Dec. 14, 1948. G. F. MILLER 2,456,010

PERMUTATION IGNITION SWITCH

Filed Oct. 25, 1946 2 Sheets-Sheet 1

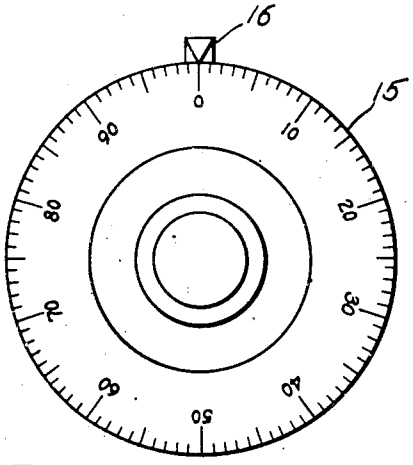


Fig. 1

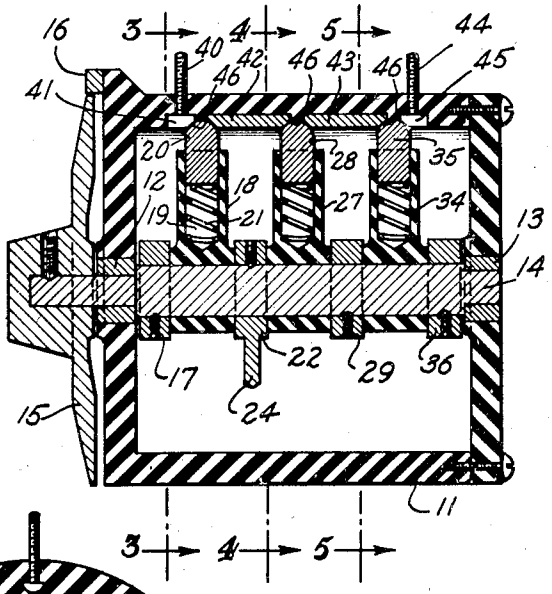


Fig. 2

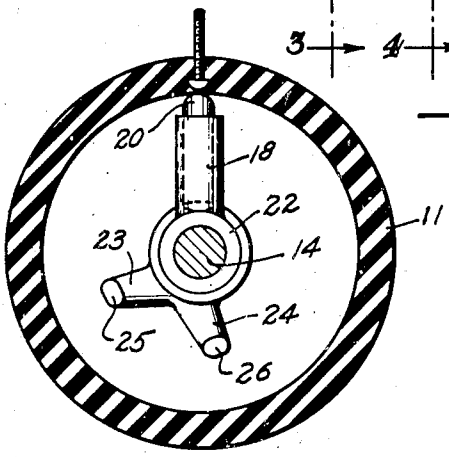


Fig. 3

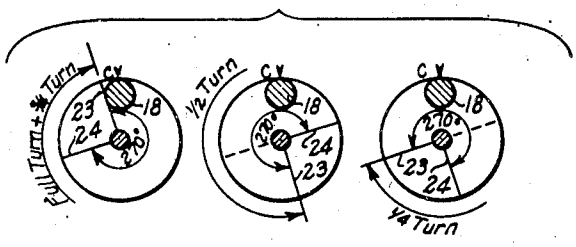


Fig. 6

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PERMUTATION IGNITION SWITCH

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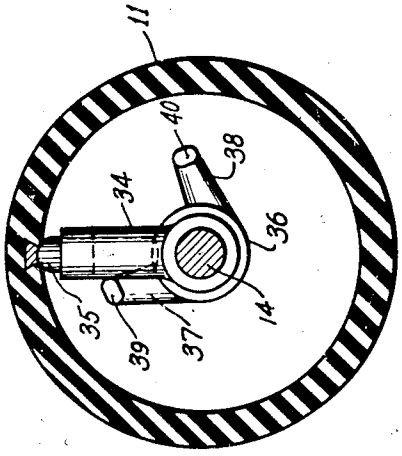


