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ELECTRICAL APPARATUS

3,013,129

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3 Sheets-Sheet 1

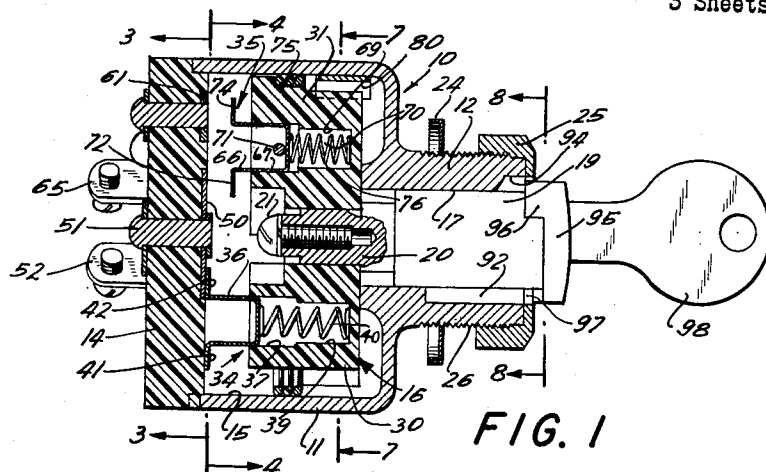


FIG. 1

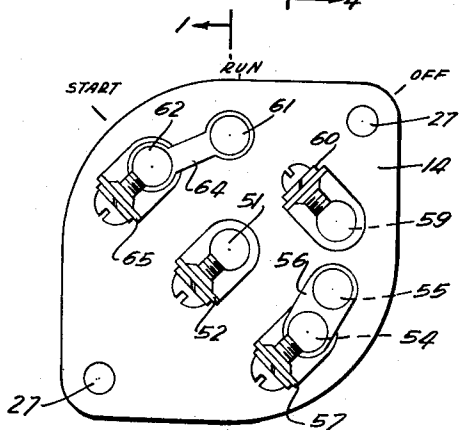


FIG. 2

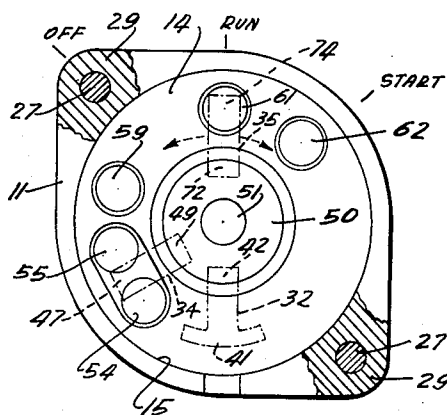


FIG. 3

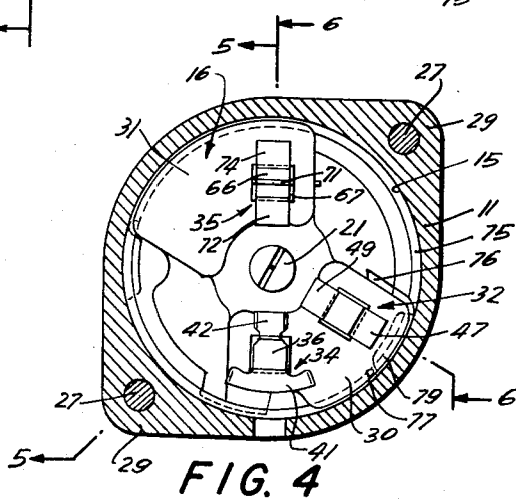


FIG. 4

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3 Sheets-Sheet 2

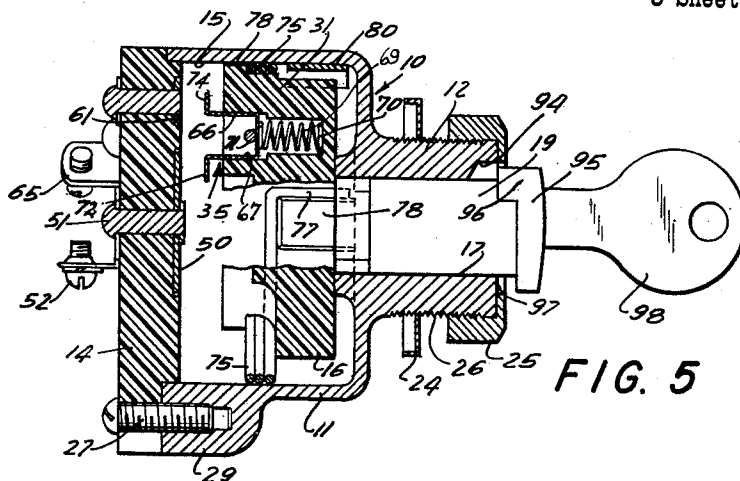


FIG. 5

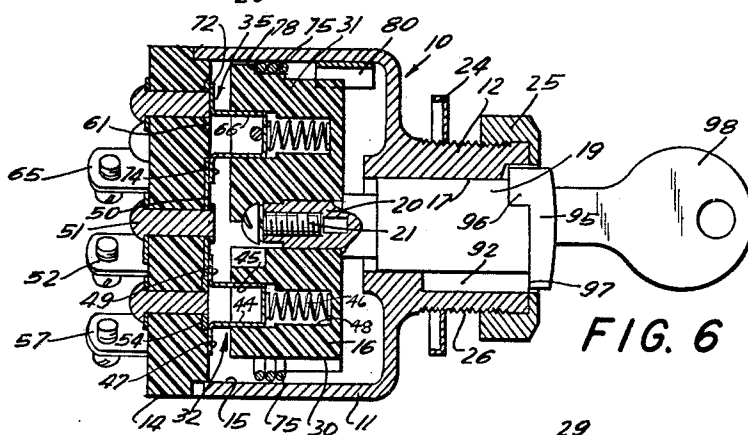


FIG. 6

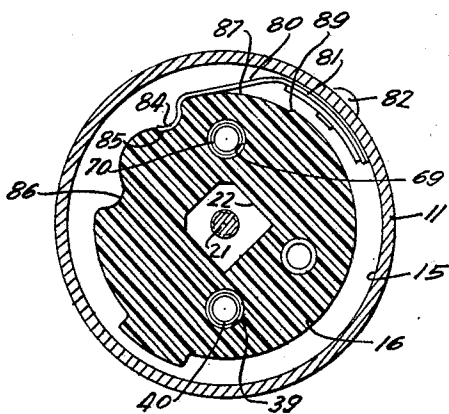


FIG. 7

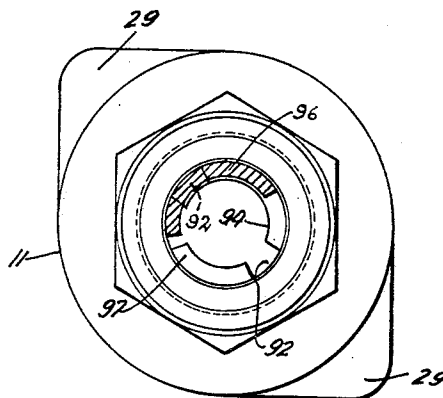


FIG. 8

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ELECTRICAL APPARATUS

3 Sheets-Sheet 3



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1

3,013,129

ELECTRICAL APPARATUS

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18 Claims. (Cl. 200-44)

This invention relates to electrical apparatus, and more particularly to a switch, such as an engine starting and ignition switch, and to an electrical circuit embodying such switch.

The invention has among its objects the provision of a novel multi-position switch.

Another object of the invention lies in the provision of a novel multi-position switch which is easily controlled, and which selectively allows energization of an auxiliary circuit when the switch is in at least one of its operative positions.

Yet another object of the invention lies in the provision of a novel multi-position switch of the character indicated wherein the switch is of the rotary type, and the auxiliary circuit is energized by axial displacement of a switch rotor from its normal position.

Still another object of the invention is the provision of a multi-position switch of such construction that it is easily operated, is simple and rugged, and is economical to make and maintain.

A further object of the invention lies in the provision of a novel circuit incorporating the switch of the invention.

