

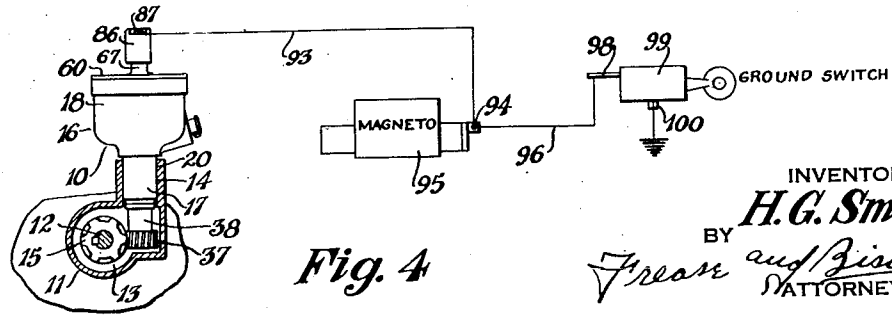
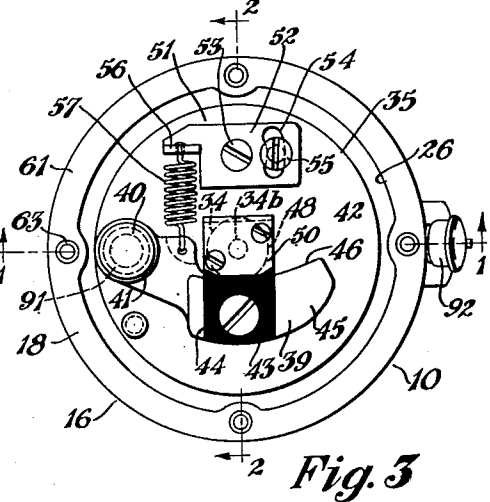
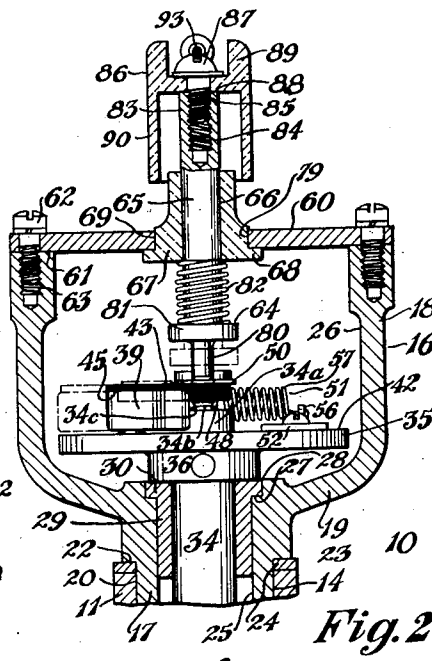
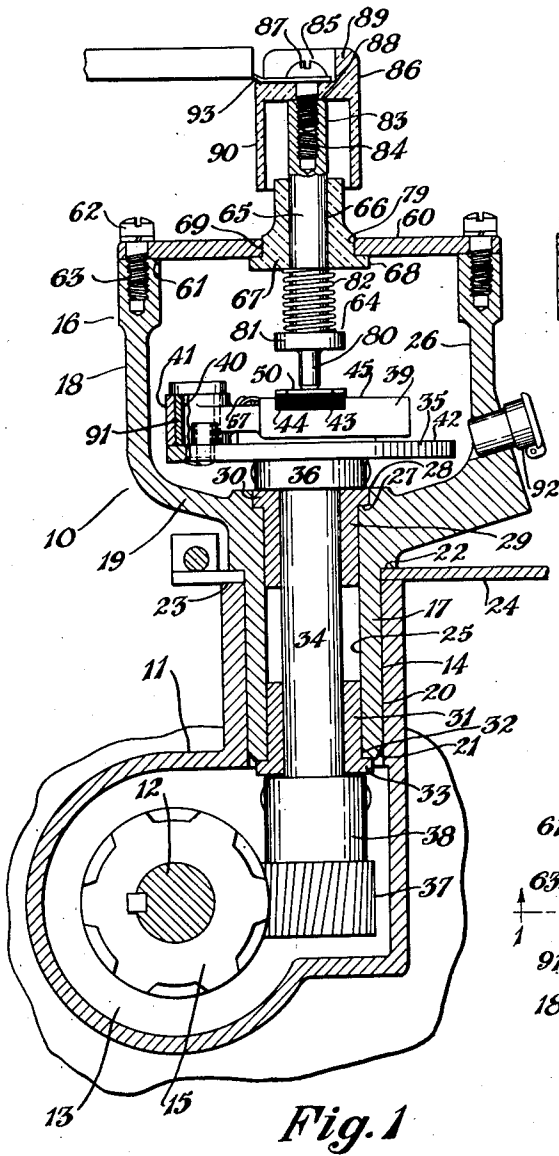
Sept. 5, 1933.

