Dec. 31, 1929. A. G. DECKER 1,741,406

SWITCH

Filed Feb. 25, 1928 2 Sheets-Sheet 1

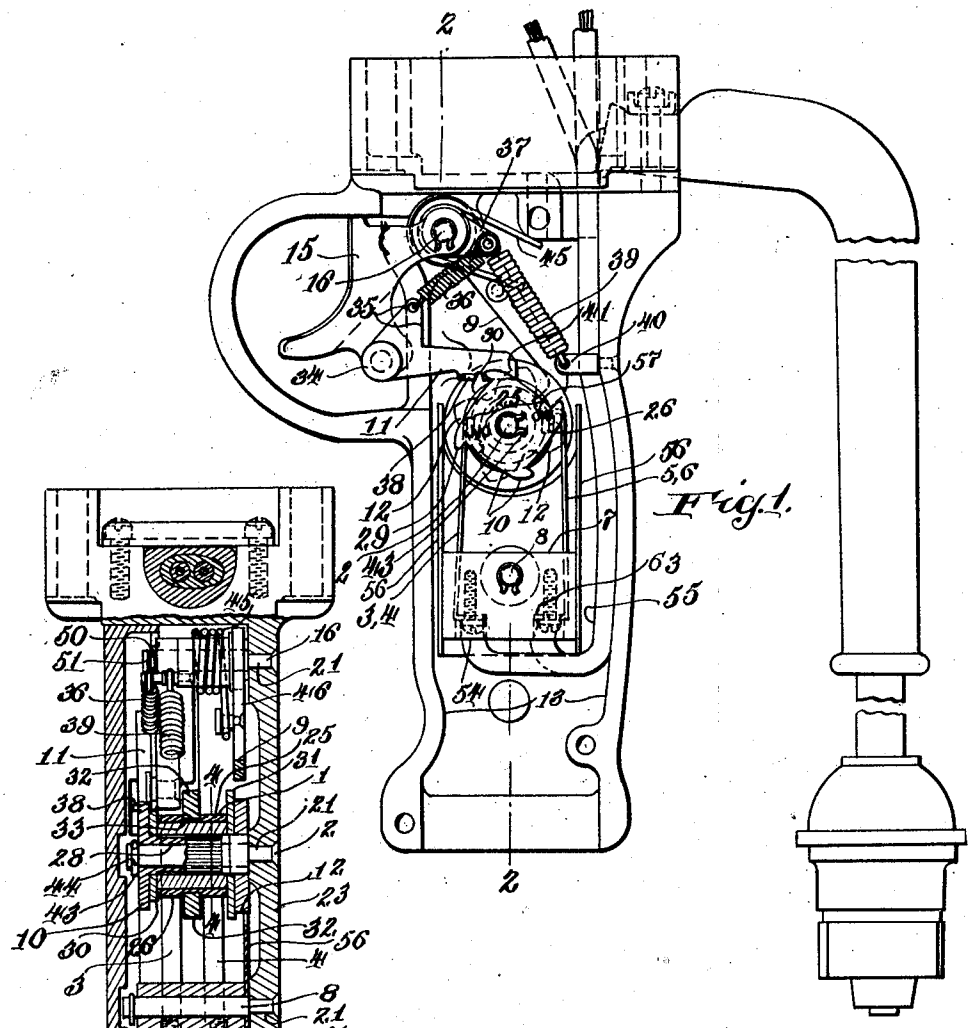

Fig. 1.