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

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

FIG. 1 is a view in axial section through an ignition switch made in accordance with the invention, the switch rotor being shown in the "run" position, certain parts of the switch being shown in elevation and other parts thereof being broken away for clarity of illustration, the section being taken along line 1-1 of FIG. 2;

FIG. 2 is a view in rear elevation of the switch of FIG. 1;

FIG. 3 is a view in transverse section through the switch of FIG. 1, the movable contacts of the switch being shown in phantom lines in the "run" position of the switch, the section being taken along the line 3-3 of FIG. 1;

FIG. 4 is a view in transverse section through the switch, the rotor being shown in the "run" position of FIG. 1, the section being taken generally along the line 4-4 of FIG. 1;

FIG. 5 is a view in longitudinal section through the switch of FIG. 1, the section being taken generally along the line 5-5 of FIG. 4, the switch rotor and the contacts carried thereby being shown in their normal "run" position;

FIG. 6 is a view in longitudinal section through the switch with the rotor thereof in its "run" position but with such rotor axially displaced so as to energize an auxiliary circuit, the section being taken generally along the line 6-6 of FIG. 4;

FIG. 7 is a view in transverse section through the switch with the rotor thereof in "run" position, the section being taken generally along the line 7-7 of FIG. 1;

FIG. 8 is a view in transverse section through the mounting and locking mechanism of the switch, the central, switch-locking mechanism being omitted for simplic-

2

ity, the rotor of the switch being shown in "run" position, the section being taken along the line 8-8 of FIG. 1; and

FIG. 9 is a wiring diagram of an ignition circuit incorporating a switch made in accordance with the invention, the switch being shown somewhat diagrammatically in perspective.

The switch of the invention is illustrated herein in an application wherein it functions to control starting and choking circuits of an internal combustion engine. In such application the embodiment of switch illustrated provides positive "off" and "on" control of high or low tension magnetos or of battery ignition, and a selectively operated choke arrangement whereby the engine can be choked in a desired number of operative positions of the switch. In the embodiment shown, the switch also provides a locking mechanism, giving theft-proof security, and incorporates a spring loaded mechanism that automatically returns the switch rotor to the running or "run" position following its turning into the starting or "start" position. In the illustrative embodiment, the construction of the switch is such that it can be operated to choke the engine in both the start and the run positions, merely by axial displacement of the switch rotor from its normal axial position. As a consequence of such features, the switch permits a simple, one-handed operation thereof to start, choke, or stop the engine.

Although the switch is illustrated herein as an ignition switch permitting the selective energization of a choke circuit, it will be apparent from the following description that the switch is capable of a variety of other uses in the embodiment thereof shown, and further that it is of a construction which lends itself readily to modification of the manner of connection of the contacts thereof, such as the stator contacts, so as to permit the switch to be employed for a large number of other purposes.

Turning now to the drawings, there is shown therein a switch, generally designated 10, which is useful, for example, as the ignition switch of an outboard motor. Switch 10 has a housing, made for example of metal, having a rear hollow cup-like portion 11 and a forward mounting and locking barrel receiving portion 12 generally coaxial with portion 11. The cavity 15 in portion 11 contains a switch rotor 16, to be described, carrying a plurality of rotor contacts; barrel 12 contains a key actuated locking cylinder 19 rotatable in bore 17 of barrel 12 and made fast to the switch rotor, whereby the switch may be operated by a locking key 98. The rear end of portion 11 of the housing is closed by a transversely extending electrically insulating stator plate 14 which carries a plurality of stator contacts selectively cooperating with the rotor contacts.

As will be seen in FIGS. 1, 5, 6, and 7, the locking cylinder 19 has a generally square central tang 20 on its rear end, the tang being retained by a screw 21 in a central passage 22 of generally square cross section snugly receiving the tang 20. To permit the mounting of locking cylinder 19 in only one angular position with respect to the switch rotor, two adjacent edges of tang 20 are bevelled, and the corresponding two corners of passage 22 in the rotor have a straight fillet, as shown in FIG. 7. The switch may be mounted, for example, on a switch board or panel, not shown, by having barrel 12 extend through a hole in such board or panel, an inner or rear nut 24 and an outer or forward nut 25 mounted on threads 26 on barrel 12 being adapted to overlie and engage the respective sides of the board or panel.

As shown in FIGS. 2, 3, and 4, the stator contact plate 14 and the rear portion 11 of the switch housing are provided with mating ears, the plate being retained on the housing by studs 27 extending through holes in the ears

of the plate and into threaded blind holes in the ears 29 on portion 11 of the housing.