H. G. SMITH
CUT-OFF SWITCH

1,925,883

Filed March 6, 1933

3 Sheets—Sheet 1



INVENTOR
H. G. Smith
BY
Frean and Bishop
ATTORNEYS

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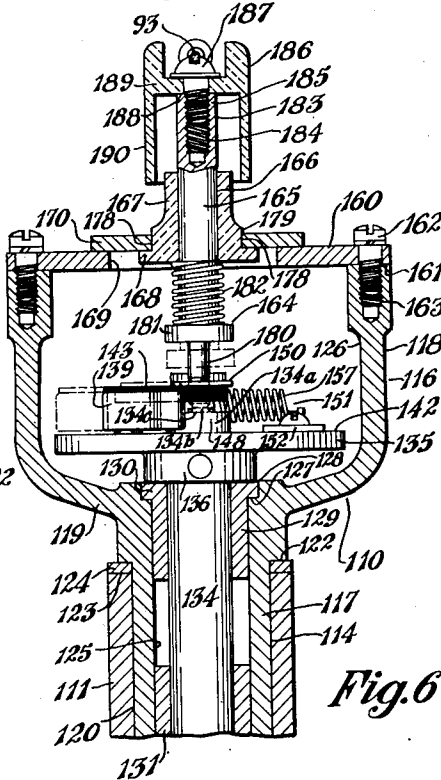
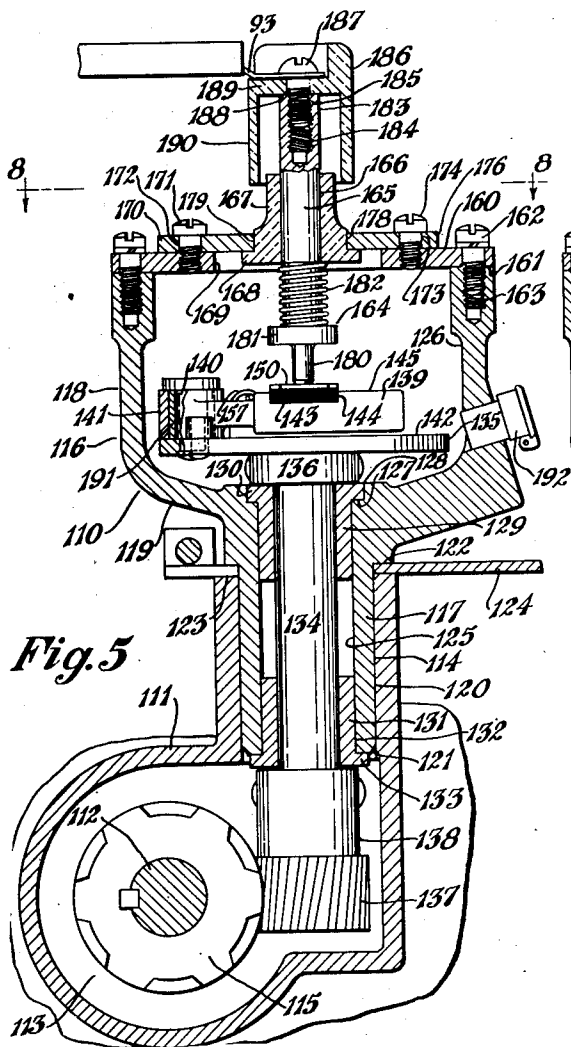
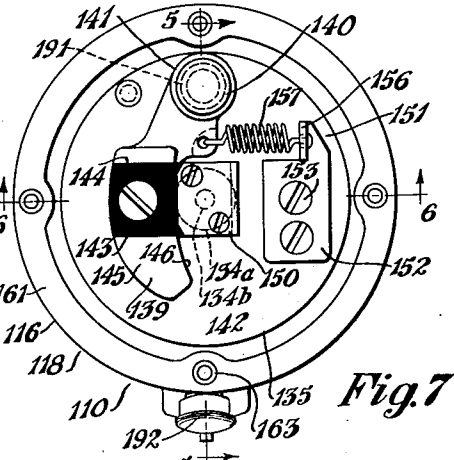
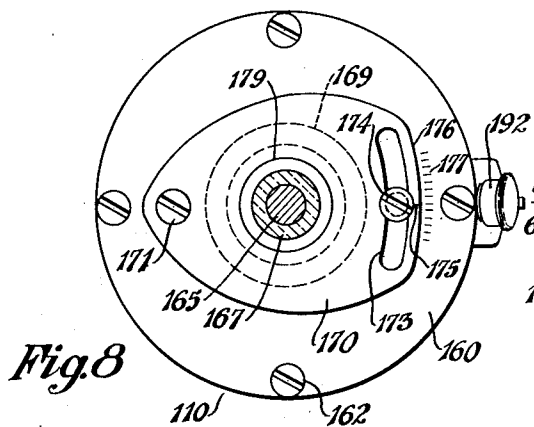
H. G. SMITH

1,925,883

CUT-OFF SWITCH

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3 Sheets-Sheet 2



INVENTOR
H.G. Smith
BY *Fress and Bishop*
ATTORNEYS

Sept. 5, 1933.

H. G. SMITH

1,925,883

CUT-OFF SWITCH

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3 Sheets-Sheet 3

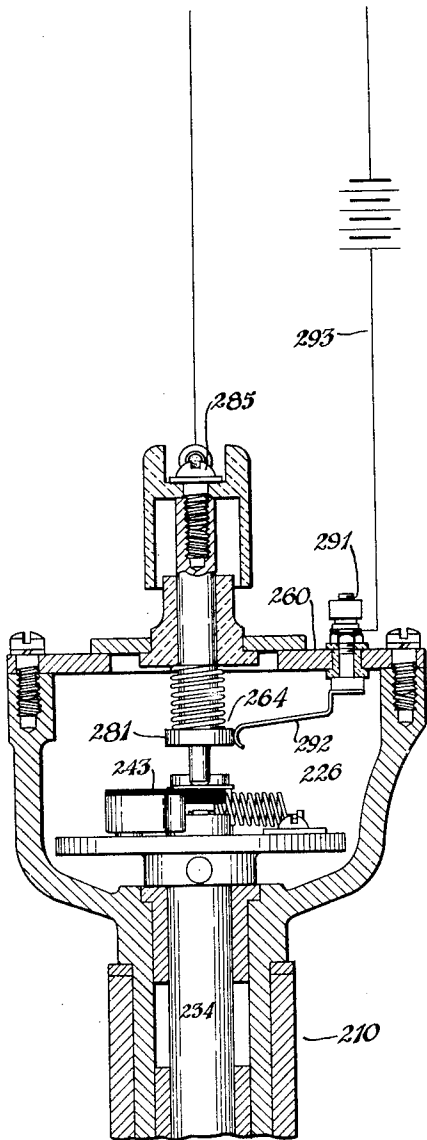


Fig. 9

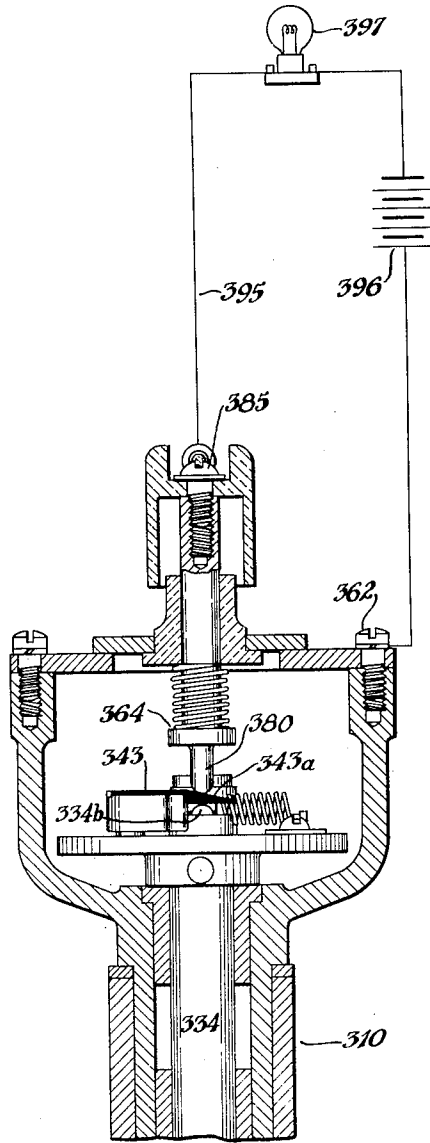


Fig. 10

INVENTOR
H. G. Smith
BY *Trease and Bishop*
ATTORNEYS

UNITED STATES PATENT OFFICE

1,925,883

CUT-OFF SWITCH

Harold G. Smith, Canton, Ohio, assignor to Hercules Motors Corporation, Canton, Ohio, a corporation of Ohio

