March 26, 1957 F. R. SIBBALD 2,786,905

ELECTRICAL SWITCH

Filed June 9, 1955 4 Sheets-Sheet 1

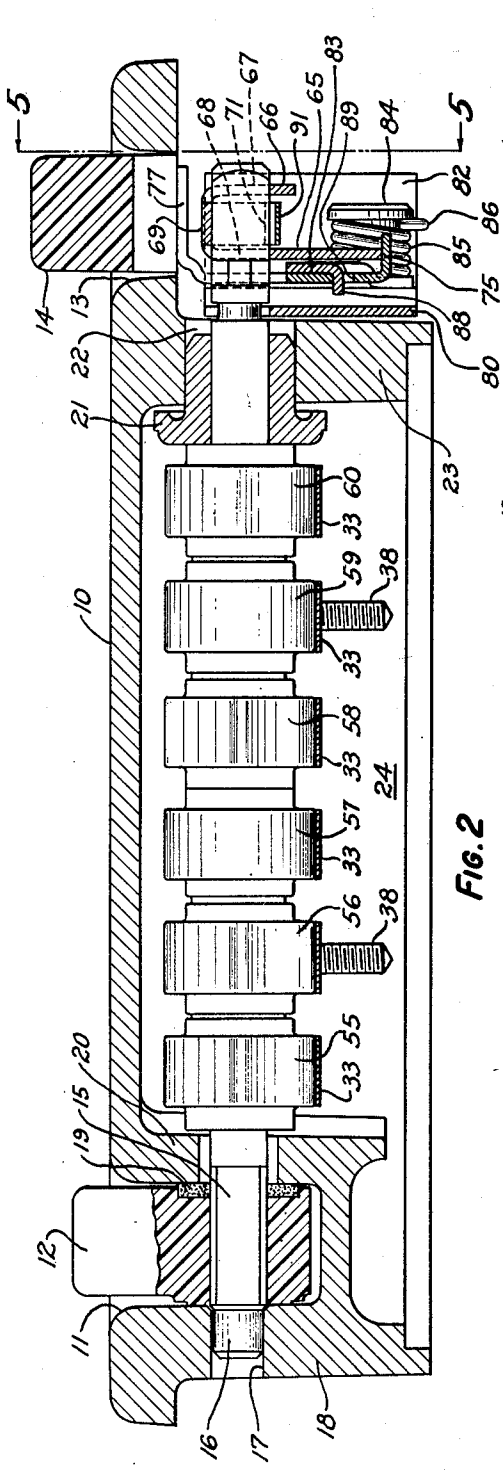


FIG. 2

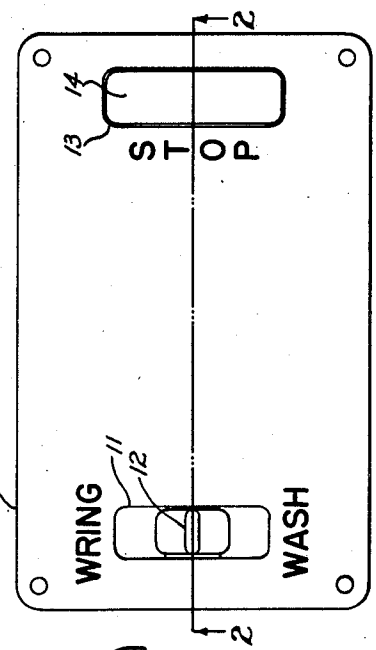


FIG. 1

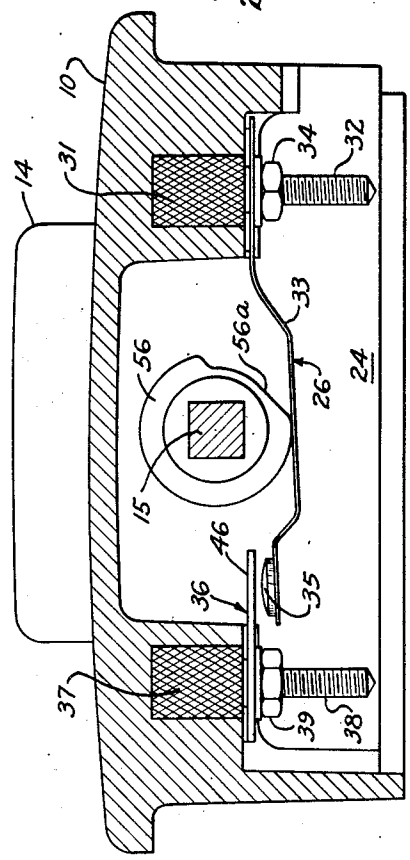


FIG. 4

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ELECTRICAL SWITCH