In the embodiment of switch shown, the switch rotor 16, which is made of electrically insulating material such as molded resin, for example, has two oppositely extending generally similar broad wings 30 and 31 lying generally radially of the rotor. Wing 30, lying at the bottom in FIGS. 1 and 4, serves to support a first (run) contact 32 and a second (start) contact 34. Wing 31, lying at the top in FIGS. 1 and 4, serves to support a third, selectively operated (choke) contact 35. Contacts 32 and 34 are similar, and, as will appear, are operative at all times when the switch rotor is in its normal, axially outer position and is turned into the respective angular "run" and "start" positions. The choke contact 35 is operative only when it is in either its "start" or "run" angular positions and the rotor is thrust into its axially inner position (FIG. 6). To permit the described axial movement of the switch rotor, the cavity 15 in housing portion 11 is made with an axial length somewhat exceeding the axial length of the switch rotor.

Since contacts 32 and 34 and their manner of mounting in the switch rotor are similar, detailed description thereof will be confined to contact 34, which is best shown in FIG. 1. Contact 34 is a generally U-shaped sheet metal member which has a rectangular body configuration, the body being axially reciprocally received in a rearwardly open blind passage 37 in wing 30 of the rotor. The body of contact 34 and the section of passage 37 are generally the same, so that the contact is non-rotatably held with respect to the rotor. The forward, blind end of passage 37 is of reduced diameter at 39, so as to form a seat for a coil compression spring 40 disposed in passage 37 and held compressed between the closed end of the passage and the transverse bight portion of contact 34. The large rear, open end of passage 37 is axially long enough to receive the contact 34 therewithin when the switch rotor is axially displaced rearwardly into the engine-choking position of FIG. 6.

The body of contact 34 has oppositely extending feet 41 and 42 lying in the same transverse plane, foot 41 being peripherally extended as shown in FIG. 4 so that it has wing portions at both sides of the body of the contact 34. Foot 42 is of the same width as the body of contact 34. The feet 41 and 42, which constitute contacts proper, lie in engagement with the inner face of contact plate 14, or with the inner faces of the respective stator contacts, at all times.

Contact 32 has a U-shaped body 44 which is slidably and non-rotatably received in a rectangular blind passage 45 in wing 30 of rotor 16. A coil compression spring 46 disposed in the smaller inner end 48 of passage 45 between the closed end thereof and the bight of contact body 44 urges such body in an axially outwardly direction. The outer free ends of body 44 are bent oppositely to form an outer foot or contact proper 47 and an inner foot or contact proper 49. Feet 47 and 49 have the same width as the body 44 of contact 32.

The stator plate 14 is provided with a central circular contact 50 coaxial of the switch rotor. Contact 50 is embedded in plate 14 so that the inner face of the contact lies flush with the inner face of plate 14. As shown in FIGS. 1, 3, and 6 the inner contacts proper 42 and 49 overlie and engage at all times the central circular stator contact 50. A headed stud or rivet 51 extends centrally through contact 50 and stator plate 14, stud 51 serving to secure a central terminal 52 on the outer face of plate 14.

The various other stator contacts of the illustrative switch are shown most clearly in FIG. 3. All such contacts have their inner faces lying flush with the inner face of plate 14. Such contacts will be described in connection with their function when the switch is employed as an engine ignition switch in the manner to be described in connection with FIG. 9. Proceeding clockwise from

the bottom of FIG. 3, the stator plate 14 is provided with a first "run" contact 54 and a second "run" contact 55, the inner operative portions of which lie in an elongated recess in the inner face of plate 14. Contacts 54 and 55 are in the form of headed studs projecting through plate 14, the inner surfaces of the heads lying flush with the inner surface of the plate. The outer ends of the studs of such contacts, lying at the rear of plate 14, are connected by a strap conductor member 56; a terminal 57 is connected to the outer end of contact 54. The outer ends of the stud portions of contacts 54 are headed to retain strap connector 56 and terminal 57. Contacts 54 and 55 are so located angularly about the axis of plate 14 that when the switch rotor is in a "run" position the contact 47 thereof, shown in phantom lines in FIG. 3, partially overlies both contacts 54 and 55. In such "run" position the starting contact 34 lies at the bottom of FIG. 3 in inoperative position.

Stator plate 14 is provided with a third contact 59 in the form of a stud having an enlarged head positioned in a recess in the inner face of the plate. Contact 59 has its stud portion extending through plate 14, the outer end of the stud being connected to a terminal 60. Contact 59, which is interposed in the starter circuit, is so spaced angularly about the axis of plate 14 that when the switch rotor is turned clockwise (FIG. 3) into its starting position contact 47 overlies contact 59. It will also be seen that when the rotor is so turned contact 41 overlies contacts 54 and 55.

