United States Patent [19]

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[54] **IGNITION SWITCHES**

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[51] **Int. Cl.**.....**H01h 27/06**

[58] **Field of Search**...200/42, 44, 42 A; 70/237, 238, 70/239

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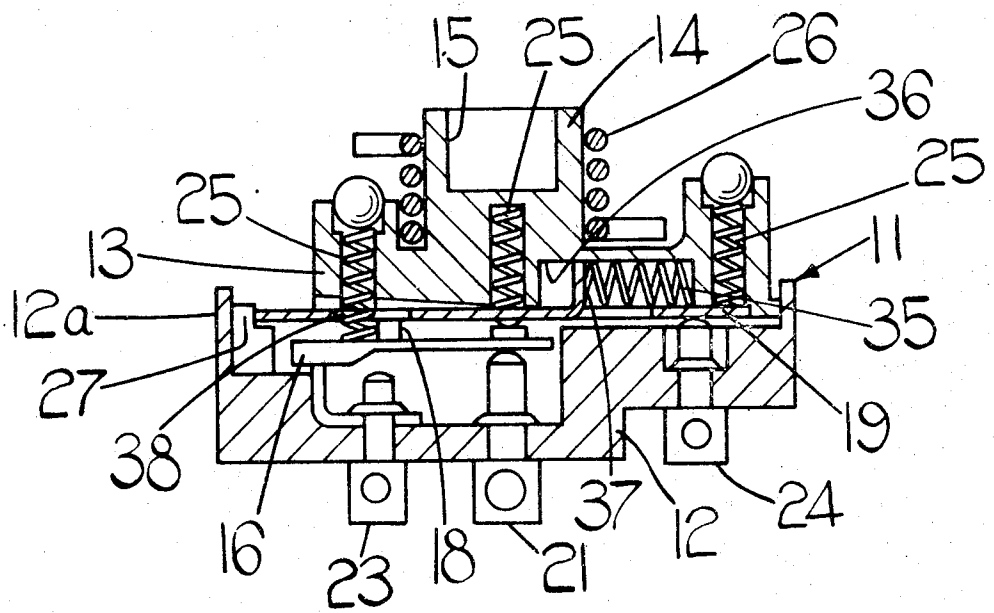
[57] **ABSTRACT**

An ignition switch comprises a casing and a rotor mounted in the casing for rotation within the casing from a stable first position to a stable second position and from the stable second position to an unstable third position, from which the rotor is resiliently urged back to said second position. First and second fixed contacts are supported in the casing and a first bridging member is rotatable with the rotor and operable to complete an electrical circuit between the first and second fixed contacts in the third position of the rotor. An arcuate cam track is provided on the inner surface of the casing and said first bridging member is resiliently urged into engagement with the cam track. The arrangement of the cam track is such that during movement of the rotor from the second position to the third position unless the preceding movement of the rotor was from the first position to the second position, the first bridging member is moved by the cam track in a direction such that in the third position the circuit between the first and second fixed contacts is not completed.

4 Claims, 5 Drawing Figures



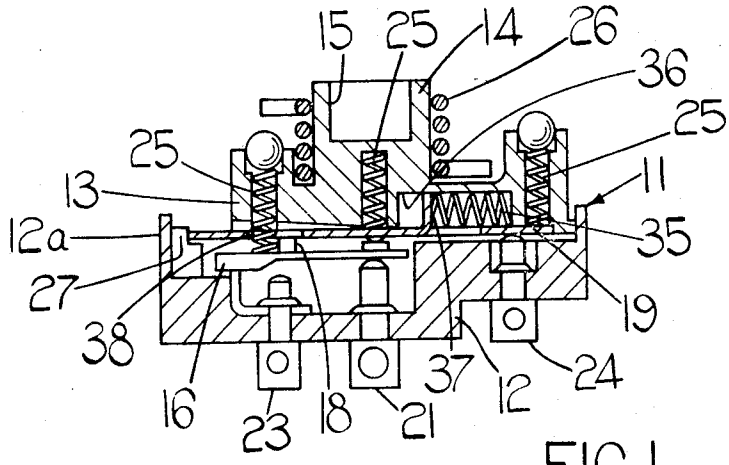


FIG. 1.