Fig. 5

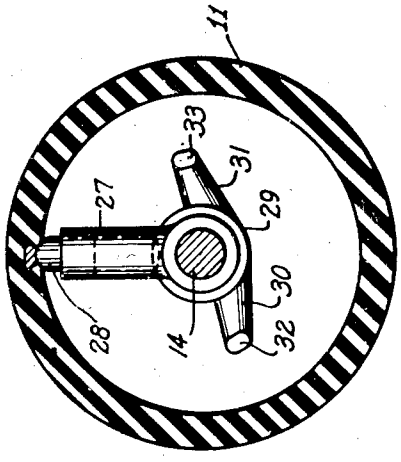


Fig. 4

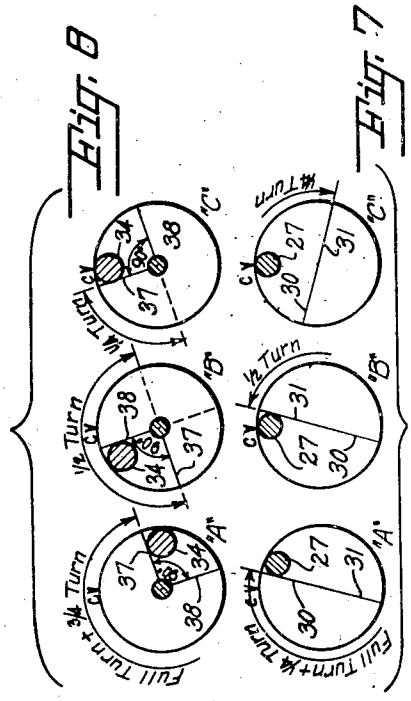


Fig. 7

Fig. 8

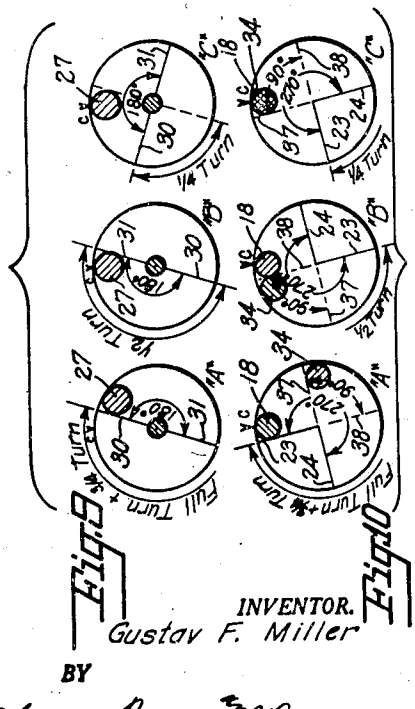


Fig. 9

Fig. 10

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2,456,010

PERMUTATION IGNITION SWITCH

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Application October 25, 1946, Serial No. 705,753

5 Claims. (Cl. 200—43)

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This invention relates to switch devices, and more particularly to a switch device adapted for use as an automobile ignition switch or the like.

A main object of the invention is to provide a novel and improved switch of the combination type, said switch requiring no key for its operation but being inoperable by any person without knowledge of the proper combination therefor.

A further object of the invention is to provide an improved rotary switch of the combination type, said switch being very simple in construction, inexpensive to manufacture, and being especially adapted for use as the ignition switch of an automobile yet requiring no key for the operation thereof.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a front elevational view of a combination switch device according to the present invention.

Figure 2 is a longitudinal cross-sectional view of the switch device of Figure 1.

Figure 3 is a transverse vertical cross-sectional view taken on line 3—3 of Figure 2.

Figure 4 is a transverse vertical cross-sectional view taken on line 4—4 of Figure 2.

Figure 5 is a transverse vertical cross-sectional view taken on line 5—5 of Figure 2.

Figure 6 is a diagrammatic sketch showing the steps in the movement of the first brush-carrying rotary arm during the closure of the switch device illustrated in Figures 1 to 5.