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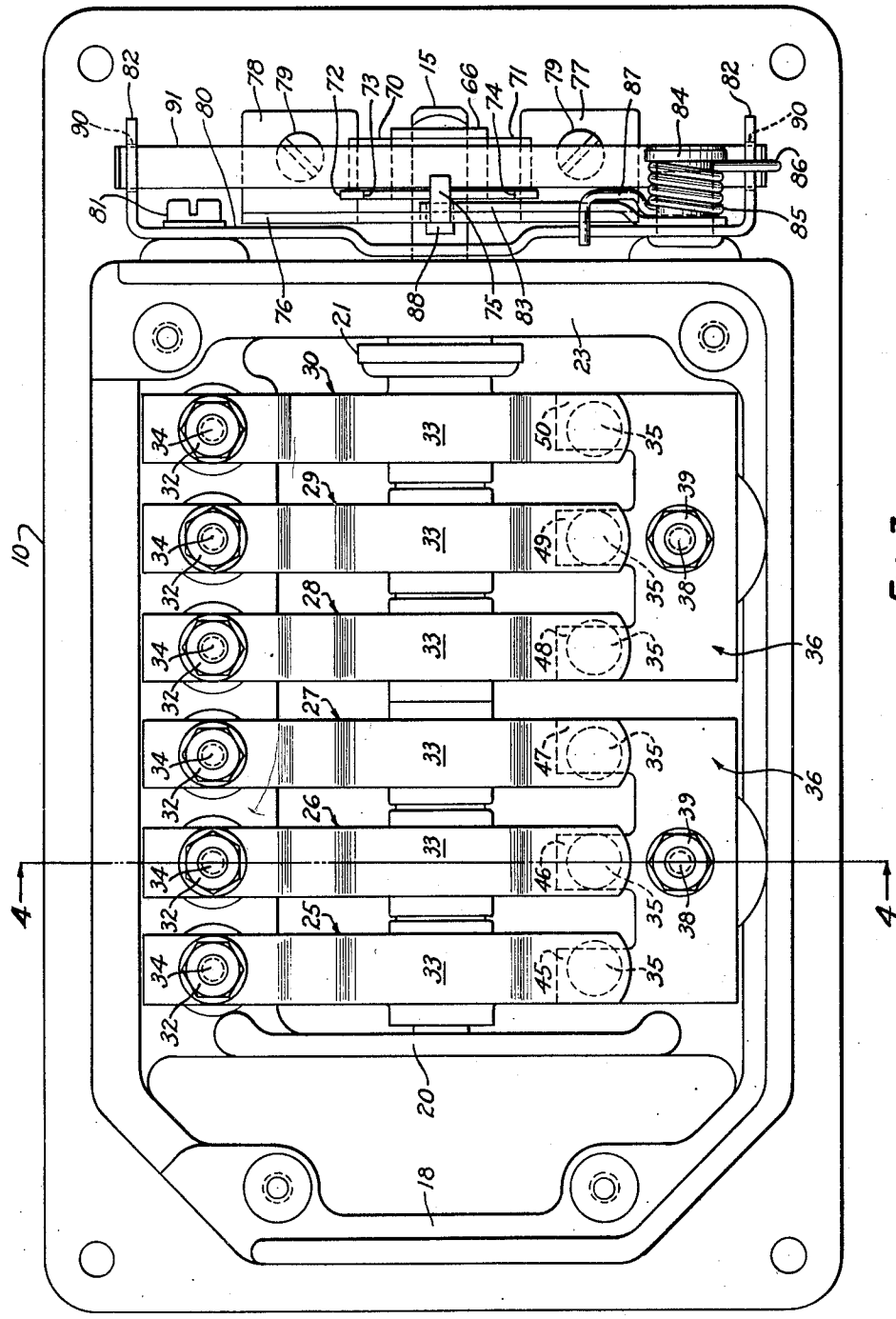


FIG. 3

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ELECTRICAL SWITCH

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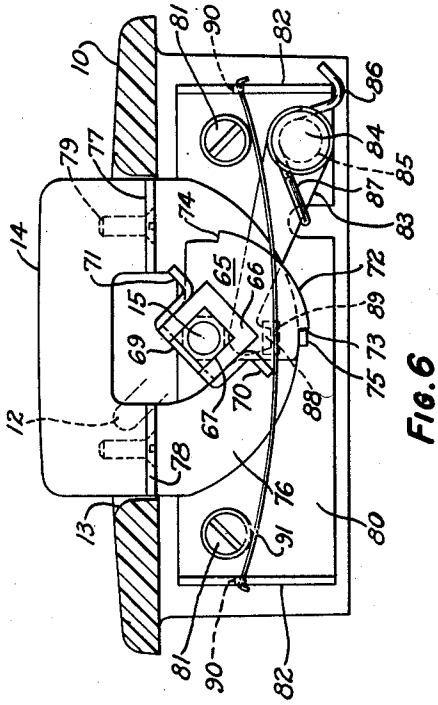