Stator plate 14 is further provided with two angularly spaced choke contacts 61 and 62, the latter of such contacts being positioned substantially diametrically opposite contact 54. In the illustrative embodiment, contacts 61 and 62, which likewise are made in the form of headed studs, are connected at their outer ends by a strap conductor member 64, there being a terminal 65 connected to contact 62 whereby contacts 61 and 62 may be connected to a choke circuit. Contacts 61 and 62 are spaced angularly about the axis of plate 14 so that the choke contact 35 on the switch rotor is aligned with contact 61 when the rotor is in the "run" position, and is aligned with contact 62 when the rotor is in the "start" position.

As shown most clearly in FIG. 4 the wing 31 of switch rotor 16 supports said choke contact 35 diametrically opposite contact 34. Contact 35 has a generally U-shaped body 66 which is slidably and non-rotatably received in a blind passage 67 in wing 31. The inner end 69 of passage 67 is of slightly reduced cross section and serves to retain a coil compression spring 70, the inner and outer ends of which engage the closed end of passage 67 and the bight of body 66 of contact 35, respectively. A pin 71 extends through a portion of wing 31 centrally across the outer larger end of passage 67 to engage the bight of contact body 66, whereby to restrain movement of contact 35 axially outwardly of the position shown in FIG. 1. Pin 71 is so located that contact 35 may move a short distance axially inwardly from the position shown in FIG. 1 until its body 66 contacts the shoulder between the inner and outer portions of passage 67.

Body 66 of contact 35 has its free ends bent oppositely to form an inner foot or contact proper 72 and an outer foot and contact proper 74. Contacts 72 and 74 lie in the same transverse plane, and are spaced axially from the inner face of stator plate 14 and the contacts carried thereby when the switch rotor is in its normal axially inner position shown in FIG. 1. The switch rotor is normally held in such axially inner position by the coil compression springs 46 and 40 of contacts 32 and 34 respectively, such springs functioning by thrusting their contacts against plate 14 to thrust the switch rotor to the right (FIG. 1). As shown, the outer contact proper 74 of contact 35 is axially aligned with stator contacts 61 and 62 when the switch rotor is in the "run" and "start" positions, respectively. The inner choke contact proper 72 is axially aligned with the central stator contact 50.

5

It will be seen, therefore, that when the switch rotor is thrust to the left (FIG. 1), after it has been turned to the proper position, contact 35 will operatively connect contact 50 with either contact 61 or 62.

The switch is provided with a switch rotor positioning means whereby the rotor stably remains in both the "off" and "run" positions when it is turned thereinto, and which automatically returns the rotor from the "start" to the "run" position when the rotor is released after having been turned to "start" position. Such positioning of the switch rotor is provided by the following means. A coil torque-providing spring 75 is disposed within housing portion 11 of the switch and is loosely received in a seat on the switch rotor 16 having a spring positioning shoulder 78. Spring 75 has a radially inwardly directed tang 76 (FIG. 4) which overlies the right hand edge of wing 30 of the rotor. The other end of spring 75 has a tang 77 extending parallel to the axis of the rotor and abutting the left hand edge of a shallow boss 79 projecting inwardly into cavity 15 of the switch housing. Spring 75 opposes turning of the switch rotor from the "off" position toward the "run" and "start" positions thereof.

The switch rotor is stably held in either of its "off" or its "run" positions, by a leaf spring 80 which has its outer end 81 secured against the inner surface of housing portion 11 by a rivet 82, as shown in FIG. 7. Spring 80 inclines inwardly somewhat toward the switch rotor, the inner end of the spring being curved at 84 to provide a detent. The rim of switch rotor 16 in the transverse zone thereof aligned with spring 80 is provided with two circumferentially spaced detent-receiving curved depressions 85 and 86. Detent 84 lies in recess 85, as shown in FIG. 7, when it is in its "run" position. When the switch rotor is turned clockwise (FIG. 7) from the position shown in FIG. 7 detent 84 rides up out of recess 85 and, when the rotor has reached its "start" position, is received in depression 86. In this position of the rotor the spring 75 will have been wound sufficiently to overcome the retardation imposed on the rotor by engagement between the detent 84 and recess 86. Thus when the switch rotor is released from its "start" position, spring 75 returns it to the "run" position. The engagement between the detent 84 and recess 85, however, is sufficient stably to retain the rotor in its "run" position unless it is manually turned therefrom into either the "start" or "off" position. When the rotor is turned counterclockwise (FIG. 7) into its "off" position, detent 84 rides up out of recess 85 and onto a part-cylindrical surface 87 on the rotor until it comes into engagement with a shoulder 89 on the rotor.