Application March 6, 1933. Serial No. 659,674

14 Claims. (Cl. 200—80)

My invention relates generally to cut-off switches for use in connection with electric circuits controlling the operation of apparatus or machinery, and in each of which the cut-off switch is operatively connected with a rotary shaft, whereby when the speed of rotation of the shaft exceeds a predetermined limit, the cut-off switch is automatically actuated to make or break an electric circuit causing a stopping of the operation of the apparatus or machine, and whereby the apparatus or machine cannot be started again until the cut-off switch is reset.

My invention furthermore relates in particular to a cut-off switch for use in connection with an internal combustion engine having spark ignition, and in which the cut-off switch is intended primarily to be a safety switch which will stop the engine in case of over-speeding arising for example from a breakage of the governor with which a usual industrial internal combustion engine is equipped, and which breakage and over-speeding may occur in the absence of the attendant of the engine.

From a somewhat different standpoint, my invention relates to centrifugal control apparatus connected with a machine having a rotary shaft, the centrifugal control apparatus including a rotary shaft driven by the rotary shaft of the machine, and centrifugally operated means on the shaft of the control apparatus, said centrifugally operated means acting to stop the machine when the speed of the machine shaft and thus of the control operating shaft exceeds a predetermined limit.

The objects of the present improvements include the provision of centrifugal control apparatus preferably in the form of a centrifugal electric switch, and which is of simplified construction and arrangement including a relatively few number of parts, and in which the parts are arranged with each other so that there is no wear causing a changing of the setting of the switch after prolonged use, and in which the parts are arranged to operate noiselessly, and in which the switch parts are easily adjustable so that the setting of the switch may be varied over a relatively wide speed range, which may be between 300 and 5000 R. P. M., it being understood that the setting of the switch is that speed of rotation of its shaft in excess of which the centrifugally operated means of the switch actuate to stop the machine controlled by the improved switch.

The nature of the improved centrifugal control apparatus, preferably a centrifugal electric switch, of the present invention may be described in general terms as comprising a preferably unitary apparatus including a shaft or rotary member operatively mounted for rotation and adapted for being driven by a shaft of the machine or

engine or the like which is to be controlled by the improved apparatus.

The shaft or rotary member of the unitary control apparatus preferably has a transverse end contact face, and the apparatus furthermore includes an arm, means on the shaft and adjacent the transverse end face thereof and operatively mounting the arm for swinging about an axis laterally offset from the axis of the shaft, a latch member insulated from the shaft, the latch member being secured on the arm and extending from one side thereof, yielding means normally maintaining the arm with its latch member extending transversely across the transverse end contact face of the shaft, a plunger member insulated from the shaft and slidably mounted adjacent the transverse end contact face of the shaft, the plunger member having a transverse end contact face opposite the transverse end contact face of the shaft, and the plunger member being arranged so that its transverse end contact face may rest on the latch member when the latch member extends across the transverse end contact face of the shaft, the shaft and plunger each being a conductor and each being adapted for being connected in an electric control circuit, and preferably yielding means tending to displace the plunger member towards the shaft, and means for varying the setting of the switch which may be adjustable spring means, but which are preferably means for adjusting the position of the plunger member laterally with respect to the axis of the shaft.

In the foregoing embodiments of the improvements, when the speed of the shaft exceeds a predetermined limit, the arm swings outwardly under the action of centrifugal force, so that the latch member is displaced from beneath the contact face of the plunger member, and strikes the contact face of the shaft, thereby making an electric circuit.

In another embodiment of the improvements, the plunger contact member is normally located in contact with an insulated conductor, so that when the plunger member is displaced against the shaft, the circuit is broken between the plunger member and the insulated conductor.

In still another embodiment of the improvements, a cam faced latch member serves to automatically reset the plunger member to a circuit breaking position, after the speed of the shaft has been reduced from a speed which has caused displacement of the plunger to a circuit making position.

Embodiments of the present improvements are illustrated in the accompanying drawings forming part hereof, in which

Figure 1 is a fragmentary view illustrating an engine and one embodiment of the improved unitary centrifugal switch operatively mounted

in the engine and connected with an auxiliary shaft thereof, portions of the engine being broken away and illustrated in section, and the improved unitary centrifugal electric switch being illustrated in longitudinal section as on line 1—1, Fig. 3, and portions of the switch being broken away and illustrated in section;

Fig. 2, another longitudinal sectional view of the switch of Fig. 1 as on line 2—2, Fig. 3;

Fig. 3, a top plan view of the switch of Figs. 1 and 2, with the top cover plate and the parts mounted thereon removed;

Fig. 4, a diagrammatic view illustrating the electrical circuits and connections for the engine and the cut-off switch of Fig. 1;

Fig. 5, a view similar to Fig. 1, and illustrating a second embodiment of the improved cut-off switch in longitudinal section as on line 5—5, Fig. 7;

Fig. 6, a view similar to Fig. 2, illustrating the switch of Fig. 5 in another longitudinal section as on line 6—6, Fig. 7;

Fig. 7, a view similar to Fig. 3, and illustrating the switch of Figs. 5 and 6 with the top cover and parts thereon removed;

Fig. 8, a plan sectional view of the switch of Figs. 5, 6, and 7 as on line 8—8, Fig. 5;

Fig. 9, a fragmentary view similar to Figs. 2 and 6, and illustrating a third embodiment of the improved cut-off switch; and

Fig. 10, a fragmentary view similar to Figs. 2, 6, and 9, and illustrating a fourth embodiment of the improved cut-off switch.