FIG. 6

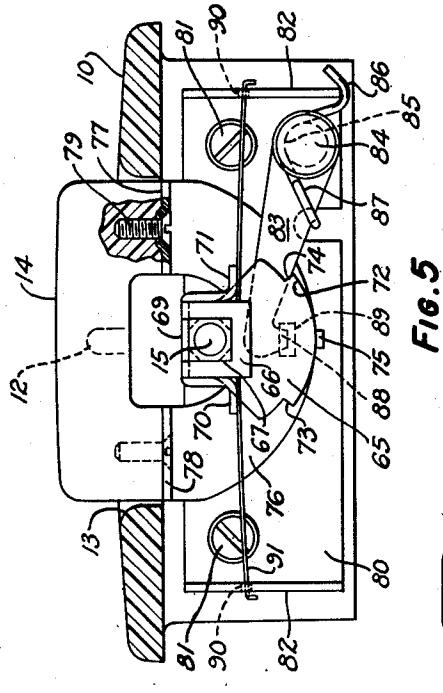


FIG. 5

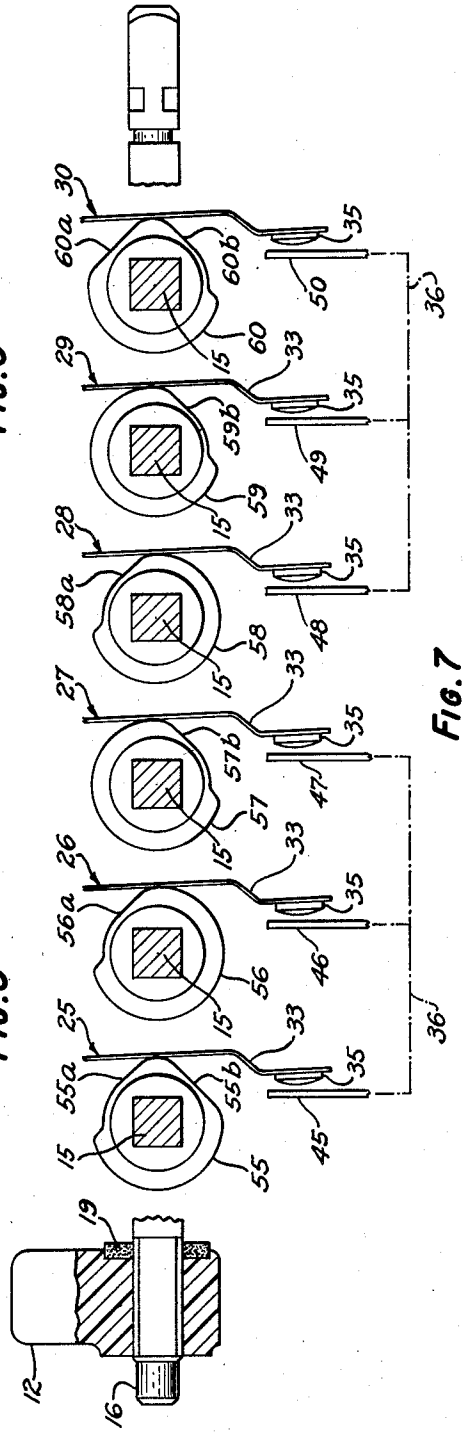


FIG. 7

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ELECTRICAL SWITCH

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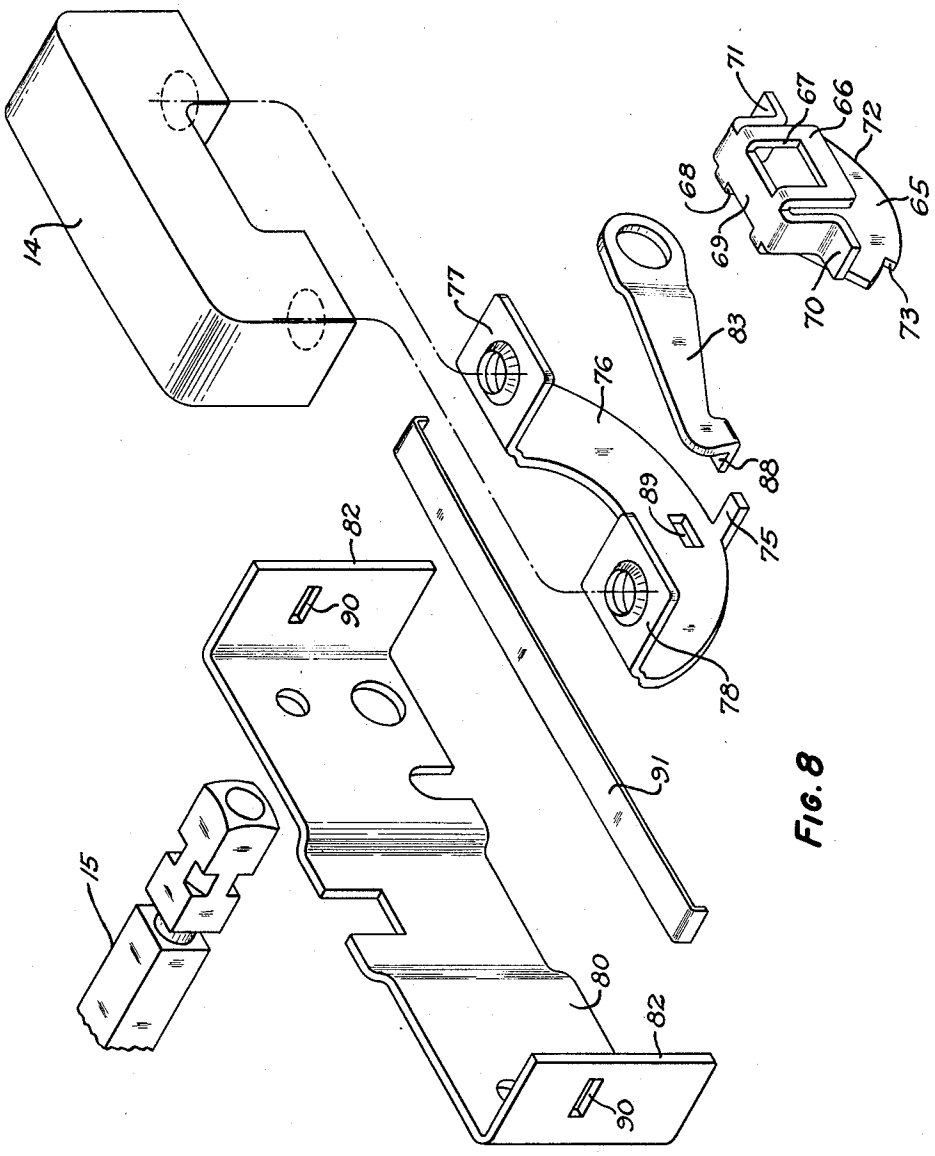


FIG. 8

United States Patent Office 2,786,905 Patented Mar. 26, 1957

2,786,905

ELECTRICAL SWITCH

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Application June 9, 1955, Serial No. 514,209

Claims priority, application Great Britain July 5, 1954

7 Claims. (Cl. 200—5)

The instant invention relates to electrical switches and more particularly to a novel switch having means for closing the switch contacts and distinct means for opening said switch contacts, and including means for locking the switch contacts in closed position which means is automatically released when the means for opening the switch contacts is actuated.

In accordance with the instant invention, the novel switch comprises one or more switch elements, each of which includes a fixed contact and a spring contact which is normally biased to a closed position making electrical contact with the fixed contact. A cam is provided for each switch element to operate the spring contact, the cams normally holding the contacts open and being rotatable to permit the contacts to close in response to the bias of the spring. The cams are mounted on a rotatable shaft which is provided with a lever or the like for rotating the shaft to operate the cams for closing the switch contacts.

A switch locking sector is secured to the shaft, and when the switch elements are closed, the locking sector is moved to a locking position in which a spring biased detent engages the sector for locking the rotatable shaft and thereby locking the switch with the contacts closed. The detent is part of a control plate which is secured to an "off" button control for opening the contacts of the switch elements. Operation of the button control disengages the detent from the locking sector, in order to permit reverse rotation of the shaft and the cams for opening the switch contacts. The locking sector includes an operator extending laterally from the shaft, which operator is engaged by a portion of the control plate when the button control is actuated to open the switch contacts. The control plate engages the operator on the locking sector and rotates the shaft in a direction to move the cams to a position where they will open the switch element contacts. There is additionally provided a leaf spring which engages the operator on the locking sector and biases the shaft in a direction to move the cams to a position opening the switch contacts. In the event that the leaf spring alone fails to effect operation of the shaft to open the switch contacts, the control button provides a positively actuated means for doing so.

