

Feb. 9, 1965

P. HUTT

3,169,174

PUSH-BUTTON SWITCH

Original Filed March 19, 1958

3 Sheets-Sheet 1

Fig. 1.

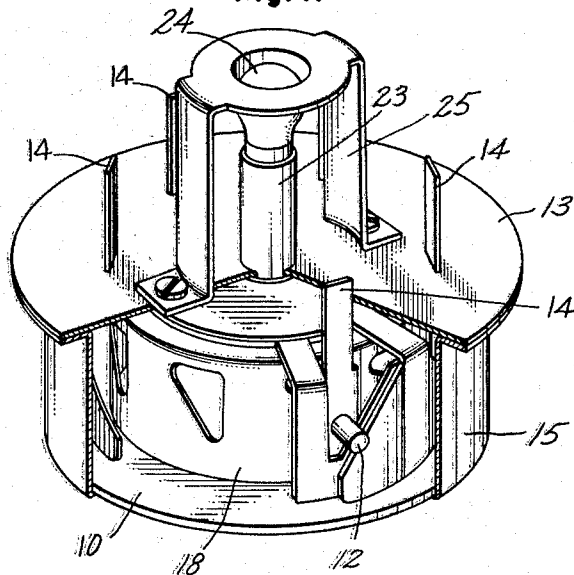


Fig. 2.

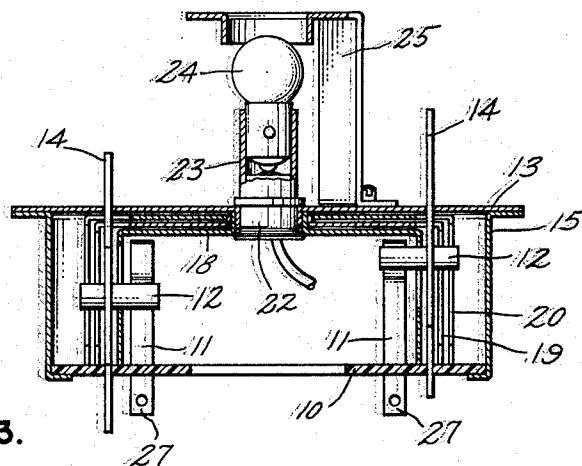
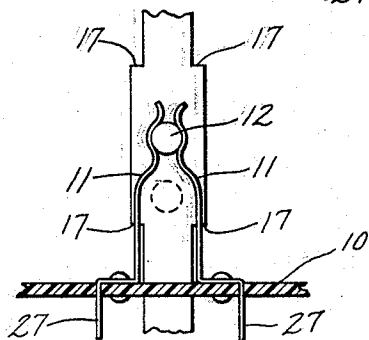


Fig. 3.



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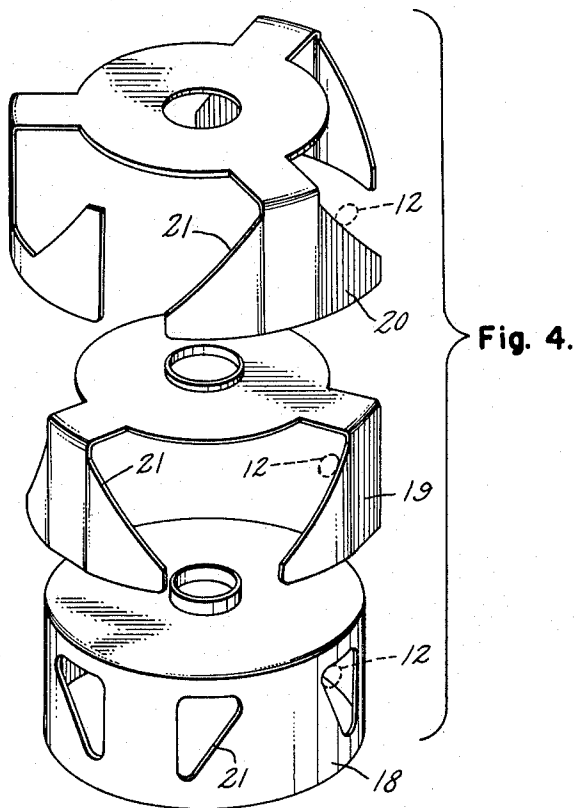
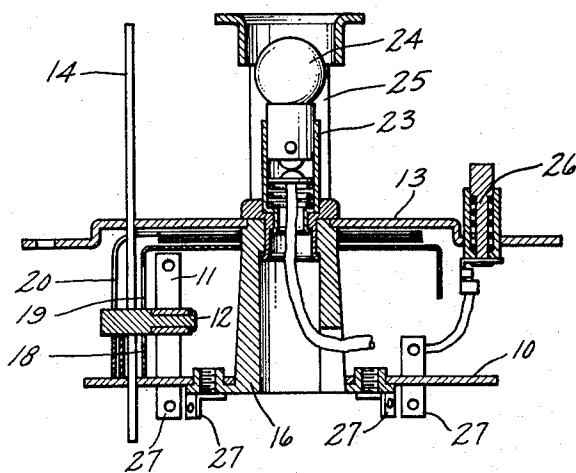


Fig. 5.