Figure 7 is a sketch similar to Figure 6 but illustrating the steps in the movement of the second brush-carrying rotary arm during the process of closure of the switch device of Figures 1 to 5.

Figure 8 is a sketch similar to Figure 6 but illustrating the movement of the third brush-carrying arm during the process of closing the switch device of Figures 1 to 5.

Figure 9 is a sketch showing the movements of the second brush-carrying arm in a modified form of the switch device.

Figure 10 is a sketch showing the movements of the first and third brush-carrying arms in the modified form of the switch device.

Referring to the drawings, 11 designates a cylindrical housing of insulating material. Rotatably supported in housing 11 by bushings 12 and 13 is an axially extending shaft 14. Secured to the forward end of shaft 14 outside the housing is a calibrated dial 15. Secured to housing 11 adjacent the periphery of dial 15 is a fixed pointer 16.

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Secured to shaft 14 inside housing 11 and adjacent its front end wall is a collar 17. Freely rotatable on shaft 14 rearwardly adjacent collar 17 is an arm 18 of insulating material. Arm 18 is formed with a radial recess 19 in which is slidably postioned a conductive brush member 20 biased outwardly from recess 19 by a coiled spring 21 contained in the recess, said brush member bearing on the inner wall surface of housing 11. Secured to shaft 14 rearwardly adjacent arm 18 is a collar 22 carrying a pair of radial arms 23 and 24. Arms 23 and 24 are provided with respective forwardly directed end lugs 25 and 26 adapted to drivingly engage arm 18 responsive to rotation of shaft 14. As shown in Figure 3, radial arms 23 and 24 are separated by a relatively small angle of about 90 degrees which does not include arm 18, and by a relatively large angle of about 270 degrees which does include arm 18. Freely rotatable on shaft 14 rearwardly adjacent collar 22 is a second arm 27 similar to arm 18 and containing an outwardly biased brush member 28 which bears on the inside surface of housing 11. Secured to shaft 14 rearwardly adjacent arm 27 is a collar 29 carrying radial arms 30 and 31, the radial arms having respective forwardly extending end lugs 32 and 33 adapted to drivingly engage arm 27 responsive to rotation of shaft 14. As shown in Figure 4, radial arms 30 and 31 are separated by an angle of about 180 degrees which includes arm 27. Freely rotatable on shaft 14 rearwardly adjacent collar 29 is a third arm 34 similar to arm 18 and containing an outwardly biased brush member 35 which bears on the inside surface of housing 11. Secured to shaft 14 rearwardly adjacent arm 34 is a collar 36 carrying radial arms 37 and 38, the radial arms having respective forwardly extending end lugs 39 and 40 adapted to drivingly engage arm 34 responsive to rotation of shaft 14. As shown in Figure 5, radial arms 37 and 38 are separated by a relatively small angle of about 90 degrees which includes arm 34.

It is to be noted, therefore, that arm 18 is included in a relatively large angle separating radial arms 23 and 24, arm 27 is included in a smaller angle separating radial arms 30 and 31 and arm 34 is included in a still smaller angle separating radial arms 37 and 38.

Secured in the wall of housing 11 adjacent its forward end is a terminal stud 40 having an inner head portion 41 adapted to be engaged at times by brush 20. Longitudinally aligned with head portion 41 and carried in the inside wall surface of housing 11 is a contact plate 42 whose forward end is engaged by brush 20 as said brush engages

head portion 41. The rearward end of plate 42 is adapted to be engaged by brush 20. Longitudinally aligned with plate 42 is a similar plate 43 extending rearwardly from the transverse plane of brush 20. Brush 20 is adapted to engage the forward end of plate 43 at the same time as it engages the rearward end of plate 42. Longitudinally aligned with plate 43 is a terminal stud 44 carried in the wall of housing 11 and having a head portion 45 adapted to be engaged by brush 35 at the same time as brush 35 engages the rearward end of plate 43. It is thus seen that when brush members 20, 28 and 35 are all aligned in the same radial plane which contains the stud members 40 and 44, said brush members establish a conductive path including plate members 42 and 43 between the stud members.