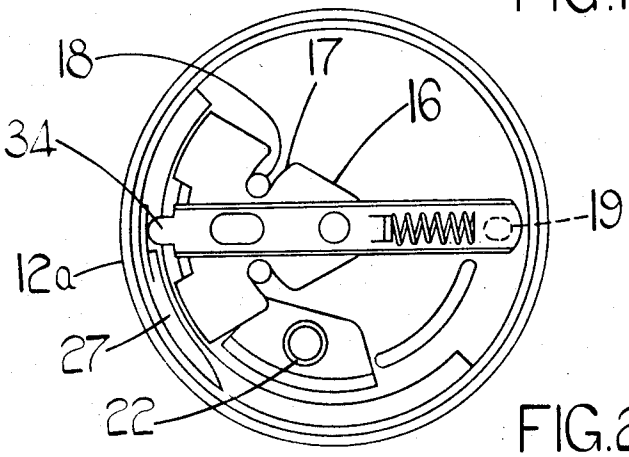


FIG. 2.

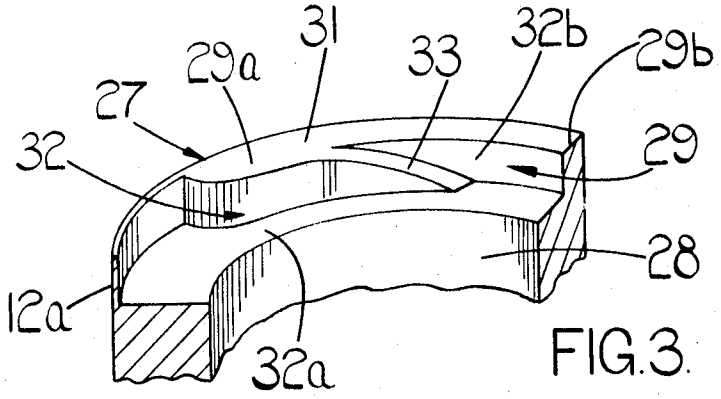


FIG. 3.

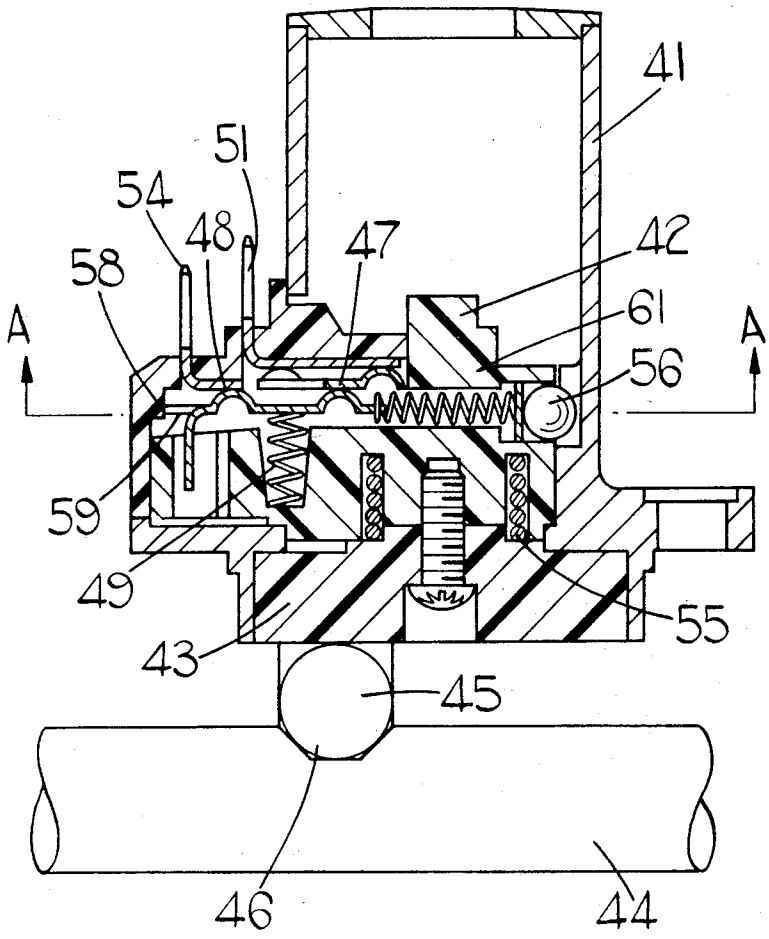


FIG.4.

