact 8. The starting winding 2 and running winding 3 are not energized again however since the only available connection with movable element 6 of switch 7 in engagement with contact 8 is through contacts 18 and 21 of switch 17, which are open. It will thus be seen that the windings are deenergized and the motor 1 will not restart after being stalled.

In order to stop the motor when it is running or to again start it after a stall, button 33 is depressed against the bias of end 44 of spring 45. This causes extension portion 40 of button 43 to engage the upper surface of end 36 of latching member 37 moving it to the left, as viewed in Figs. 2, 3, and 4 until it moves into notch 35 of flexible member 19. As soon as end 36 of latching member 37 moves out of engagement with the upper surface of flexible member 19 into notch 35, flexible member 19 will return to its normal position as viewed in Fig. 2, due to its inherent resilience, with both pairs of contacts open. Thus, if the motor 1 is running, it will be deenergized bringing it to a stop, or if it has been stopped due to a stall, it cannot be again restarted without first depressing starting button 32.

It will now be readily seen that this invention provides a simple, inexpensive, compact and readily assembled switch mechanism which closes two pairs of contacts responsive to initial manual actuation with one of the pairs of contacts being latched closed and the other pair opening when the manual pressure is removed. The one pair of contacts will remain closed thereafter until the latching device is released by manual actuation of the stop button.

While I have shown and described a particular embodiment of this invention, further modifications and improvements will occur to those skilled in the art. I desire that it be understood therefore that this invention is not limited to the particular form shown and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A switch structure comprising a pair of spaced stationary contacts, a flexible contact carrying member having one end fixed, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts forming a first and second pair of contacts, said flexible member being normally positioned with both of said pairs of contacts open, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first actuating means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said holding latching means and not engaged by said first manually actuated means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts.

2. A switch structure comprising a support, a pair of spaced stationary contacts mounted on said support, a flexible contact carrying member having one end secured to said support, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said flexible member being normally positioned with both of said pairs of contacts open, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first manually actuated means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by said first manually actuated means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts.

3. A switch structure comprising a support, a pair of spaced stationary contacts mounted on said support, an elongated flexible contact carrying member having one end secured to said support, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said

one end of said flexible member being spaced from said support whereby said flexible member normally opens both of said pairs of contacts, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first actuating means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by said first actuating means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts.

4. A switch structure comprising a support, a pair of spaced stationary contacts mounted on said support, a flexible contact carrying member having one end secured to said support, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said flexible member being normally positioned with both of said pairs of contacts open, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first actuating means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by first manually actuated means, second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts, and resilient means arranged normally to bias said first and second actuating means out of engagement with said flexible member and latching means.

5. A switch structure comprising a base member, a cover member attached to said base member and defining a cavity therewith, a pair of spaced stationary contacts mounted on said base member in said cavity, an elongated flexible contact carrying member in said cavity having one end secured to said base member, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said flexible member being normally positioned with both of said pairs of contacts opened, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means mounted on said cover member arranged to engage said flexible member after operation of said first manually actuated means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by said first manually actuated means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts.

6. A switch structure comprising a base member, a pair of spaced stationary contacts mounted on said base member, an elongated flexible contact carrying member having one end secured to said base member, a first movable contact mounted on said flexible member adjacent its free end and cooperating with one of said stationary contacts to form a first pair of contacts, a second movable contact mounted on said flexible member intermediate said ends and cooperating with the other of said stationary contacts to form a second pair of contacts, said one end of said flexible member being spaced from said base member whereby said flexible member normally opens both of said pairs of contacts, first manually actuated means arranged to engage said flexible member thereby biasing same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first manually actuated means thereby holding said first pair of contacts closed, said flexible member moving to open said second pair of contacts when engaged by said latching means and not engaged by said manually actuated means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said first pair of contacts.

7. A switch structure comprising a base member, a cover member attached to said base member defining a cavity therewith, a pair of spaced stationary contacts mounted on said base member in said cavity, an elongated flexible contact carrying member in said cavity having one end secured to said base member, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said one end of said flexible member being spaced from said base member whereby said flexible member normally opens both of said pairs of contacts, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means mounted on said cover member arranged to engage said flexible member after operation of said first manually actuated means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by said first manually actuated means, second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts, and resilient means secured to said cover member and arranged normally to bias said first and second manually actuating means out of engagement with said flexible member and said latching means.