The invention is disclosed herein in a preferred embodiment for controlling the operation of a washing machine in which there is provided a single motor which is adapted to be operated in reverse directions for driving the washing and wringing means of the machine, respectively. In the preferred embodiment of the invention, the novel switch includes six switch elements. Two of these switch elements are connected to the line for supplying power to the motor. The remaining four elements are paired, and each pair is alternately closed in circuit with the first mentioned pair of switch elements for operation of the motor in reverse directions. The switch structure is enclosed within a suitable casing which in turn is secured to the washing machine structure. As

a further feature of the invention, the operating means for closing the contacts of the switch elements and the button control for opening the switch element contacts are remotely located on the switch housing, thereby discouraging simultaneous operation of these controls, so that the user will first stop the motor before attempting to reverse the rotation of the same.

It is the object of the instant invention to provide a novel switch comprising a plurality of open switch elements, means for operating the switch to close the contacts of the switch elements, means for locking the switch operating means with the switch element contacts closed, and distinct means for releasing the locking means and restoring the switch elements to open position.

It is a further object of the instant invention to provide a novel switch comprising a plurality of switch elements, in which means is provided for closing the contacts of switch elements and distinct means is provided for opening the switch element contacts.

Further objects and advantages of the instant invention will be apparent to those skilled in the art upon consideration of the detailed description of a preferred embodiment of the invention which follows, reference being had to the drawings in which:

Figure 1 is a plan view of the exterior of the novel switch,

Figure 2 is a sectional view taken on the line 2—2 in Fig. 1,

Figure 3 is a bottom plan view of the novel switch,

Figure 4 is a sectional view of the novel switch taken on the line 4—4 in Fig. 3,

Figure 5 is an elevational view of the novel switch taken on the line 5—5 in Fig. 2,

Figure 6 is an elevational view of the novel switch, similar to Fig. 5, with certain of the elements shown in different positions,

Figure 7 is a diagrammatic view of the cam operating elements of the novel switch, and

Figure 8 is an exploded view of the locking means for the novel switch.

Referring to the drawings, the instant invention is illustrated as embodied in a switch for controlling the operation of a washing machine in which a single motor is utilized for operating the washing and wringing means, the motor being operated in reverse directions for operating the wringing and washing means independently of each other. The novel switch mechanism is contained within an appearance housing **10** which may be molded or cast to a suitable configuration.

The appearance housing **10** is of a generally rectangular configuration in plan view, and at one end thereof there is provided an opening **11** through which projects a switch lever **12** for selectively closing the switch elements contained within the housing **10**. As viewed in Fig. 1, the switch lever **12** may be moved downwardly, pivoting about its axis, to close the appropriate switch elements for energizing the motor to operate the machine for washing. The switch lever **12** has a second position to which it may be moved by pivoting it upwardly as viewed in Fig. 1, in which position the switch lever **12** selectively closes certain switch elements for energizing the motor to operate in a reverse direction for operating the wringing means provided in the washing machine. At the opposite end of the housing **10**, there is provided an opening **13** through which projects an "off" push button control **14** for opening the switch elements that have been closed by operation of the switch lever **12**, thereby stopping operation of the washing or wringing machine by deenergization of the motor.

The switch lever **12** is secured to a shaft **15** which is rotatably mounted within the housing **10** for movement by the switch lever through an arc of substantially 45°

to either side of its central neutral position. The shaft **15** is of a square cross-section over the major portion of its length. The end portion **16** of the shaft **15** is formed with a circular cross-section and forms a journal seating within a bearing **17** formed in the end wall **18** of the housing **10** to support the shaft **15** at its one end. A felt washer **19** is interposed between the switch lever **12** and the adjacent wall **20** of the housing **10**, to provide a liquid tight seal at this point to prevent the entrance of liquids to the interior of the housing **10**. Adjacent the opposite end of the shaft **15**, there is provided a bushing **21**, which is press fitted to the shaft **15**, and seats within a bearing **22** formed in the end wall **23** of the housing **10**. The bushing **21** provides a seal in the end wall **23** to prevent the entrance of liquid to the interior of the housing **10** through the opening **22**.

Within the appearance housing **10**, intermediate the walls **20, 23**, there is provided a chamber **24** within which there are disposed six switch elements denoted by the reference numerals **25** to **30**. The switch elements **25** to **30** are arranged parallel to each other in two groups of three each. Each of the switch elements in the one group is paired with a switch element in the other group for a purpose that will be apparent hereafter.