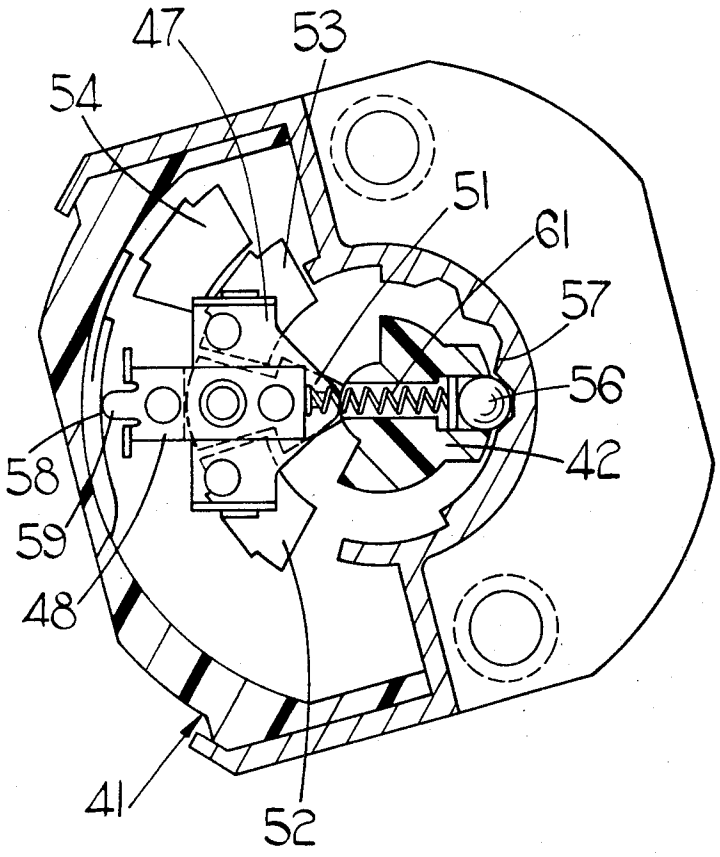


FIG. 5.

IGNITION SWITCHES

This invention relates to ignition switches for road vehicles.

An ignition switch, according to the invention, comprises a casing, a rotor mounted in the casing for rotation within the casing from a stable first position to a stable second position and from the stable second position to an unstable third position from which the rotor is resiliently urged back to said second position, first and second fixed contacts supported in the casing, a first bridging member rotatable with the rotor and operable to complete an electrical circuit between said first and second fixed contacts in said third position of the rotor, and an arcuate cam track on the inner surface of the casing, said first bridging member being resiliently urged into engagement with said cam track, and the arrangement of said cam track being such that during movement of the rotor from said second position to said third position unless the preceding movement of the rotor was from the first position to the second position said first bridging member is moved by said cam track in a direction such that in said third position said circuit between the first and second fixed contacts is not completed.

Preferably, the switch further includes a third fixed contact and a second bridging member movable with the rotor, the second bridging member serving to bridge the first and third fixed contacts in the second and third positions of the rotor, and the first fixed contact defining the feed terminal of the switch.

Desirably, in the third position of the rotor the first bridging member is engaged with the second fixed contact and is engageable with said second bridging member so that when the first bridging member engages the second bridging member the circuit between the first and second fixed contacts is completed through the first and second bridging members.

Conveniently, when the rotor is moved to the third position from the second position without previously being moved from the first position to the second position the first bridging member is displaced by the cam track out of engagement with the second bridging member so that the circuit between the first and second fixed contacts is not completed.

Alternatively, in the third position of the rotor the first bridging member is engaged with the second bridging member and is engageable with the second fixed contact so that when the first bridging member engages the second fixed contact the circuit between the first and second fixed contacts is completed through the first and second bridging members.

Conveniently, when the rotor is moved to the third position from the second position without previously being moved from the first position to the second position the first bridging member is displaced by the cam track in a direction away from the second fixed contact so that the circuit between the first and second fixed contacts is not completed in the third operative position.

In the accompanying drawings,

FIG. 1 is a sectional view of part of an ignition switch according to one example of the invention,

FIG. 2 is a plan view of the switch shown in FIG. 1 with the rotor removed for clarity,

FIG. 3 is an exploded, fragmentary perspective view of the casing of the switch shown in FIG. 1,

FIG. 4 is a sectional view of an ignition switch according to a second example of the invention, and

FIG. 5 is a sectional view along the line A—A in FIG. 4.

Referring to FIGS. 1 to 3 of the drawings, the switch includes a cylindrical casing 11 closed at one end thereof by a base 12. Housed within the casing 11 is a rotor 13, the rotor 13 being rotatable in the casing and including at its end remote from the base 12 an integral, axially extending spigot 14. The spigot 14 is provided with a non-circular bore 15 which in use receives a non-circular shaft (not shown) coupled to the rotatable core of a key operated cylinder lock, the rotor 13 being driven in use by the core of the lock and the cylinder of the lock being defined by the switch casing 11.