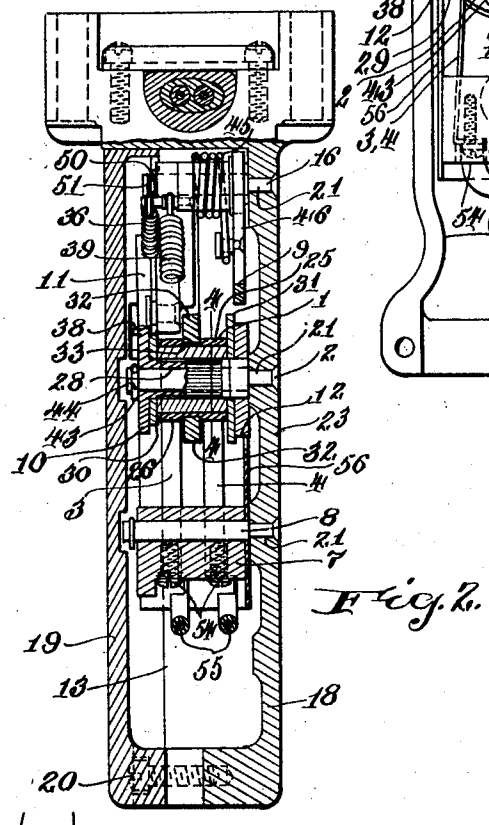

Fig. 2.

Witnesses:
Porter H. Hewett

Inventor
Alonzo G. Decker

By Edwin P. Lamuth
Attorney

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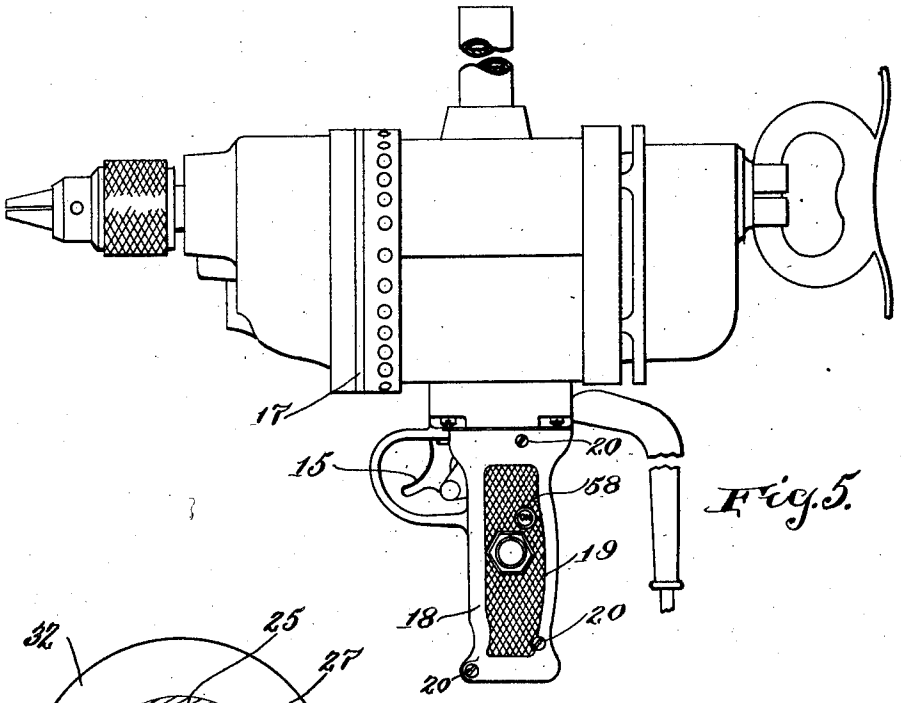

Fig. 5.

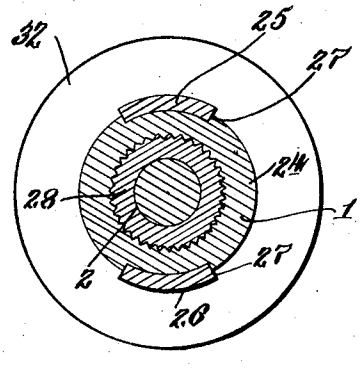

Fig. 4.