As seen in Fig. 4, the switch element **26** comprises a post **31** embedded in the housing **10** and formed with a knurled surface for securing the same to the housing **10**. The post **31** projects beyond the interior surface of the housing **10** in a bolt portion **32**. A conducting spring contact arm **33** is secured to the post **31** by means of a nut **34** threaded to the bolt **32**. The spring contact arm **33** projects into the interior chamber **24** and has an electrical contact **35** secured to its end in any satisfactory manner. Each of the switch elements **25** to **30** includes the post **31** and spring contact arm **33** as described immediately above. At the opposite side of the interior chamber **24**, there are provided two fixed contact plates **36**, of electrically conductive material, disposed in the path of the contacts **35** on the spring arms **33**, for cooperation therewith. For each of said fixed contact plates **36**, there is provided a post **37** embedded within the material of the housing **10**, and formed with a knurled surface for securing the post **37** to the body of the housing **10**. The post **37** projects beyond the housing **10** into the chamber **24** in a bolt portion **38** to which is secured one of the fixed contact plates **36** by means of a nut **39** threaded to the bolt **38**. One of said fixed contact plates **36** comprises individual fixed contacts **45, 46, 47** adapted to cooperate with the contacts **35** of the switch elements **25, 26, 27**, respectively. The other of the fixed contact plates **36** comprises individual fixed contacts **48, 49, 50** adapted to cooperate with the contacts **35** of the switch elements **28, 29, 30**, respectively.

The spring arms **33** of the switch elements **25** to **30** are biased in a direction to dispose the contacts **35** in contact with the fixed contacts **45** to **50**, respectively. A plurality of cam operators **55** to **60** is secured to the shaft **15**, with a cam disposed in alignment with each of the switch elements **25** to **30**. Cams **55** to **60** cooperate with switch elements **25** to **30**, respectively, to move the spring contact arm **33** of each of the switch elements **25** to **30** to a position in which the contacts **35** are separated from the fixed contacts **45** to **50**, respectively.

In the preferred embodiment of the instant invention, the switch elements **25** and **30** are connected to the line by means of a conventional service cord providing electrical energy to the machine. The switch elements **25** and **30** are paired. The switch elements **26** and **28** also constitute a pair and are connected to the washing machine motor for driving the motor in a direction to operate the washing mechanism of the machine. Thus, in order to energize the motor for washing operations, the contacts of switch elements **25, 26, 28, 30** are closed, the circuit being completed through the fixed contact plates **36**.

The switch elements **27** and **29** are paired and are connected to the driving motor for operating the same in a reverse direction for operation of the wringing means provided in the machine. Thus, upon closing the contacts of the switch elements **25, 27, 29, 30**, the motor will be energized for rotation thereof in a reverse direction for operation of the wringing mechanism. The fixed contact plates **36** complete the circuit between the respective switch elements.

Referring to Fig. 7, the cam operators for the switch elements are diagrammatically illustrated for explaining the operation thereof. The switch operator **12** is adapted to be moved through an arc of substantially 45° in either direction from its central neutral position, illustrated in Fig. 1. Upon rotation of the switch operator **12** in a forward direction, the shaft **15** will be rotated through an angle of 45°. Each of the cams **55** to **60** secured to the shaft **15** will be rotated therewith in a clockwise direction as viewed in Fig. 7. Cams **55, 56, 58, 60** are formed with flats **55***a*, **56***a*, **58***a*, **60***a*, respectively, which are disposed in contiguity to the spring contact arms **33** of the switch elements **25, 26, 28, 30**, respectively, upon clockwise direction rotation of the cams as aforementioned. The spring arms **33** on the switch elements **25, 26, 28, 30** are thereby freed to bias their contacts **35** into contact with the fixed contacts **45, 46, 48, 50**, respectively, closing the circuit for energization of the motor to rotate it in a forward direction for operation of the washing means. The shaft **15** and the cams sesured thereto are rotated in a reverse direction to open the contacts of switch elements **25, 26, 28, 30** by means to be described hereinafter.

Movement of the switch operator **12** to its wring position rotates the shaft **15** and cams **55** to **60** in a counterclockwise direction as viewed in Fig. 7. The cams **55, 57, 59, 60** are formed with flats **55***b*, **57***b*, **59***b*, **60***b*, respectively, which are disposed in contiguity to the spring arms **33** of the switch elements **25, 27, 29, 30**, respectively, upon counterclockwise rotation of the shaft **15**. This operation permits the spring arms **33** of the switch elements **25, 27, 29, 30**, to close the respective contacts forming a circuit for energization of the motor for rotation in a reverse direction to operate the wringing means provided in the washing machine. Restoration of the cams and the shaft **15** to the central neutral position opens the contacts of the switch elements **25, 27, 29, 30** to stop operation of the machine.

The novel switch of the instant invention further comprises means for locking the switch operator **12** and the shaft **15** in either of its positions in which the motor is energized for washing or wringing operations. In accordance with the invention, the switch operator **12** can only be operated to close the contacts of the switch elements, and upon such operation it is locked, so that it cannot again be operated until it is unlocked by the means provided therefor. Thus, where the switch is used to energize a machine operated by a motor that cannot be instantaneously reversed, the switch provides a safety feature in that the motor must first be completely deenergized before the switch operator **12** can be utilized to reverse the connections of the motor for reverse rotation thereof. The unlocking means for the switch operator **12** is actuated by the "off" push button control **14** which is operative to simultaneously unlock the switch operator **12** as well as to restore the operator to its neutral position thereby opening the contacts of the switch elements.