Similar numerals refer to similar parts throughout the several views.

One embodiment of the improved cut-off switch is indicated generally by 10 in Figs. 1 to 4 inclusive, and the switch 10 is preferably as illustrated in the form of a unit which is removably mounted in a housing 11 and which is in separable operative connection with a drive shaft 12 which is operatively mounted in the housing 11.

The drive shaft 12 as illustrated is an auxiliary drive shaft of an internal combustion engine including the housing 11 and not otherwise shown, the switch 10 being particularly adapted as aforesaid for use as a safety cut-off switch for an internal combustion engine.

The housing 11 includes walls forming a compartment 13 through which the shaft 12 extends in one direction, which is normally horizontal, and the housing 11 furthermore includes walls forming a preferably cylindrical bore 14, the normally lower end of which communicates with the compartment 13, and the longitudinal axis of which extends at right angles to and is offset from the longitudinal axis of the shaft 12, and the longitudinal axis of the bore 14 thus being normally vertical.

A spiral gear 15 is secured upon the shaft 12 within the compartment 13.

The cut-off switch unit 10 includes walls forming a shouldered tubular casing indicated generally by 16, and including at one end a tubular shank 17 and at the other end an enlarged tubular head 18 and a shoulder wall 19 connecting adjacent ends of the tubular shank and the tubular head.

The shank 17 is preferably formed externally with a cylindrical surface 20 which is adapted to fit and telescope within the bore 14 of the housing 11, and the surface 20 extends longitudinally from the normally lower extremity 21 of the shank 17 to an annular seating shoulder 22 formed on the shank 17 intermediate its ends and extending radially outward from the cylindrical surface 21.

A faced seat 23 is formed on the housing 11 about the upper extremity of the bore 14, and the unit 10 is removably supported in the housing 11 with the cylindrical outer surface 20 of the shank 17 fitting and telescoped within the bore 14, and with the seating shoulder 22 supported by the faced seat 23, and as illustrated a clamping bracket arm 24 is preferably interposed between the seating shoulder 22 and the faced seat 23, so that the seating shoulder 22 rests upon the arm 24 which in turn rests upon the seat 23.

The tubular shank 17 and the tubular head 18 are preferably formed internally respectively with tubular bores 25 and 26 extending respectively throughout the lengths of the shank and the head, and the bores 25 and 26 communicate with each other at their inner adjacent ends.

The bore 25 is preferably provided with an enlarged counterbored bearing flange seat 27 at the normally upper junction end 28 of the bore 25 communicatingly connecting with the bore 26.

A flanged bearing bushing 29 is fitted in the junction end 28 of the bore 25, with the flange 30 of the bearing bushing 29 seating in the flange seat 27.

Another flanged bearing bushing 31 is preferably fitted in the other normally lower end 32 of the bore 25, and the flange 33 of the bushing 31 seats against the normally lower extremity 21 of the shank 17.

The unit 10 furthermore includes a shaft or rotary member 34 extending through and journaled in the bores of the bushings 29 and 31, and the normally upper end of the shaft 34 extends beyond the bushing 29 and into the bore or chamber 26 of the head 18, and a disk 35 is secured on the shaft 34 within the chamber 26, the disk 35 preferably being provided with a central aperture through which the shaft 34 extends, and the upper end 34a of the shaft is located above the disk 35, and the disk 35 also has preferably formed thereon at its normally lower side a hub 36, the normally lower annular end face of which rotatably thrusts against the normally upper annular end face of the flange 30 of the bushing 29.

The normally lower end of the shaft 34 extends beyond the bushing 31 and into the chamber 13, and a spiral pinion 37 is secured on the lower end of the shaft 34 within the chamber 13, the pinion 37 meshing with the gear 15 on the shaft 12, and the pinion 37 preferably including at its normally upper side a hub 38, the normally upper annular end of which rotatably thrusts against the normally lower annular end face of the flange 33 of the bushing 31.

A centrifugally actuatable switch arm 39 is pivotally mounted on the disk 35, as by means of a headed stub shaft 40, the shank of which extends through a suitable bearing aperture formed in one enlarged boss end 41 of the arm 39, and the longitudinal axis of the stub shaft 40 is preferably parallel with the longitudinal axis of the shaft 34, and the stub shaft 40 is located at one side of the shaft 34 and preferably adjacent the periphery of the disk 35, and the arm 39 is offset from and extends across the normally upper face 42 of the disk 35, and the arm 39 is furthermore preferably curved in a scimitar-like manner and extends about one side of the upper end 34a of the shaft 34 located above the disk 35.

A latch member 43 of insulating material, is secured at one end in a preferably notched seat 44 formed in the normally upper face 45 of the switch arm 39, and the latch member 43 extends angularly from the switch arm 39 beyond the curved

side 46 thereof adjacent the shaft 34 and over the top of the upper extremity 48 of the shaft 34.

A hardened steel plate 50 is preferably secured upon the normally top face of the latch member 43.

In the unit 10, adjustable yielding means indicated generally by 51 are provided for maintaining the arm 39 against swinging outwardly towards the periphery of the disk 35 under the action of centrifugal force, until the speed of rotation of the shaft 34 exceeds a desired predetermined limit.

As illustrated the yielding means 51 include an anchor member 52 which is adjustably mounted on the disk 35 and upon the normally upper face 42 thereof, as by means of a pivot screw 53 extending through a suitable central aperture formed in the anchor member 52. At one side of the pivot screw 53 the anchor member 52 has formed therein an arcuate slot 54 through which extends the shank of a headed adjusting screw 55 which is screwed into the disk 35. At the other side of the pivot screw 53 the anchor member 54 has formed thereon a normally upwardly extending anchor tang 56, the tang 56 being preferably located between the stub shaft 40 and the pivot screw 53, and a tension spring 57 is anchored or connected at one end with the tang 56 and at the other end with the switch arm 39, preferably between the stub shaft 40 and the unit shaft 34.

Accordingly the loading of the spring 57 may be varied by releasing the adjusting screw 55 and swinging the anchor member 52 about the pivot screw 53 to apply the desired tension loading on the spring 57 and thus upon the arm 39.

The unit 10 furthermore includes a cover and mounting plate 60 which extends across the normally upper end of the tubular bore 26 and is secured to the end face 61 of the tubular head 18 as by means of cap screws 62 whose shanks extend through suitable apertures formed in the cover plate 60, and the externally threaded ends of which shanks are screwed into suitable internally threaded sockets 63 formed in the head 18.