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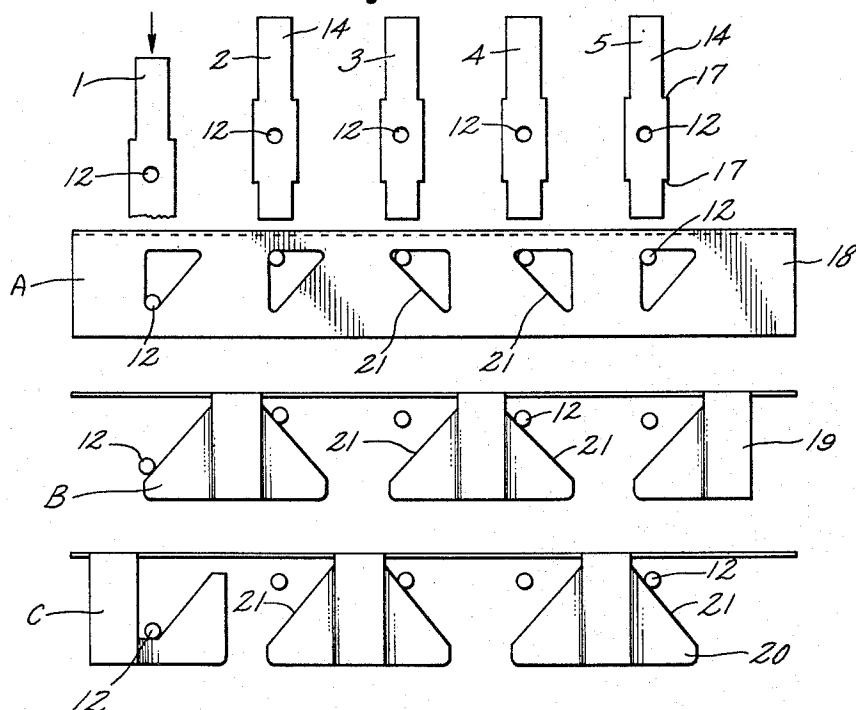
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PUSH-BUTTON SWITCH

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Fig. 6.



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3,169,174

PUSH-BUTTON SWITCH

Philip Hutt, Milford, Conn., assignor to General Electric Company, a corporation of New York
Continuation of application Ser. No. 722,411, Mar. 19, 1958. This application Dec. 31, 1962, Ser. No. 251,460
3 Claims. (Cl. 200—5)

This invention relates to a push-button switch of the type wherein a plurality of push-buttons are controlled by an interlock arrangement whereby only one of the push-buttons at a time may be placed in an operating position. Such a switch is disclosed in Andrews Patent No. 2,431,904, which is assigned to the same assignee as the present application.

This application is a continuation of my co-pending application Serial No. 722,411 filed March 19, 1958, for the Push-Button Switch, now abandoned.

Push-button switches of the Andrews type consist of a plurality of circuit opening-and-closing elements selectively actuated by pressing push-buttons. In order to prevent undesired combinations of the circuit elements from being closed at a time, the push rods through which the push-buttons act are equipped with pins which selectively engage the working surfaces of a plurality of slide members having diagonal working surfaces which control the setting of the push rods and thus the push-buttons. Whenever one of the push-buttons is depressed, the slides are so displaced that their diagonal working surfaces will restore any other push-button to its non-operating position. Normally, there is an "Off" push-button which, when depressed, does not close a circuit but restores any of the push-buttons which are depressed.

One of the objects of the present invention is to provide a push-button switch in which the push-buttons are arranged in a circular pattern.

It is another object of the present invention to provide a push-button switch which is sufficiently compact for use as an automobile transmission switch.

Other objects of the invention will become apparent from the following specification taken in conjunction with the enclosed drawings wherein FIG. 1 is a cut-away perspective of a push-button switch in accordance with the present invention.

FIG. 2 is a sectional view of the switch of FIG. 1.

FIG. 3 is a sectional view of one of the circuit opening-and-closing elements.

FIG. 4 is an exploded view of the three cylindrical slides forming the interlock mechanism.

FIG. 5 is a sectional view of an alternative circular push-button switch structure.

FIG. 6 is a schematic view showing how the interlock members of FIG. 4 operate.