The described turning of the switch rotor from the "off" into either the "run" or "start" positions, and from the "run" to the "off" position, is effected by a key 98 inserted in a conventional cylindrical lock, not specifically shown, positioned in lock barrel 19. The inner wall 17 of barrel 12 of the switch housing is provided with two diametrically opposite axially extending grooves 92 (FIGS. 6 and 8), one of which selectively receives the locking dogs of the lock when the key 98 is withdrawn and the switch rotor is in "off" position.

The outer end of the lock barrel 19, which is secured to the switch rotor, and the outer end of the housing mounting barrel 19 and the rotor 16 attached thereto are locked into their axially inner position (at the right in FIG. 1) when the switch rotor is in "off" position, but are free to be thrust into their axially outer position (at the left in FIG. 6) when the switch rotor is in either its "run" or "start" position. In the embodiment shown, such means takes the form of a semi-circular groove 94 at the outer end of mounting barrel 12 and a terminal flange 95 on the inner end of lock barrel 19. Flange 95 has an axially thickened portion 96 which extends circumferentially of the locking barrel throughout an angular extent which is less than that of groove 94 by an amount somewhat greater than the angle between the

6

"run" and "start" positions of the switch rotor. The groove 94 and the thickened portion 96 of the flange on the locking barrel are so oriented and related that when the switch rotor is in the "off" position a part of the thickened portion of the flange overlies the ungrooved part of the end of barrel 12, thereby preventing axially outward movement of the switch rotor. The groove 94 and the thickened portion 96 of the flange are further so related that portion 96 of the flange lies within the projection of, or within groove 94, when the switch rotor is in either its "run" or "start" positions. The axially extending edges of the groove 94 and of the thickened portion 96 of the flange on the locking barrel function as positive stops when the switch rotor is thrust outwardly, to confine angular motion of the rotor in such axial position between the "run" and "start" positions.

In FIG. 9 there is shown an ignition and starting circuit for a two-cylinder engine such as an outboard motor. Such motor (not shown) is provided with an electrical starting motor 100 which is selectively energized by a starting relay 101. The engine is also provided with a magneto and current distributing device which may be for example of the type disclosed in the application of Dingman, Serial No. 609,999, now Patent No. 2,930,826. The output wires from such device may be selectively short circuited, to render the magneto 102 thereof inoperative, by a relay 104. The engine is also provided with an engine choking device (not shown) operated by a relay generally shown at 105. A source of direct current such as a battery 106 is provided for the engine. The illustrative switch 110 shown somewhat diagrammatically in FIG. 9 is connected to the relays and the battery so that the relays are deenergized when the switch is in its "off" position. Relay 104 is energized to remove the short circuit across the output of magneto 102 when the switch rotor is in either its "start" or "run" position, the starting relay 101 is energized when the switch is in its "start" position, and the relay 105 is energized to choke the engine when the switch rotor is in either its "start" or "run" positions and is thrust axially outwardly.

Proceeding now to a detailed description of the circuit of FIG. 9, there is preferably provided a detachable connector 99 which readily allows the engine, bearing the portion of the circuit to the left of connector 99, to be removed from its support such as a boat. A wire 107 is connected to the negative terminal of battery 106 and to ground, which may be the frame of the engine. A wire 109 is connected to the positive terminal of battery 106, and extends to one contact of switch 114 of relay 101 where it is joined to a wire 111 leading to the central stator contact 50. A wire 112 leads from starter contact 59 on the stator to one end of the coil 113 of relay 101. The other end of such coil is grounded. It will thus be seen that when contact 32 is positioned to extend between contacts 50 and 59 (in the "start" position of the switch) starter switch 114 is closed. The motor 110, which has one terminal connected to ground and the other connected to switch 114 through wire 110 is thus energized to start the engine.