A preferably spring pressed plunger member 64 is mounted in the cover and mounting plate 60, and the plunger member 64 is made of conducting material, such as brass, and includes an elongated normally upper shank portion 65, which is preferably cylindrical, and is longitudinally slidably mounted in the bore 66 of a bushing 67, made of insulating material, such as fiber or the like.

The bushing 67 is preferably provided at its normally lower end with a radially outwardly extending flange 68. The cover plate 60 has formed therein a central opening 69 through which the bushing 67 extends together with the plunger member 64 slidably mounted in the bushing 67, and external shank surfaces 79 of the bushing 67 fit in the opening 69 of the cover plate 60, with the bushing flange 68 preferably located in abutment against the normally lower face of the cover plate 60.

The plunger member 64 terminates at its normally lower end in a contact head 80 which is cylindrical, and the diameter of which is preferably relatively small and less than the diameter of the cylindrical shank portion 65 of the plunger member 64.

The plunger 64 furthermore includes an enlarged flange portion 81 located between the adjacent ends of the shank portion 65 and the contact head 80, and a compression spring 82 is located about the shank portion 65 and is interposed between opposite faces of the flange 81 of

the plunger member 64 and the flange 68 of the bushing 67.

The normally upper end 83 of the shank portion 65 of the plunger member 64 is provided with an internally threaded socket 84 in which is screwed the externally threaded end of the shank of a binding screw 85 and a skirted insulating and shield member 86 is preferably interposed between the head 87 of the binding screw 85 and the opposite normally upper end face 88 of the plunger member 64.

The insulating and shield member 86 includes a normally upper end portion 89 which extends across the upper end face 88 of the plunger member 64, and having an aperture formed therein through which the shank of the binding screw 85 extends, and the insulating shield member 86 furthermore preferably includes a tubular skirt portion 90 extending from the circular end portion 89 towards the bushing 67 and the length of the skirt portion 90 in the direction of the longitudinal axis of the plunger member 64 is preferably sufficient to overlap the upper end of the bushing 67 when the switch parts are in their normal set position during normal operation of the engine or other machine controlled thereby, as illustrated in the drawings, whereby the upper end 83 of the shank portion 65 extending beyond the bushing 67 is insulated from the operator or attendant of the engine or machine, and is also shielded from dirt.

As aforesaid, the upper end 34a of the shaft 34 is located above the disk 35, and a contact head 34b is preferably formed on the upper end face 34c of the shaft 34.

The foregoing described arrangement and mounting of the plunger member 64 serves to position the plunger member 64, so that its contact head 80 is directed towards the adjacent upper end face 34c of the shaft 34, and preferably the longitudinal axis of the plunger member 64 is coaxial with the longitudinal axis of the shaft 34, and the compression spring 82 tends to displace or plunge the plunger member 64 and its contact head 80 towards the contact head 34b of the shaft 34.

In normal use of the improved cut-off switch unit 10, the shaft 34 continuously rotates over prolonged periods, and accordingly, to insure effective and proper lubrication, the bushings 29 and 31 are preferably made of oil impregnated material, and for similar reasons a preferably oil impregnated bushing 91 is interposed between the bearing aperture of the boss end 41 of the arm 39 and the stub shaft 40.

Also for lubrication purposes an oil cup 92 is preferably provided in a suitable aperture formed in one side of the casing head 18, whereby lubricating oil may be introduced into the bore or chamber 26 of the head, and it may be noted that if desired, the chamber 26 may be entirely filled with lubricating oil without affecting the proper operation of the switch.

The improved switch unit 10 as aforesaid is particularly adapted for use in connection with an internal combustion engine having magneto ignition, and Fig. 4 illustrates diagrammatically the electrical circuit for such use of the improved cut-off switch 10.

The binding screw 85 is connected with one terminal of a conductor 93, the other terminal of which is connected with the grounding binding post 94 of the magneto 95. The grounding binding post 94 of the magneto 95 is also connected with one terminal of a conductor 96 the other

terminal of which is connected with a usual incoming terminal 98 of a usual ground switch 99, and the outgoing terminal 100 of the ground switch 99 being grounded in the usual manner, with uninsulated metal parts of the engine which include the shaft 34.

In the normal operation of the internal combustion engine with which the cut-off switch unit 10 is operatively associated and driven by the auxiliary shaft 12, when the engine is running, the ground switch 99 is thrown so that the circuit is broken between its incoming terminal 98 and its outgoing terminal 100, and the magneto 95 rotates in the usual manner and provides ignition for the engine.

The several parts of the improved cut-off switch unit 10 have been manually set to their relative positions illustrated in full lines in Figs. 1, 2, and 3, with the contact head 80 of the plunger member 64 resting upon the upper surface of the preferably hardened steel plate 50, which is secured as aforesaid upon the normally top face of the latch member 43 of insulating material, which as aforesaid is secured on the switch arm 39.

The spring 57 normally maintains the switch arm 39 against one side of the upper end 34a of the shaft 34, and with such relative positions of the cut-off switch parts, the shaft 34 continuously rotates as long as the auxiliary drive shaft 12 is rotated by the crank shaft of the engine.

The tension in the spring 57 has been previously adjusted in the manner described aforesaid, so that a predetermined centrifugal displacement or swinging of the arm 39 about its shaft 40 and away from the upper end 34a of the shaft 34, will displace the latch member 43 and the plate 50 from beneath the contact head 80 of the plunger member 64, and accordingly the contact head 80, by reason of the pressure of the spring 82 is immediately plunged against the contact head 34b of the shaft 34, whereby the magneto 95 is grounded, and the engine stops and cannot again be operated until the cut-off switch parts are reset to their positions illustrated in full lines in Figs. 1 to 4 inclusive.

Such displacements of the parts of the switch unit are indicated in dot-dash lines in Fig. 2, and may occur for example in the case of an engine equipped with the usual governor, when the governor breaks in the absence of the attendant, and the engine crank shaft speed exceeds a desired maximum R. P. M., and the tension in the spring 57 having been adjusted so that the centrifugal displacement or swinging of the arm 39 will occur whenever the engine crank shaft speed exceeds the desired maximum R. P. M.