Dished recesses 46 are formed in the inside wall surface of housing 11 at the bridging positions of the brush members so that the brush members may be positively seated in bridging relationship to their contacts.

As shown in the drawings by way of example, the three brushes are in bridging positions when the dial 15 is set at zero. Assuming that the dial is initially set at some other value, say "50," and the bushes 20, 28 and 35 are in open circuit positions with respect to their contacts, Figure 6 shows the movements required to place brush 20 in contact-bridging position. Dial 15 is rotated a full turn plus three-quarters of a turn clockwise, whereby arm 23 pushes arm 18 into the contact-bridging position for brush 20. This is shown in the sketch "A" of Figure 6. Sketch "A" of Figure 7 shows the position of arm 27 and sketch "A" of Figure 8 shows the position of arm 34 at this time. Dial 15 is then turned one half turn counter-clockwise. This moves arm 27 into contact-bridging position for brush 28, as shown in sketch "B" of Figure 7. Arm 18 remains in contact-bridging position, as shown in sketch "B" of Figure 6. Dial 15 is then turned one-quarter turn clockwise to zero. This moves arm 34 into contact bridging position for brush 35, as shown in sketch "C" of Figure 8. Arms 18 and 27 meanwhile remain in contact-bridging positions, as shown in the respective sketches "C" of Figures 6 and 7. Brushes 20, 28 and 35 are now in contact-bridging positions and the switch is closed.

An infinite number of combinations may be had by using different angular spacings between the radial arms, the prime requisite being that the first rotary arm 18 be driven by the radial arms having the greatest angular spacing (which includes the rotary arm), the second rotary arm 27 be driven by the radial arms having the next lesser angular spacing, and that the third rotary arm 34 be driven by the radial arms having the least angular spacing. The principle may be extended to employ more than three rotary arms and radial pairs of driving arms therefor if so desired.

In a modified form of the invention, collars 22 and 36 are combined, and the radial arms 23 and 24, having the largest including angle, and the radial arms 37 and 38, having the smallest including angle, are carried on the same collar. The respective lugs carried by the radial arm pairs extend in opposed directions and the driven rotary arms are oppositely adjacent said collar. The cycle of operations to close the switch is the same as in the first embodiment of the invention, and the movements of the parts are illustrated in Figures 9 and 10. Figure 9, which illustrates the movement of rotary arm 27 is of course identical with Figure 7, since the second collar 29 is unchanged. Figure 10 illustrates the movements of driven rotary arms 18 and 34 under the same cyclical sequence of operations as occurs in Figures 6 and 8. As shown in Figures 9 and 10, the rotary arms 27, 18 and 34 are moved into circuit closing positions by the same sequence of operations as is employed in Figures 6, 7 and 8.

The final dial setting may have, of course, any other numerical value than zero, the zero value having been arbitrarily chosen in the present description. The other dial combination settings will be in accordance with the required angular rotations to establish the closed circuit positions of the driven rotary arms.

While certain specific embodiments of a combination switch useful as an automobile ignition switch and for other purposes have been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention other than as defined by the scope of the appended claims.

What is claimed is:

1. A switch device comprising a housing, a shaft journalled in said housing, a pair of brush members, each brush member being freely rotatable on said shaft, a first pair of angularly spaced driving arms engageable with one of the brush members, a second pair of angularly spaced driving arms engageable with the other brush member, the driving arms being rigidly secured to said shaft and the angular spacing of the first pair of arms being different from that of the angular spacing of the second pair of arms, and longitudinally aligned contact means carried inside said housing cooperating with the brush members.