A locking sector **65** is secured to the end of the shaft **15** which projects beyond the wall **23** of the housing **10**. The locking sector **65** includes an integral tab **66** parallel to the plane of the sector **65** and formed with a square opening **67** which is aligned with and of equal size to the square opening **68** formed in the sector **65**. The sector **65** is secured to the projecting end of the shaft **15** by inserting the shaft **15** into the openings **67, 68** with a press fit. A web **69** connects the sector **65** and the tab **66**. Operators **70, 71** are formed integrally with the

web 69 and extend laterally of the shaft 15 to opposite sides thereof for a purpose to be described hereafter.

The sector 65 is adapted to rotate with the shaft 15 through an arc of substantially 45° to either side of its neutral position as illustrated in Figs. 5 and 6. The sector 65 is formed with an arcuate surface 72 of substantially 90° in extent, terminating in locking shoulders 73, 74 at the ends thereof. An upwardly biased detent 75, extending parallel to the axis of the shaft 15, is adapted to engage either of the locking shoulders 73, 74 on the sector 65 when the latter is turned in either a clockwise or a counterclockwise direction by the shaft 15.

The detent 75 is formed integrally with the control plate 76 which is disposed behind and parallel to the locking sector 65. The control plate 76 has an arcuate profile, the opposite ends of which terminate in lands 77, 78 which underlie the "off" push button control 14. The control plate 76 is secured to the push button control 14 by means of bolts 79, or the like, threaded into the push button control 14 through the lands 77, 78.

A frame 80 of generally U-section is secured to the wall 23 of the housing 10 by means of a pair of bolts 81, or the like. The frame 80 includes a pair of laterally extending legs 82 projecting outwardly therefrom at the opposite ends of the frame 80. An arm 83 is pivotally secured to the frame 80 by means of a headed rivet 84. A torsion spring 85 is wounded on the rivet 84, with one arm 86 engaging under a leg 82, and the other arm 87 of the spring 85 engaging under the pivoted arm 83. The arm 83 is thus biased in a clockwise direction as viewed in Figs. 5 and 6. The arm 83 terminates in a laterally extending finger 88 which is received within a slot 89 in the control plate 76, whereby the control plate 76 and the push button stop control 14 is biased in an upward direction to maintain the detent 75 in engagement with the locking sector 65. The detent 75 rides on the sector surface 72 when the sector 65 is rotated, until the sector 65 reaches the limit of its movement at which time the detent 75 will engage either the locking shoulder 73 or 74, depending on the direction of rotation, thereby preventing return rotation of the shaft 15, whereby the switch operator 12 cannot be operated to open the closed switch elements.

The legs 82 on the frame 80 are each formed with a slot 90 within which there are disposed the opposite ends of a leaf spring 91 which extends between the legs 82. The leaf spring 91 is biased in an upward direction into contact with the operators 70, 71 on the locking sector 65 as seen in Fig. 5. Upon rotation of the shaft 15, the operators 70, 71 will be displaced, for example as illustrated in Fig. 6, flexing the leaf spring 91 downwardly to place it under tension. When the detent 75 is released from the locking shoulder 73, as seen in Fig. 6, the leaf spring 91 acting on the operator 70 will exert a force tending to restore the shaft 15 to its central neutral position in which the contacts of the switch elements are open.

Assuming now that it is desired to set the switch for operation of the washing means in the machine, the switch operator 12 is moved to its wash position in Fig. 1, rotating the shaft 15 in a counterclockwise direction as viewed in Figs. 5 and 6. The cams 55, 56, 58, 60 are thereby rotated in a clockwise direction as viewed in Fig. 7, bringing the cam flats 55*a*, 56*a*, 58*a*, 60*a*, respectively, into contiguity to the spring arms 33 of the switch elements 25, 26, 28, 30 permitting those spring arms to bias the contacts 35 thereof into contact with the fixed contacts 45, 46, 48, 50, respectively, thereby closing the circuit for the operation of the motor in a forward direction to operate the washing means.