Briefly stated, in accordance with one of its aspects, this invention is directed toward a push-button switch comprising a base plate and top plate, the top plate defining a plurality of radially positioned apertures, a support member for maintaining the plates in spaced relationship, a plurality of circuit opening-and-closing elements radially positioned on the base plate in the space between the two plates, a reciprocally movable push rod for actuating each of the circuit elements, the push rods extending through the radially positioned apertures of the top plate, a pin projecting from each of the push rods toward the radial center of the push rods, and a plurality of cylindrical slides freely rotatable with respect to the base plate and top plate, the slides having a plurality of working surfaces diagonal or inclined to the direction of movement of the push rods, the working surfaces in the slides forming a plurality of groups in registration, each group having a push rod pin extending therethrough and engageable with the diagonal surfaces whereby the diagonal surfaces selectively control the motion of the push rods to form an interlock

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preventing more than one of the push rods at a time from being positioned at the limit of its movement in the direction of the base plate.

As shown in FIGS. 1-5, the switch has a base plate 10, preferably composed of nonconducting material and also preferably circular in configuration. Radially disposed around the perimeter of the base plate 10 are a number of circuit opening-and-closing elements 11, as best shown in FIGS. 2 and 3. While the circuit elements 11, as shown in FIG. 3, are spring biased toward each other so that the movement of an insulating separating pin 12 to the position illustrated in dotted lines enables the circuit elements 11 to come together to make electrical contact, it is obvious that other forms of actuation may be employed for this purpose. For instance, the separating pin 12 could be made itself of metal thereby closing contact when in the position illustrated in FIG. 3 and opening contact when in the position shown in dotted lines in FIG. 3. In this latter case the circuit elements 11 would not be strongly enough biased toward each other to make contact, with the separating pin 12 in the position shown in dotted lines. Again, the pin 12 could work on the outside curvature of one of the circuit elements 11 to apply sufficient force to it so that it would make contact with its associated circuit element 11.

In spaced relationship with the base plate 10 is a top plate 13 likewise preferably of circular configuration and having a plurality of radially positioned apertures through which extend a number of push rods 14 having reciprocal motion through the top plate 13. The base plate 10 may be conveniently spaced from the top plate 13 by means of a housing wall 15, as illustrated in FIGS. 1 and 2, or a central column 16, as illustrated in FIG. 5.

As shown in FIG. 3, each of the push rods 14 is equipped with a pair of shoulders 17 which limit its reciprocal movement within the space between the base plate 10 and top plate 13. Each push rod 14 is also equipped with a separating pin 12 which extends radially with respect to the base plates and which serves not only to separate the contacts 11, as previously explained, but also to operate a plurality of cylindrical slides 18, 19, and 20 which are equipped with a plurality of working surfaces 21 diagonal to the direction of movement of the push rods 14. The slides 18, 19, and 20 are rotatable about the bearing surface 22 (FIG. 2) or the column 16 (FIG. 5).

The slides 18, 19, and 20 are freely rotatable and their interlocking action will be described with reference to the exploded view of FIG. 4 and the schematic view of FIG. 6, particularly the latter. Each slide has five diagonal or inclined working surfaces 21 and these are radially aligned in groups of three so that each group has a push rod separating pin 12 extending therethrough whereby each pin 12 can engage its particular group of diagonal working surfaces. In FIG. 6, the push rods 14 have been designated 1, 2, 3, 4, and 5 for the sake of convenience of description and the slides 18, 19, and 20 have been designated A, B, and C. With the push rod 1 in the depressed condition illustrated, it may be seen that the push rod 2 is maintained in the undepressed position illustrated by the slide B, the push rod 3 by both slides A and C, the push rod 4 by both slides A and B, and the push rod 5 by slide C.

If push rod 2 were now depressed, its pin 12 would apply rotational torque to rotate slide B slightly to the left of its position illustrated in FIG. 6. The diagonal surface of slide B would then act upon the pin of push rod 1 to restore it to its undepressed position and push rod 3 would be maintained in the position illustrated by all three of the slides while push rod 4 would be maintained by slide A and push rod 5 by slides B and C.

If push rod 3 were now depressed, all three of the slides would be rotated—slides A and C to the left of their posi-

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tions illustrated and slide B back to the position illustrated. Push rod 1 would now be maintained in its undepressed position by slides A and C, push rod 2 by all three of the slides, push rod 4 by slides B and C, and push rod 5 by slide A.

If push rod 4 were now depressed, slide A would not have its position changed but slides B and C would be rotated—slide B to the left of its position shown and slide C to the right thereof. Push rod 1 would now be maintained in its undepressed position by slides A and B, push rod 2 by slide A, push rod 3 by slides B and C, and push rod 5 by all three of the slides.

If push rod 5 were depressed, slides A and B would be restored to the position shown in FIG. 6 and slide C would be rotated to the left. Push rod 1 would now be maintained in undepressed position by slide C, push rod 2 by slides B and C, push rod 3 by slide A, and push rod 4 by all three of the slides.