Coil 115 of ignition relay 104 has one terminal thereof connected to ground and the other terminal connected to contacts 54 and 55 by wire 116. As we have seen when the switch is in its "run" position, contacts 50 and 54, 55 are bridged by rotor contact 32, and when the switch is in the "start" position contacts 50 and 54, 55 are bridged by rotor contact 34. Accordingly, in both positions of the switch, relay 104 is energized to retract movable contact 117, thereby to remove the short circuit between wires 119 and 120 connected to the leads of the magneto whereupon the magneto delivers timed electrical impulses to discharge devices such as spark plugs diagrammatically indicated at 121 and 122.

Choke contacts 61 and 62 on the stator are connected to one terminal of the coil 125 of choke relay 105 by wire 124. The other end of such coil is connected to

ground. When the switch rotor is turned so as to be aligned with either of contacts 61 and 62, that is, when it lies in either of its "run" or "start" positions, the rotor may be thrust axially outwardly so that its contact 35 bridges stator contact 50 and the respective one of contacts 61 and 62, thereby to energize relay 105 to choke the motor.

Although only one embodiment of the switch of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art. Thus although the illustrative switch is a three-position switch permitting selective energization of an auxiliary circuit in adjacent second and third positions of the switch rotor, the switch may be constructed to permit energization of the auxiliary circuit in only one of such positions, in all of its positions, or in the two positions at each side of its central position. Further, in some applications it may be desirable to make the switch of the two-position type, and in others to construct it so that it has more than three positions. In all such latter switches, they may, in accordance with the invention, be made to selectively energize an auxiliary circuit in all or a selected number of positions of the switch.

What is claimed is:

1. A multi-position rotary switch comprising a stator having a first set of contacts disposed in an arc about the center of the stator, said first set of contacts comprising a first contact, a second contact, and a third contact, a rotor which may be selectively turned to any one of three angular positions, said rotor having a second set of contacts disposed in an arc about the center of the rotor, at least one of the second set of contacts engaging the first contact of the first set when the rotor is in its second position and at least one of the second set of contacts engaging the second contact of the first set when the rotor is in its third position, and a further contact on the rotor confronting the third contact on the stator when the rotor is in its second and third positions, means to connect the second set of contacts and the further contact to one side of a current source, the rotor and stator being selectively relatively movable axially toward and away from each other, the contacts of both sets being so constructed and arranged as to maintain the recited engagement therebetween at said second and third angular positions regardless of the axial movement of the rotor toward and away from the stator, the third contact on the stator and the further contact on the rotor being so constructed and arranged that in said second and third angular positions they are out of engagement when the rotor is moved axially to a first terminal position with respect to the stator and are in engagement when the rotor is moved axially to the second terminal position with respect to the stator.

2. A switch as defined in claim 1, comprising resilient means urging the rotor toward its first axial terminal position with respect to the stator.

3. A switch as defined in claim 1, comprising means preventing the rotor from being moved from its first axial terminal position into its second axial terminal position with respect to the stator when the rotor is in its first angular position.

4. A switch as defined in claim 1, wherein in its first axial terminal position the rotor lies further from the stator, and in its second axial terminal position the rotor lies closer to the stator.

5. A switch as defined in claim 1, comprising resilient means for urging the rotor from its third angular position

to its second angular position, and means for yieldably retaining the rotor in its second angular position.

6. A switch as defined in claim 4, comprising resilient means urging the contacts in the second set axially toward the stator, the contacts in the second set normally projecting axially from the rotor a greater distance than the further contact when the rotor is in its first axial position.

7. A switch as defined in claim 6, wherein the first set of contacts, on the stator, includes a central contact which is selectively placed in circuit with the respective arcuately disposed contacts of the first set of contacts by the second set of contacts, on the rotor, the contacts on the rotor having inner terminal portions adapted to engage, respectively, the central contact on the stator and the arcuately disposed contacts of the first set.

8. A switch as defined in claim 7, wherein each of the second set of contacts is generally of U-shape having parallel leg portions joined by an outer bight portion, the rotor having arcuately disposed passages therein parallel to the axis of the rotor and rearwardly open, said passages reciprocally receiving the bight and the rear ends of the legs of the contacts, oppositely generally radially directed flanges on the rear ends of the legs of the contacts, the radially inner flange overlying the central contact on the stator and the radially outer flange being positioned selectively to overlie the arcuately disposed contacts of the first set, and means constantly resiliently urging the first two recited contacts of the second set rearwardly so that the flanges of the second contacts firmly engage the first contacts.