Mounted on the rotor 13 for rotation therewith is a contact plate 16, the contact plate 16 including a pair of slots 17 on opposite sides respectively of the plate 16 and the rotor 13 being formed integrally with a pair of lugs 18 which located in the slots 17 respectively to mount the contact plate 16 for rotation with the rotor 13. Engaged between the contact plate 16 and the rotor 13 is a contact member 19, the contact member 19 being rotatable with the rotor and defining with the contact plate 16 the movable contacts of the switch. Mounted on the base 12 so as to extend into the casing 11 are a plurality of fixed contacts 21,22 (FIG. 2), 23 and 24, the contact plate 16 and the contact member 19 being resiliently urged by springs 25 towards the base 12 so as to complete electrical circuits between the fixed contacts during rotational movement of the rotor 13.

In use, the switch is intended for use as the ignition switch of a road vehicle, the fixed contact 21 being connected to one terminal of the vehicle battery to define the feed terminal of the switch and the fixed contacts 22,23 and 24 being connected in an accessories circuit, the ignition circuit and the starter motor circuit of the vehicle respectively. As can be seen from FIG. 1, the feed contact 21 is positioned on the axis of rotation of the rotor 13 and hence is engaged by the contact plate 16 in all angular positions of the rotor. The rotor 13 is movable in one angular direction from an off position, in which no electrical circuits are made, to a stable, first operative position in which the contact plate 16 bridges the accessories circuit of the vehicle. From the first position, the rotor 13 is movable in said one angular direction to a stable, second operative position in which the contact plate 16 remains in engagement with the accessories contact 22 and also bridges the ignition contact 23 and the terminal 21 so as to complete the ignition circuit, as well as the accessories circuit of the vehicle. From said second position, the rotor 13 is movable in said one angular direction to an unstable, third operative position in which the contact member 19 engages the starter motor contact 24 whereby the starter motor circuit of the vehicle is normally completed by way of the feed terminal 21, the contact plate 16, the contact member 19 and the contact 24. The ignition circuit is also completed by the contact plate 16 in the operative third position of the switch. In the third position, the rotor 13 is resiliently urged towards the second operative position by a spring 26 which is mounted around the spigot 14 for rotational movement with the rotor 13, the spring 26 en-

gaging a fixed stop on the casing **11** during movement of the rotor **13** from the second position to the third position so as to be flexed in said third operative position.

In addition to the fixed contacts of the switch, the base **12** is provided with an upstanding cylindrical portion **12***a* which is formed on its inside surface remote from the fixed contact **24** with an arcuate cam track **27**. The cam track **27** extends intermediate the ends of a substantially flat, radially inwardly extending surface **28** and includes a raised plateau **29** defining at its summit a substantially flat, radially inwardly extending cam surface **31**. The surface **28** extends further into the casing **11** than the cam surface **31** and so defines with the plateau **29** and arcuately extending shoulder **32**. Intermediate its ends, the plateau **29** is stepped to define a wide portion **29***a* and a narrow portion **29***b* so that the shoulder **32** is formed as two arcuately extending, radially spaced parts **32***a*, **32***b* defined between the surface **28** and the portions **29***a*, **29***b* respectively. Further the height of the shoulder part **32***a* decreases towards its end adjacent the part **29***b* to define an inclined surface **33** extending between the surface **28** and the cam surface **31**. Also the plateau **29** adjacent its end remote from the portion **32***b* tapers towards the base portion **12***a* so that the distance the cam surface **31** extends into the casing **11** decreases to a zero value at said one end of the plateau **29**.

The arrangement of the switch is such that the contact member **19** is resiliently urged towards the surface **28** by the springs **25** and during angular movement of the rotor **13** a cam follower **34** formed at one end of the contact member **19** is engageable with the cam track **27**. In order to allow the cam follower **34** to move over the cam track **27**, the contact member **19** is capable of radial movement relative to the casing **11** and the base portion **12***a*, a helical compression spring **35** urging the cam follower portion **34** radially towards the cam track **27**. The helical compression spring **35** is mounted in a recess **36** in the rotor **13** and acts between one end of the recess **36** and an upstanding finger **37** on the contact member **19**. Further, although one of the springs **25** extends through an aperture **38** in the contact member **19** to urge the contact plate **16** towards the base **12**, the dimensions of the aperture **38** are such as to allow radial movement on the contact member **19** relative to the spring **25**.