Thus it may be seen that the slides 18, 19, and 20 cooperate to form an interlock which prevents more than one push rod at a time from being moved to its position of maximum travel in the direction of the base plate 10. Obviously, rotation of the slides 18, 19, and 20 is not without frictional engagement. A certain amount of friction is desirable in order that the switch will maintain a setting but care must be exercised to avoid so much friction that the switch action is stiff. In order to control friction the bearing surfaces in both of the illustrated embodiments have been given a diameter considerably less than the diameter of the slides 18, 19, and 20.

Where the push-button switch of this invention is used as an automobile transmission switch, it is desirable that it be equipped with a socket 23 for illuminating lamp 24 which may be protected by means of a metal yoke 25. As shown in FIG. 5, the switch may also be equipped with a spring biased horn switch 26.

The switch of this invention includes features which give it the compactness necessary for mounting at the hub of an automobile steering wheel. A number of soldering tabs 27 are conveniently positioned on the exterior side of the base plate 10. These tabs may be extensions of the circuit opening-and-closing elements 11, as shown in FIG. 3.

While the invention has been described with reference to particular embodiments thereof, it is obvious that there may be a number of variations which fall within the true spirit of the invention. Accordingly, the invention should be limited in scope only as may be necessitated by the scope of the appended claims.

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

1. A push-button switch comprising a base plate, a plurality of push rods located at predetermined radial distances from a common radial center, a plurality of electrical circuit opening-and-closing elements radially positioned on said base plate, a top plate spaced from said base plate and fixedly positioned with respect thereto, said top plate defining a plurality of radially positioned apertures, said push rods reciprocally movable through said radial apertures in said top plate to actuate said circuit opening-and-closing elements, a pin projecting from each push rod toward the radial center of said push rods, a central inner column at the radial center of said push rods extending from said top plate toward said base plate, and a plurality of cylindrical slides of successively larger diameters having portions extending radially to said central inner column so as to be guided for rotation by said central inner column thereby to control the friction between said slides and between the slides and said column, said slides having a plurality of working surfaces diagonal to the direction of movement of said push rods, said working surfaces in said slides forming a plurality of groups in registration with each group having a push rod pin extending

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therethrough and engageable with said diagonal surfaces whereby said diagonal surfaces selectively control the motion of said push rods to form an interlock preventing more than one of said push rods at a time from being positioned at the limit of its movement in the direction of said base plate.

2. A push-button switch comprising a base plate, a plurality of electrical circuit opening-and-closing elements radially positioned on said base plate, a top plate spaced from said base plate and fixedly positioned with respect thereto, said top plate defining a plurality of radial apertures, a plurality of radially positioned push rods reciprocally movable through said radial apertures in said top plate to actuate said circuit elements, a pin projecting from each push rod toward the radial center of said push rods, a central column at the radial center of said push rods extending from said top plate toward said base plate, and a plurality of cylindrical slides of different diameter rotatably mounted around said central column, said slides having a generally cup shaped configuration including a transverse portion and being arranged in a nested relationship, bearing surfaces on said slides formed near the center of said transverse portion, the bearing surfaces of said slides around said column having a substantially less diameter than the maximum diameter of said slides thereby to control the friction between said slides and between said slides and column, said slides having a plurality of registered sets of working surfaces diagonal to the direction of movement of said push rods and engageable by the pins projecting from said push rods to impart rotary motion selectively to said slides whereby said diagonal surfaces selectively control the motion of said push rods to form an interlock preventing more than one of said push rods at a time from being positioned at the limit of movement in the direction of said base plate.

3. A push-button switch comprising a base plate and top plate, said top plate defining a plurality of radially positioned apertures, at least one support member for maintaining said plates in spaced relationship, a plurality of electrical circuit opening-and-closing elements radially positioned on said base plate in the space between said plates, a reciprocally movable push rod for actuation of each of said circuit elements, said push rods extending through the radially positioned apertures of said top plate, a pin projecting from each of said push rods toward the radial center of said push rods, and a plurality of cup-shaped cylindrical slides of different diameter freely rotatable with respect to said base plate and top plate, a central bearing annulus disposed at the radial center of the push-rods, said slides each including a transverse disc shaped portion disposed in a plane perpendicular to the axis of said slide, bearing surfaces for said slides formed at the center of said transverse portions thereof, said bearing surfaces of said slides being guided for rotary movement by said central bearing annulus thereby to control the friction between said slides and said bearing annulus, said slides having a plurality of working surfaces diagonal to the direction of movement of said push rods, said working surfaces in said slides forming a plurality of groups in registration, each group having a push rod pin extending therethrough and engageable with said diagonal surfaces whereby said diagonal surfaces selectively control the motion of said push rods to form an interlock preventing more than one of said push rods at a time from being positioned at the limit of its movement in the direction of said base plate.

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