A second embodiment of the improved cut-off switch is indicated generally by 110 in Figs. 6 to 9 inclusive, and the switch 110 is preferably as illustrated in the form of a unit which is removably mounted in a housing 111 and which is in separable operative connection with a drive shaft 112 which is operatively mounted in the housing 111.

The drive shaft 112 as illustrated is an auxiliary drive shaft of an internal combustion engine including the housing 111 and not otherwise shown, the switch 110 being particularly adapted as aforesaid for use as a safety cut-off switch for an internal combustion engine.

The housing 111 includes walls forming a compartment 113 through which the shaft 112 extends in one direction, which is normally horizontal, and the housing 111 furthermore includes

walls forming a preferably cylindrical bore 114, the normally lower end of which communicates with the compartment 113, and the longitudinal axis of which extends at right angles to and is offset from the longitudinal axis of the shaft 112, and the longitudinal axis of the bore 114 thus being normally vertical.

A spiral gear 115 is secured upon the shaft 112 within the compartment 113.

The cut-off switch unit 110 includes walls forming a shouldered tubular casing indicated generally by 116, and including at one end a tubular shank 117 and at the other end an enlarged tubular head 118 and a shoulder wall 119 connecting adjacent ends of the tubular shank and the tubular head.

The shank 117 is preferably formed externally with a cylindrical surface 120 which is adapted to fit and telescope within the bore 114 of the housing 111, and the surface 120 extends longitudinally from the normally lower extremity 121 of the shank 117 to an annular seating shoulder 122 formed on the shank 117 intermediate its ends and extending radially outward from the cylindrical surface 121.

A faced seat 123 is formed on the housing 111 about the upper extremity of the bore 114, and the unit 110 is removably supported in the housing 111 with the cylindrical outer surface 120 of the shank 117 fitting and telescoped within the bore 114, and with the seating shoulder 122 supported by the faced seat 123, and as illustrated a clamping bracket arm 124 is preferably interposed between the seating shoulder 122 and the faced seat 123, so that the seating shoulder 122 rests upon the arm 124 which in turn rests upon the seat 123.

The tubular shank 117 and the tubular head 118 are preferably formed internally respectively with tubular bores 125 and 126 extending respectively throughout the lengths of the shank and the head, and the bores 125 and 126 communicate with each other at their inner adjacent ends.

The bore 125 is preferably provided with an enlarged counterbored bearing flange seat 127 at the normally upper junction end 128 of the bore 125 communicatingly connecting with the bore 126.

A flanged bearing bushing 129 is fitted in the junction end 128 of the bore 125, with the flange 130 of the bearing bushing 129 seating in the flange seat 127.

Another flanged bearing bushing 131 is preferably fitted in the other normally lower end 132 of the bore 125, and the flange 133 of the bushing 131 seats against the normally lower extremity 121 of the shank 117.

The unit 110 furthermore includes a shaft or rotary member 134 extending through and journaled in the bores of the bushings 129 and 131, and the normally upper end of the shaft 134 extends beyond the bushing 129 and into the bore or chamber 126 of the head 118, and a disk 135 is secured on the shaft 134 within the chamber 126, the disk 135 preferably being provided with a central aperture through which the shaft 134 extends, and the upper end 134a of the shaft is located above the disk 135, and the disk 135 also has preferably formed thereon at its normally lower side a hub 136, the normally lower annular end face of which rotatably thrusts against the normally upper annular end face of the flange 130 of the bushing 129.

The normally lower end of the shaft 134 extends beyond the bushing 131 and into the cham-

ber 113, and a spiral pinion 137 is secured on the lower end of the shaft 134 within the chamber 113, the pinion 137 meshing with the gear 115 on the shaft 112, and the pinion 137 preferably including at its normally upper side a hub 138, the normally upper annular end of which rotatably thrusts against the normally lower annular end face of the flange 133 of the bushing 131.

A centrifugally actuatable switch arm 139 is pivotally mounted on the disk 135, as by means of a headed stub shaft 140, the shank of which extends through a suitable bearing aperture formed in one enlarged boss end 141 of the arm 139, and the longitudinal axis of the stub shaft 140 is preferably parallel with the longitudinal axis of the shaft 134, and the stub shaft 140 is located at one side of the shaft 134 and preferably adjacent the periphery of the disk 135, and the arm 139 is offset from and extends across the normally upper face 142 of the disk 135, and the arm 139 is furthermore preferably curved in a scimitar-like manner and extends about one side of the upper end 134a of the shaft 134 located above the disk 135.

A latch member 143 of insulating material, is secured at one end in a preferably notched seat 144 formed in the normally upper face 145 of the switch arm 139, and the latch member 143 extends angularly from the switch arm 139 beyond the curved side 146 thereof adjacent the shaft 134 and over the top of the upper extremity 148 of the shaft 134.

A hardened steel plate 150 is preferably secured upon the normally top face of the latch member 143.

In the unit 110, yielding means indicated generally by 151 are provided for yieldingly maintaining the arm 139 against swinging outwardly towards the periphery of the disk 135 under the action of centrifugal force below a predetermined minimum.

As illustrated the yielding means 151 include an anchor member 152 which is mounted on the disk 135 and upon the normally upper face 142 thereof, as by means of screws 153 extending through suitable apertures formed in the anchor member 152. At one side of the screws 153 the anchor member 154 has formed thereon a normally upwardly extending anchor tang 156, the tang 156 being preferably located between the stub shaft 140 and the screws 153, and a tension spring 157 is anchored or connected at one end with the tang 156 and at the other end with the switch arm 139, preferably between the stub shaft 140 and the unit shaft 134.

The unit 110 furthermore includes a cover and mounting plate 160 which extends across the normally upper end of the tubular bore 126 and is secured to the end face 161 of the tubular head 118 as by means of cap screws 162 whose shanks extend through suitable apertures formed in the cover plate 160, and the externally threaded ends of which shanks are screwed into suitable internally threaded sockets 163 formed in the head 118.

A preferably spring pressed plunger member 164 is adjustably mounted in a novel manner in the cover and mounting plate 160, whereby the switch 110 may be externally adjusted to effect its cut-off operation within a relatively wide speed range, which may be between 300 and 5000 R. P. M. of the crank shaft of the internal combustion engine with which the switch 110 is operatively associated as aforesaid.

For this purpose, the plunger member 164 is

made of conducting material, such as brass, and includes an elongated normally upper shank portion 165 which is preferably cylindrical and is longitudinally slidably mounted in the bore 166 of a bushing 167, made of insulating material, such as fiber or the like.