Referring to Figs. 5 and 6, the locking sector 65 is rotated in a counterclockwise direction until the detent 75 snaps into engagement with the shoulder 73, thereby locking the switch operator 12 in its wash position, so that

it cannot be operated to open the closed contacts, nor to set the contacts for reverse operation of the motor, as above described. The arm 83, operating under the bias of the torsion spring 85, biases the control plate 76 and its detent 75 in an upwardly direction to maintain engagement of the detent 75 with the shoulder 73 on the locking sector 65. When it is desired to restore the switch elements to open position, stopping operation of the motor, the "off" push button control 14 is depressed in opposition to the bias of the arm 83. Initial movement of the push button control 14 removes the detent 75 from the shoulder 73. Further downward movement of the push button control 14 brings the under side of the land 77 into contact with the operator 71 applying a force thereto for rotating the shaft 15 in a clockwise direction to restore the cams to their neutral position to open the contacts of the switch elements 25, 26, 28, 30. A positive force is thereby applied to the operator 71, acting to restore the switch elements to their open position by means of the cams. The leaf spring 91 also applies a force to the operator 70 tending to rotate the shaft 15 and the cams to the neutral position thereof; thus, at least the last part of the movement of the shaft 15 will be under control of the leaf spring 91 returning the shaft 15 with a snap action into its neutral position. When the operator 71 returns to contact with the spring 91, as illustrated in Fig. 5, the shaft 15 and the switch operator 12 will be secured in the neutral position for further settings thereof by the switch operator 12. The same mode of operation obtains when the switch operator 12 is moved to its wring position, except that the elements operate in the opposite direction, and the contacts of switch elements 25, 27, 29, 30 are closed.

It is a feature of the novel switch construction that the switch operator 12 and the "off" push button control 14 are remotely located on the housing 10. Thus, the user will be discouraged from attempting to simultaneously operate the push button control 14 and the switch operator 12. Also, should the need arise the operation of the machine may be stopped by the application of pressure to the push button control with the arm or leg pressing thereagainst.

While the instant invention in an electrical switch has been described herein as embodied in a preferred construction, it is to be understood that the described embodiment of the invention is merely exemplary thereof and is not to be taken as limiting the scope of the invention, since that embodiment is subject to modifications falling within the spirit of the invention. Accordingly, it is not intended that the scope of the invention be limited, except as set forth in the claims which follow.

I claim:

1. An electrical switch comprising a pair of contacts adapted to be closed to energize a circuit, switch operating means normally maintaining said contacts open and rotatable to close the contacts, means for rotating said switch operating means to close the contacts, locking means cooperating with the switch operating means to lock the switch with the contacts closed, said locking means including a sector adapted to be moved by the switch operating means to a switch locking position, a detent engaging the sector in its switch locking position, said sector including an operator for rotating the switch operating means to open the switch contacts, spring means engaging said operator to bias the switch operating means in a direction opening the switch contacts, and means for disengaging the detent from the sector and engaging the operator to rotate the switch operating means to restore the switch contacts to open position.

2. An electrical switch comprising a pair of contacts adapted to be closed to energize a circuit, switch operating means normally maintaining said contacts open and adapted to be rotated to close the contacts, means for rotating said switch operating means to close the contacts, locking means cooperating with the switch operating

means to lock the switch operating means with the contacts closed, a sector secured to the switch operating means adapted to be moved thereby to a switch locking position, means for opening said switch contacts including a control plate having a detent engaging the sector in its locking position, means biasing the detent into engagement with the sector, said sector including an operator for the switch operating means, and means including the control plate for disengaging the detent from the sector and engaging the operator to rotate the switch operating means to open the switch contacts.

3. An electrical switch as recited in claim 2 including spring means cooperating with the operator to bias the switch operating means in a direction to open the switch contacts.

4. An electrical switch comprising a pair of contacts adapted to be closed to energize a circuit, a cam secured to a rotatable shaft for opening and closing the contacts, switch operating means adapted to rotate the shaft and the cam to close the switch contacts, locking means adapted to lock the switch operating means with the contacts closed including a sector secured to the shaft, rotation of the shaft moving the sector to a switch locking position, a control plate including a detent adapted to engage the sector in its locking position, means biasing the detent into engagement with the sector, means for opening the switch

contacts secured to the control plate, a switch operator extending laterally from the shaft adapted to be engaged by the switch opening means, said switch contacts opening means being adapted to disengage the detent from the locking sector and engaging the operator to rotate the shaft to open the switch contacts.

5. An electrical switch as recited in claim 4 in which there are provided a plurality of pairs of contacts and a cam for each pair of contacts, said switch operating means being adapted to rotate the shaft in opposite directions to close selected pairs of contacts.

6. An electrical switch as recited in claim 5 in which each pair of contacts includes a fixed contact and a spring contact, said spring contact being biased to a position closing said contacts, said cams operating to open the contacts in opposition to the bias of spring contacts.

7. An electrical switch as recited in claim 4 in which the switch operating means and the means for opening the switch contacts are remotely spaced one from the other.

References Cited in the file of this patent

UNITED STATES PATENTS

1,902,700	Hadano	Mar. 21, 1933
2,404,940	Beal	July 30, 1946