In operation, as the rotor **13** is moved from the off position of the switch towards the first operative position of the switch the cam follower **34** moves parallel to but is spaced above the surface **28**. In the first operative position, as stated above, the accessories circuit of the vehicle incorporating the switch is made and during further movement of the rotor **13** from the first operative position towards the second operative position the cam follower **34**, as it moves over the surface **28**, engages the shoulder **32** at the tapered end of the plateau **29**. Thus during further movement of the rotor **13** towards the second operative position, the portion **34** moves along the shoulder part **32***a* and so is urged by the part **32***a* radially into the casing **11** against the action of the spring **35**. The cam follower **34** remains in engagement with the part **32***a* in the second operative position of the switch, in which the ignition circuit of the vehicle is completed, but when the rotor **13** is moved towards the third operative position, that is the start position, the cam follower **34** moves over the step in the plateau **29** and is urged by the spring **35** into engagement with the shoulder part **32***b*.

As previously stated, the rotor **13** is resiliently urged away from the start position by the spring **26** so that when the rotor is released from the start position the rotor is moved towards the second operative position whereby the cam follower **34**, which is urged into engagement with the shoulder part **32***b*, moves over the cam surface **28** onto the inclined surface **33**. Further movement of the rotor **13** under the resilient action of the spring **26** into the second operative position moves the cam follower **34** along the surface **33** and into engagement with the cam surface **31**. The contact member **19** is then urged by the spring **35** in a direction to move the cam follower **34** radially outwardly towards the base portion **12***a* although a fixed stop (not shown) prevents the portion **34** from actually engaging the base portion **12***a*. If the rotor is now immediately moved back into the third operative position, without initially going to the first operative position, then the cam follower portion **34** will be constrained to move over the region of the cam surface **31** defined above the narrow portion **29***a* of the plateau **29**. The height of the cam surface **31** above the cam surface **28** is arranged to be such that, when the cam follower **34** is in engagement with the cam surface **31**, the contact member **19** is pivoted about its end remote from the cam follower **34** so that the member **19** is spaced from the contact plate **16** whereby the circuit between the terminal **21** and the contact **24** is not completed. Thus, if the rotor **13** is moved from the second operative position to the third operative position without initially being moved through the first operative position the starter motor circuit, which should be completed in the third operative position, is not completed.

However, if the rotor **13**, after being resiliently urged from the third operative position to the second operative position, is moved towards the first operative position the portion **34** is moved along the cam surface **31** and over the tapered end of the plateau **29** to a position above the cam surface **28**. Thus if the rotor **13** is now moved from the first operative position through the second position to the third operative position, the cam follower **34** is constrained to move over the cam surface **28** so that in the third operative position the contact member **19** remains in engagement with the contact plate **16** so that the starter motor circuit of the vehicle is completed.

In a second example of the invention, as illustrated in FIGS. **4** and **5**, the switch includes a cylindrical, two-part casing **41** in which is housed a rotor **42** so that the rotor **42** is rotatable in the casing. The rotor **42** carries at one end a metal plate **43** for rotation with the rotor and receives at its other end a non-circular shaft coupled to the rotatable core of a key operated cylinder lock, the rotor **42** being driven in use by the core of the lock and the cylinder of the lock being defined by the switch casing **41**. The ignition switch of this second example of the invention also provides a lock for the gear box of the road vehicle using the switch, whereby movement of the gear selector shaft **44** of the road vehicle is prevented when the switch is in the locking position. The gear box lock feature of the switch is pro-

vided by a ball 45 engaged with the plate 43 and urged into a recess 46 in the shaft 44 when the switch is in the locking position by a cam surface (not shown) formed on the surface of the plate 43 remote from the rotor 42. Of course, it is to be appreciated that the switch according to the first example of the invention could have been provided with means for preventing movement to the gear selector shaft of the vehicle using the switch in a locking position of the switch.

Carried by the rotor 42 for rotation with the rotor are a contact plate 47 and a contact member 48, the contact member 48 being urged by a spring 49 into engagement with the contact plate 47. The contact plate 47 and the contact member 48 define the movable contacts of the switch and supported by the casing 41 are a plurality of angularly spaced fixed contacts 51,52,53 and 54. The spring 49 urges the contact member 48 and the contact plate 47 towards the fixed contacts so that the plate 47 and the member 48 complete electrical circuits between the fixed contacts during rotational movement of the rotor 42.