2. A switch device comprising a housing, a shaft journalled in said housing, a first brush member freely rotatable on said shaft in said housing, a first pair of angularly spaced driving arms for said first brush member rigidly secured to said shaft, a second brush member freely rotatable on said shaft in said housing, a second pair of angularly spaced driving arms for said second brush member rigidly secured to said shaft, a third brush member freely rotatable on said shaft in said housing, a third pair of angularly spaced driving arms for said third brush member rigidly secured to said shaft, the angular spacing of said first pair being greater than that of said second pair and the angular spacing of said second pair being greater than that of said third pair, and longitudinally aligned contact elements carried inside said housing, said contact elements defining three gaps adapted to be bridged by the respective brush members when said brush members are in longitudinal alignment with the contact elements.

3. A switch device comprising a cylindrical housing, a shaft concentrically journaled in said housing, a first brush-carrying arm freely rotatable on said shaft in said housing, a brush supported by said arm in contact with the inner surface of said housing, a first collar secured to said shaft, a pair of angularly-spaced arms carried by said first collar arranged to drivingly engage said first brush-carrying arm responsive to rotation of said shaft, a second brush-carrying arm freely rotatable on said shaft in said housing, a brush supported by said second brush-carrying arm in contact with the inner surface of said

housing, a second collar secured to said shaft, a pair of angularly-spaced arms carried by said second collar arranged to drivingly engage said second brush-carrying arm responsive to rotation of said shaft, the angular separations of said two pairs of collar-carried arms being different, and contact means carried inside said housing engageable by said brushes to complete an electrical circuit through said switch.

4. A combination switch comprising a cylindrical housing, a shaft concentrically journaled in said housing, a first brush-carrying arm rotatable on said shaft, a brush supported on said arm in contact with the inner surface of said housing, a pair of radial arms secured to said shaft adjacent said first brush-carrying arm, means on said first pair of radial arms adapted to drivingly engage said first brush-carrying arm responsive to rotation of said shaft, a second brush-carrying arm freely rotatable on said shaft, a brush carried by said second arm in contact with the inner surface of said housing, a second pair of radial arms secured to said shaft adjacent said second brush-carrying arm, means on said second pair of radial arms adapted to drivingly engage said second brush-carrying arm responsive to rotation of said shaft, a third brush-carrying arm freely rotatable on said shaft, a brush carried by said third arm in contact with the inner surface of said housing, a third pair of radial arms secured to said shaft adjacent said third brush-carrying arm, means on said third pair of radial arms adapted to drivingly engage said third brush-carrying arm responsive to rotation of said shaft, said pairs of radial arms including different angles within which the corresponding brush-carrying arms are disposed, a pair of terminals carried by said housing, and contact means carried inside said housing cooperating with said brushes to provide an electrical connection between said terminals.

5. A switch device comprising a cylindrical housing, a shaft concentrically journaled in said housing, a first brush-carrying arm freely rotatable on said shaft, a brush carried by said arm contacting the inner surface of said housing, a

first pair of angularly-spaced driving arms for said first brush-carrying arm rigidly secured to said shaft, a second brush-carrying arm freely rotatable on said shaft, a brush carried by said second arm contacting the inner surface of said housing, a second pair of angularly-spaced driving arms for said second brush member rigidly secured to said shaft, a third brush member freely rotatable on said shaft, a brush carried by said third brush-carrying arm contacting the inner surface of said housing, a third pair of angularly-spaced driving arms for said third brush-carrying arm rigidly secured to said shaft, the angular space between said first pair of driving arms including said first brush-carrying arm being greater than the corresponding angular space between said second pair of driving arms and the angular space between said second pair of driving arms including said second brush-carrying arm being greater than the corresponding space between said third pair of driving arms, whereby said first, second and third brush-carrying arms are successively brought to predetermined position within said housing, axially aligned contact members carried by said housing and engageable by said brushes to complete an electrical circuit through said switch when said brushes are in a predetermined position in said housing, and a graduated dial fixed on one end of said shaft for rotating said shaft.

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