8. A switch structure comprising a base member, a cover attached to said base member and defining a cavity therewith, a pair of spaced stationary contacts mounted on said base member in said cavity, an elongated flexible contact carrying member in said cavity having one end secured to said base member, a first movable contact mounted on said flexible member adjacent its free end and cooperating with one of said stationary contacts to form a first pair of contacts, a second movable contact member mounted on said flexible member intermediate said ends and cooperating with the other of said stationary contacts to form a second pair of contacts, said one end of said flexible member being spaced from said base member whereby said flexible member normally opens both of said pairs of contacts, first manually actuated means arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, latching means mounted on said cover member arranged to engage said flexible member after operation of said first manually actuated means thereby holding said first pair of contacts closed, said flexible member moving to open said second pair of contacts when engaged by said latching means and not engaged by said first manually actuated means, second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said first pair of contacts, and resilient means secured to said cover member and arranged normally to bias said first and second actuating means out of engagement with said flexible member and said latching means.

9. A switch structure comprising a base member, a cover member attached to said base member and defining a cavity therewith, a pair of spaced stationary contacts mounted on said base member in said cavity, an elongated

flexible contact carrying member in said cavity having one end secured to said base member, a first movable contact mounted on said flexible member adjacent its free end and cooperating with one of said stationary contacts to form a first pair of contacts, a second movable contact mounted on said flexible member intermediate said ends and cooperating with the other of said stationary contacts to form a second pair of contacts, said one end of said flexible member being spaced from said base member whereby said flexible member normally opens both of said contacts, first manually actuated means arranged to engage said flexible member thereby biasing same to close both of said pairs of contacts, said flexible member having a notch formed in one side thereof, a flexible latching member having one end secured to said cover member and its other end normally arranged in said flexible member notch, movement of said flexible member by said first manually actuated means causing said latching member to engage the upper surface of said flexible member thereby holding said first pair of contacts closed, said flexible member moving to open said second pair of contacts when engaged by said latching member and not engaged by said first manually actuated means, and second manually actuated means arranged to move said latching member out of engagement with said flexible member thereby permitting the same to return to said normal position opening said first pair of contacts.

10. A switch structure comprising a support, a pair of spaced stationary contacts mounted on said support, a flexible contact carrying member having one end secured to said support, a pair of spaced movable contacts mounted on said flexible member adjacent its free end and respectively cooperating with said stationary contacts to form a first and second pair of contacts, said flexible member being normally positioned with both of said pairs of contacts open, said movable contacts being electrically connected by said flexible member, first manually actuated means arranged to engage said flexible member thereby biasing same to close both of said pairs of contacts, latching means arranged to engage said flexible member after operation of said first manually actuated means thereby holding one of said pairs of contacts closed, said flexible member moving to open the other of said pairs of contacts when engaged by said latching means and not engaged by said first manually actuated means, and second manually actuated means arranged to move said latching means out of engagement with said flexible member thereby permitting the same to return to said normal position opening said one pair of contacts.

11. A switch structure comprising a base member, a cover member attached to said base member and defining a cavity therewith, a pair of spaced stationary contacts mounted on said base member in said cavity, an elongated flexible contact carrying member in said cavity having one end secured to said base member, a first movable contact mounted on said flexible member adjacent its free end and cooperating with one of said stationary contacts to form a first pair of contacts, a second movable contact mounted on said flexible member intermediate said ends and cooperating with the other of said stationary contacts to form a second pair of contacts, said movable contacts being electrically connected by said flexible member, said one end of said flexible member being spaced from said base member whereby said flexible member normally opens both of said pairs of contacts, said cover member having a pair of openings formed therein communicating with said cavity, a first manually actuated button seated in one of said openings and having an end portion in said cavity arranged to engage said flexible member thereby biasing the same to close both of said pairs of contacts, said flexible member having a notch formed in one side thereof, a flexible latching member having one end secured to said cover member and its other end normally arranged in flexible member notch, movement of said flexible member by said first manually actuated button causing said latching member to engage the upper surface of said flexible member thereby holding said first pair of contacts closed, said flexible member moving to open said second pair of contacts when engaged by said latching member and not engaged by said first manually actuated button, a second manually actuated button seated in the other of said cover member openings and having an end portion in said cavity adapted to engage said latching member thereby biasing the same out of engagement with said flexible member and into said notch permitting said flexible member to return to said normal position opening said first pair of contacts, and a flat spring in said cavity having a center portion secured to said cover member intermediate said openings and having its ends respectively seated in notches in said actuating button end portions, said spring being arranged normally to bias said actuating buttons out of engagement with said flexible member and said latching member.

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