When the switch is in use on a road vehicle, the fixed contact 51 is connected to one terminal of the vehicle battery to define the feed terminal of the switch and the fixed contacts 52,53 and 54 are connected in an accessories circuit, the ignition circuit and the starter motor circuit of the vehicle respectively. The fixed contact 51 is positioned adjacent the axis of rotation of the rotor 42 and is arranged so that the contact plate 47 engages the fixed contact 51 in each of three operative positions of the rotor, but is spaced from the contact 51 in an inoperative position of the rotor. Thus, in the inoperative position no electrical circuits are made, the rotor then being movable in a clockwise direction as shown in FIG. 5 to a stable, first operative position in which the contact plate 47 bridges the accessories contact 52 and the feed terminal 51 so as to complete the accessories circuit of the vehicle. From the first operative position, the rotor 42 is movable in a clockwise direction to a stable, second operative position in which the contact plate 47 engages the feed terminal 51, the accessories contact 52 and the ignition contact 53 so as to complete both the ignition circuit and the accessories circuit of the vehicle. From the second operative position, the rotor 42 is movable in a clockwise direction to an unstable, third operative position in which the contact plate bridges the ignition contact 53 and the feed terminal 51 to complete the ignition circuit and the contact member 48 normally engages the starter motor contact 54 whereby the starter motor circuit is normally completed by way of the contact 54, the member 48, the plate 47 and the feed terminal 51. A spring 55 is flexed during movement of the rotor from the second operative position to the third operative position so that the rotor 42 is resiliently urged from the third operative position towards the second operative position. The rotor 42 also carries a spring urged ball 56 which engages and moves over a detent surface 57 during rotational movement of the rotor 42, whereby the rotor is releasably retained in the inoperative position and each of the first and second operative positions.

The casing 11 of the switch is formed on its inside surface with an arcuate cam track 58 and the contact member 48 is formed with a cam follower 59 which is resiliently urged into engagement with the cam track 58 by the spring 49 and a further spring 61, the contact member 48 being movable radially in the casing 11 against the resilient action of the spring 61. The cam track 58 is substantially the same as the cam track 47 described in the first example of the invention and shown in FIG. 3, the arrangement of the switch according to the second example being such that if the rotor 42 is moved from the second operative position to the third operative position without previously being moved from the first operative position to the second operative position the contact member 48 is moved in a direction away from the fixed contact 54, whereby in the third operative position the contact member 48 is spaced from the fixed contact 54 and the starter motor circuit of the vehicle is not completed. Of course, as in the previous example, if the rotor 42 is moved from the first operative position through the second position to the third operative position the contact member 48 engages the fixed contact 54 in the third operative position and the starter motor circuit of the vehicle is completed.

From the foregoing description, it will be appreciated that the arrangement of each of the switches described in the above examples is such that when in use on a road vehicle and the engine of the vehicle is running the starter motor circuit cannot be completed until the ignition circuit has been broken. Thus, when the switch is in use in a road vehicle, the driver of the vehicle cannot energize the starter motor of the vehicle when the engine is running, although the driver can still move the rotor 13 into the start position when the engine is running.

I claim:

1. An ignition switch comprising a casing, a rotor in the casing, means mounting the rotor for rotation within the casing from a stable first position to a stable second position and from the stable second position to an unstable third position from which the rotor is resiliently urged back to said second position, first and second fixed contacts supported in the casing, a first bridging member rotatable with the rotor and operable to complete an electrical circuit between said first and second fixed contacts in said first position of the rotor, an arcuate cam track on the inner surface of the casing, resilient means urging said first bridging member into engagement with said cam track, and a cam surface forming part of said cam track and being engageable by said first bridging member during movement of the rotor from said second position to said first position unless the preceding movement of the rotor was from the first position to the second position, said cam surface being arranged so as to move said first bridging member, when engaged by the bridging member, in a direction such that in said third position said circuit between the first and second fixed contacts is not completed.

2. A switch as claimed in claim 1 and further including a third fixed contact and a second bridging member movable with the rotor, the second bridging member serving to bridge the first and third fixed contacts in the second and third positions of the rotor, and the first fixed contact defining the feed terminal of the switch.

3. A switch as claimed in claim 1 wherein detent means releasably retains the rotor in each of said first and second stable positions.

4. A switch as claimed in claim 1 wherein the rotor is movable to a further stable position in which locking means operable by the rotor can prevent movement of the gear selector shaft of a vehicle using the switch.

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