9. A switch as defined in claim 8, wherein the legs of the said further contact of the second set are shorter than the legs of the first two recited second contacts comprising means on the rotor for retaining said further contact in a rearward terminal position in the rotor, and means constantly resiliently urging the said further contact into said rearward terminal position whereby when the rotor is axially thrust toward the stator into its second, inner terminal position the said further contact may yield axially forwardly with respect to the rotor.

10. A three-position rotary ignition switch comprising a stator having a first set of contacts disposed in an arc about the center of the stator, said first set of contacts comprising a starter contact, an ignition contact, and a first choke contact, a rotor which may be selectively turned to "off," and "run," and "start" angular positions, said rotor having a second set of contacts disposed in an arc about the center of the rotor, at least one of the second set of contacts engaging the starter contact in the "start" position of the rotor and at least one of the second set of contacts engaging the ignition contact in the "start" and "run" positions of the rotor, the rotor having a second choke contact confronting the first choke contact when the rotor is in "start" and "run" positions, means connecting the second set of contacts and the second choke contact to one side of a current source, the rotor being mounted for relative axial movement toward and away from the stator, the contacts of both sets being so constructed and arranged as to maintain the recited engagement therebetween at said "run" and "start" positions regardless of the axial movement of the rotor toward and away from the stator, the first and second choke contacts being so constructed and arranged that in the "start" and "run" positions they are out of engagement when the rotor is moved axially to a first terminal position with respect to the stator and are in engagement when the rotor is moved axially to the second terminal position with respect to the stator.

11. A switch as defined in claim 10, comprising resilient means urging the rotor towards its first axial terminal position with respect to the stator.

12. A switch as defined in claim 10, wherein the rotor is turned sequentially in one direction from its "off" to its "run" and "start" positions, and comprising means pre-

venting the rotor from being moved from its first axial terminal position into its second axial terminal position with respect to the stator when the rotor is in its first angular position.

13. A switch as defined in claim 10, wherein in its first axial terminal position the rotor lies further from the stator, and in its second axial terminal position the rotor lies closer to the stator.

14. A switch as defined in claim 10, comprising resilient means for urging the rotor from its "start" position into its "run" position, and means for yieldably retaining the rotor in its second angular position.

15. A switch as defined in claim 13, comprising resilient means urging the contacts in the second set axially the stator, the contacts in the second set normally projecting axially from the rotor a greater distance than the second choke contact when the rotor is in its first axial position.

16. A switch as defined in claim 15, wherein the first set of contacts, on the stator, includes a central contact which is selectively placed in circuit with the respective arcuately disposed contacts of the first set of contacts by the second set of contacts, on the rotor, the contacts on the rotor having inner terminal portions adapted to engage, respectively, the central contact on the stator and the arcuately disposed contacts of the first set.

17. A switch as defined in claim 16, wherein each of the second set of contacts is generally of U-shape having parallel leg portions joined by an outer bight portion, the rotor having arcuately disposed passages therein parallel to the axis of the rotor and rearwardly open, said pas-

sages reciprocally receiving the bight and the rear ends of the legs of the contacts, oppositely generally radially directed flanges on the rear ends of the legs of the contacts, the radially inner flange overlying the central contacts on the stator and the radially outer flange being positioned selectively to overlie the arcuately disposed contacts of the first set, and means constantly resiliently urging the first two recited contacts of the second set rearwardly so that the flanges of the second contacts firmly engage the first contacts.

18. A switch as defined in claim 17, wherein the legs of the said further contact of the second set are shorter than the legs of the first two recited second contacts comprising means on the rotor for retaining said further contact in a rearward terminal position in the rotor, and means constantly resiliently urging the said further contact into said rearward terminal position whereby when the rotor is axially thrust toward the stator into its second, inner terminal position the said further contact may yield axially forwardly with respect to the rotor.

References Cited in the file of this patent

UNITED STATES PATENTS

25	2,502,952	Jacobi	Apr. 4, 1950
	2,519,758	Heidman	Aug. 22, 1950
	2,546,744	Hasselbaum	Mar. 27, 1951
	2,666,189	Brown	Dec. 8, 1953
	2,679,601	Hart	May 25, 1954
30	2,868,906	Soreng	Jan. 13, 1959