The bushing 167 is preferably provided at its normally lower end with a radially outwardly extending flange 168.

The cover plate 160 has formed therein an enlarged central opening 169 and an adjusting and auxiliary cover plate 170 extends across the normally upper face of the main cover plate 160 and over the opening 169 therein, and the adjusting and auxiliary cover plate 170 is pivotally mounted on the main plate 160 at one side of the opening 169 as by means of a cap screw 171 whose shank extends through a suitable journal opening 172 and the externally threaded end of the shank being screwed into a suitable internally threaded bore formed in the main cover plate 160.

On the other side of the opening 169 of the main cover plate 160, the adjusting and auxiliary cover plate 170 has formed therein an arcuate slot 173 through which extends the shank of an adjusting screw 174, the externally threaded end of which shank is screwed into a suitably internally threaded bore formed in the main cover plate 160.

On the normally upper face of the adjusting and auxiliary cover plate 170, an index mark 175 is preferably formed extending from the peripheral edge 176 of the plate 170 adjacent the arcuate slot 173, and a plurality of equally spaced index marks 177 are preferably formed in the normally upper face of the main cover plate 160 beyond and adjacent the peripheral edge 176 of the adjusting and auxiliary cover plate 170.

The adjusting and auxiliary cover plate 170 has formed therein a central opening 178 through which the bushing 167 extends together with the plunger member 164 slidably mounted in the bushing 167, and external shank surfaces 179 of the bushing 167 fit in the opening 178 of the adjusting and auxiliary cover plate 170, with the bushing flange 168 preferably located in abutment against the normally lower face of the adjusting and auxiliary cover plate 170 and within the opening 169 of the main cover plate 160.

The plunger member 164 terminates at its normally lower end in a contact head 180 which is cylindrical, and the diameter of which is preferably relatively small and less than the diameter of the cylindrical shank portion 165 of the plunger member 164.

The plunger 164 furthermore includes an enlarged flange portion 181 located between the adjacent ends of the shank portion 165 and the contact head 180, and a compression spring 182 is located about the shank portion 165 and is interposed between opposite faces of the flange 181 of the plunger member 164 and the flange 168 of the bushing 167.

The normally upper end 183 of the shank portion 165 of the plunger member 164 is provided with an internally threaded socket 184 in which is screwed the externally threaded end of the shank of a binding screw 185 and a skirted insulating and shield member 186 is preferably interposed between the head 187 of the binding screw 185 and the opposite normally upper end face 188 of the plunger member 164.

The insulating and shield member 186 includes a normally upper end portion 189 which extends across the upper end face 188 of the plunger 150

member 164, and having an aperture formed therein through which the shank of the binding screw 185 extends, and the insulating shield member 186 furthermore preferably includes a tubular skirt portion 190 extending from the circular end portion 189 towards the bushing 167 and the length of the skirt portion 190 in the direction of the longitudinal axis of the plunger member 164 is preferably sufficient to overlap the upper end of the bushing 167 when the switch parts are in their normal set position during normal operation of the engine or other machine controlled thereby, as illustrated in the drawings, whereby the upper end 183 of the shank portion 165 extending beyond the bushing 167 is insulated from the operator or attendant of the engine or machine, and is also shielded from dirt.

As aforesaid, the upper end 134a of the shaft 134 is located above the disk 135, and a contact head 134b is preferably formed on the upper end face 134c of the shaft 134.

The foregoing described arrangement and mounting of the plunger member 164 serves to position the plunger member 164, so that its contact head 180 is directed towards the adjacent upper end face 134c of the shaft 134, and preferably the longitudinal axis of the plunger member 164 is coaxial with the longitudinal axis of the shaft 134, and the compression spring 182 tends to displace or plunge the plunger member 164 and its contact head 180 towards the contact head 134b of the shaft 134.

In normal use of the improved cut-off switch unit 110, the shaft 134 continuously rotates over prolonged periods, and accordingly, to insure effective and proper lubrication, the bushings 129 and 131 are preferably made of oil impregnated material, and for similar reasons a preferably oil impregnated bushing 191 is interposed between the bearing aperture of the boss end 141 of the arm 139 and the stub shaft 140.

Also for lubrication purposes an oil cup 192 is preferably provided in a suitable aperture formed in one side of the casing head 118, whereby lubricating oil may be introduced into the bore or chamber 126 of the head, and it may be noted that if desired, the chamber 126 may be entirely filled with lubricating oil without affecting the proper operation of the switch.

The improved switch unit 110 operates generally in the manner heretofore described for the unit 10.

In the unit 10 however the cover plate 60 must be removed to permit adjustments of the tension on the spring 57, for changing the speed of rotation of the shaft 34 in excess of which the arm 39 swings outwardly a sufficient distance to displace the latch member 43 from beneath the plunger member contact head 80.

In the switch 110 however, the above set forth mounting of the plunger member 164 in the auxiliary cover plate 170 permits a lateral adjustment or swinging of the cover plate 170 about the screw 171, when the adjusting screw 174 is released, so that the contact head 180 of the plunger member 164 may be laterally swung to a position with respect to the longitudinal axis of the shaft 134 so that the displacement of the latch member 143 from beneath the plunger head 180 occurs at the desired speed of rotation of the shaft 134.

After the desired adjustment of the auxiliary cover plate 170 is made, the adjusting screw 174 is screwed up so as to clamp the auxiliary cover plate 170 in the desired position.

A third embodiment of the improved cut-off switch is indicated generally by 210 in Fig. 9 and is generally similar to the embodiment 110, but in the embodiment 210 the main cover plate 260 has mounted therein a binding post 291 which is insulated from the cover plate 260.

The inner end of the binding post 291 within the chamber 226 has connected thereto the upper end of a conductor 292 which may be made of phosphor bronze wire or the like.

The lower end of the conductor 292 when the switch is in the normal operating position as illustrated in Fig. 9, contacts with the plunger flange 281 of the plunger 264.

By means of the plunger binding screw 285 and the binding screw 291 insulated therefrom the switch 210 may be connected in a circuit indicated diagrammatically in part at 293, and which may be a battery ignition circuit for an internal combustion engine.

Otherwise the parts of the apparatus 210 and the mechanical operation thereof is identical with the apparatus 110, so that in the normal operating position as illustrated a circuit is made between the binding screw 285 and the binding post 291, but when the plunger 264 is plunged toward the shaft 234 by centrifugal displacement of the latch member 243, the contact will be broken between the plunger flange 281 and the conductor 292, whereby when as aforesaid the switch 210 is incorporated in a battery ignition circuit indicated diagrammatically in part at 293, said battery ignition circuit will be broken and the engine with which it is associated cannot be started until the switch parts are reset to the position illustrated in Fig. 9.

A fourth embodiment of the improved cut-off switch is indicated generally by 310, and comprises an automatically resetting embodiment of the improved switch which is generally similar to the embodiment 110, but which includes a latch member 343 having a tapered cam end 343a which swings back and forth, depending upon the speed of rotation of the shaft 334, between the contact head 380 of the plunger 364 and the contact head 334b of the shaft 334.

The switch 310 may be series connected in a normally open signal circuit indicated diagrammatically at 395 by means of the binding screw 385 and one of the cap screws 362, and the circuit 395 may include a battery 396 and a signal light 397.

Accordingly, over-speeding of the shaft 334 will cause the cam latch member 343 to swing out from beneath the contact head 380, so that the contact head 380 is plunged against the contact head 334b thereby closing the circuit through the battery 396 and the light 397 and illuminating the light 397 and thus warning the attendant of the over-speeding; and when the shaft 334 has been reduced in speed, the latch member 343 will swing back to the position shown in Fig. 10 displacing the contact head 380 from connection with the contact head 334b, and breaking the circuit through the light 397 causing extinguishment of the same.

I claim:

1. Centrifugal control apparatus including a shaft operatively mounted for rotation and having a transverse end face, an arm, means on the shaft and adjacent the transverse end face thereof and operatively mounting the arm for swinging about an axis laterally offset from the axis of the shaft, a latch member on the arm and extending from one side thereof, yielding means

position of the plunger member laterally with respect to the axis of the shaft.

8. Centrifugal electric switch apparatus including a shaft operatively mounted for rotation and having a transverse end contact face, an arm, means on the shaft and adjacent the transverse end face thereof and operatively mounting the arm for swinging about an axis laterally offset from the axis of the shaft, a latch member insulated from the shaft, the latch member being secured on the arm and extending from one side thereof, yielding means normally maintaining the arm with its latch member extending transversely across the transverse end contact face of the shaft, a plunger member insulated from the shaft and slidably mounted adjacent the transverse end contact face of the shaft, the plunger member having a transverse end contact face opposite the transverse end contact face of the shaft, and the plunger member being arranged so that its transverse end contact face may rest on the latch member when the latch member extends across the transverse end contact face of the shaft, the shaft and plunger each being a conductor and each being adapted for being connected in an electric circuit, and yielding means tending to displace the plunger member towards the shaft, and means for adjusting the position of the plunger member laterally with respect to the axis of the shaft.

9. Centrifugal control apparatus including a shaft operatively mounted for rotation and having a transverse end face, a latch member operatively mounted on the shaft for swinging about an axis laterally offset from the axis of the shaft, yielding means normally maintaining the latch member extending transversely across the transverse end face of the shaft, a plunger member slidably mounted adjacent the transverse end face of the shaft, the plunger member having a transverse end face opposite the transverse end face of the shaft, and the plunger member being arranged so that its transverse end face may rest on the latch member when the latch member extends across the transverse end face of the shaft.

10. Centrifugal control apparatus including a rotary member operatively mounted for rotation and having a transverse end face, a latch member operatively mounted on the rotary member for swinging about an axis laterally offset from the axis of rotation of the rotary member, yielding means normally maintaining the latch member extending transversely across the transverse end face of the rotary member, a plunger member slidably mounted adjacent the transverse end face of the rotary member, the plunger member having a transverse end face opposite the transverse end face of the rotary member, and the plunger member being arranged so that its transverse end face may rest on the latch member when the latch member extends across portions of the transverse end face of the rotary member.

11. Centrifugal electric switch apparatus including a shaft operatively mounted for rotation and having a transverse end face, a latch member insulated from and operatively mounted on the shaft for swinging about an axis laterally offset from the axis of the shaft, yielding means normally maintaining the latch member extending transversely across the transverse end face of the shaft, a plunger member slidably mounted

adjacent the transverse end face of the shaft, the plunger member having a transverse end face opposite the transverse end face of the shaft, and the plunger member being arranged so that its transverse end face may rest on the latch member when the latch member extends across the transverse end face of the shaft, the shaft and plunger member each being a conductor and each being adapted for being connected in an electric circuit.

12. Centrifugal electric switch apparatus including a rotary member operatively mounted for rotation and having a transverse end face, a latch member insulated from and operatively mounted on the rotary member for swinging about an axis laterally offset from the axis of rotation of the rotary member, yielding means normally maintaining the latch member extending transversely across the transverse end face of the rotary member, a plunger member slidably mounted adjacent the transverse end face of the rotary member, the plunger member having a transverse end face opposite the transverse end face of the rotary member, and the plunger member being arranged so that its transverse end face may rest on the latch member when the latch member extends across portions of the transverse end face of the rotary member, the rotary member and the plunger member each being a conductor and each being adapted for being connected in an electric circuit.

13. Centrifugal control apparatus including a rotary member operatively mounted for rotation and having a transverse end face, a latch member operatively mounted on the rotary member for swinging about an axis laterally offset from the axis of rotation of the rotary member, yielding means normally maintaining the latch member extending transversely across the transverse end face of the rotary member, a plunger member slidably mounted adjacent the transverse end face of the rotary member, the plunger member having a transverse end face opposite the transverse end face of the rotary member, the latch member having a tapered cam end, and the plunger member being arranged so that its transverse end face may rest on the tapered cam end of the latch member when the latch member extends across portions of the transverse end face of the rotary member.

14. Centrifugal electric switch apparatus including a rotary member operatively mounted for rotation and having a transverse end face, a latch member operatively mounted on the rotary member for swinging about an axis laterally offset from the axis of rotation of the rotary member, yielding means normally maintaining the latch member extending transversely across the transverse end face of the rotary member, a plunger member slidably mounted adjacent the transverse end face of the rotary member, the plunger member having a transverse end face opposite the transverse end face of the rotary member, and the plunger member being arranged so that its transverse end face may rest on the latch member when the latch member extends across portions of the transverse end face of the rotary member, and a conductor insulated from the plunger member, the conductor having a portion contacting with the plunger member only when the plunger member rests on the latch member.

HAROLD G. SMITH.