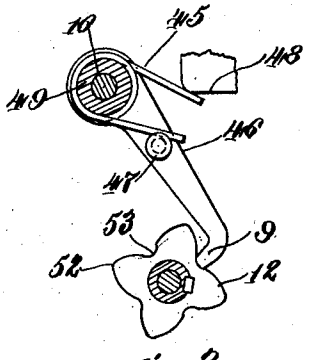

Fig. 3.

Witnesses

Inventor

Alonzo G. Decker

By Edwin P. Lincoln

Attorney

Patented Dec. 31, 1929 1,741,406

UNITED STATES PATENT OFFICE

ALONZO G. DECKER, OF BALTIMORE COUNTY, MARYLAND, ASSIGNOR TO THE BLACK AND DECKER MANUFACTURING COMPANY, OF TOWSON HEIGHTS, MARYLAND, A CORPORATION OF MARYLAND

SWITCH

Application filed February 25, 1928. Serial No. 256,895.

The invention relates to portable electric tools, as drills, tappers, valve grinders, screw drivers, wrenches, hammers and other tools which are electrically driven and intended to be manually supported or directed. More particularly the invention relates to the switch by which the motor is started and stopped.

The switch is preferably of the trigger operated type which is regarded as the most convenient for portable tools and is shown in connection with the pistol grip which, in the preferred form of the invention, is utilized as the switch casing, though the switch may be otherwise housed and operated within the scope of the invention.

In the preferred form of switch, which is the subject of the invention, the switch parts are mounted for operation within the main switch case, for which purpose the pistol grip may, in the preferred form shown, be most conveniently utilized, and this case is provided with a cover which is entirely separate from the switch parts and may be removed at any time without interfering with the operation of the switch to give access to the switch for inspection, adjustment, repairs and replacements. The switch also includes means for indicating the on and off position of the switch without any indicating device extending through the cover or switch casing as in the previous practice. While the parts are independent of the cover they are so mounted as to be instantaneously removable at any time on removal of the cover.

The invention further relates to other improved features and details of the switch, as hereinafter described and claimed and illustrated in the accompanying drawings.

In the accompanying drawings I have illustrated a switch embodying the features of my invention in the preferred form and have also shown the relation of the switch to an electric tool of one of the various types to which it is intended to be applied.

In the drawings:

Figure 1 is a side elevation of a switch casing in the form of a pistol grip enclosing a switch mechanism embodying the invention, the cover being removed to disclose the same.

Figure 2 is a section on the line 2—2 of Figure 1, the section being taken on a plane at right angles to the plane of Figure 1.

Figure 3 is a detail view of the star wheel mechanism controlling the contact block.

Figure 4 is a section through the contact block on the line 4—4 of Figure 2.

Figure 5 is an elevation of an electric tool showing the application of the switch thereto.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the switch, as shown, comprises the rotary contact member or block 1 mounted to rotate upon a stationary pin or stud 2. This contact block, to be further described, is engaged by switch blades 3, 4, 5, 6 carried by the switch blade block 7 which, in the preferred form, as shown, is mounted to oscillate upon the stationary pin or stud 8, though the exact manner of mounting the block is not essential to the invention.

The contact block is controlled and operated by means of ratchet and pawl 10, 11, and is centered in its on and off positions by the star wheel 12 and star wheel follower 9. The switch is controlled as to its on and off position and operated in opening and closing by means of trigger 15 pivotally mounted on a stationary pin or stud 16, the pawl 11 being carried by the trigger, as hereinafter described.

Figure 5 shows an electric drill or similar tool 17 having a pistol grip 18, which is most conveniently made hollow, the switch of the invention being enclosed within the grip, which serves as a casing, and actuated or controlled by the operator by means of the trigged 15.

The pistol grip 18 which, as aforesaid, serves, in the preferred form of the invention shown, as the casing or housing for the switch, has an opening 13 shown as on the side which is turned toward the observer in Figure 1, the opening being closed by means of a cover 19 which may be held in closed position by means of screws 20, or otherwise. Seated in the wall 23 of the grip or casing in

or opposite the opening 13 to serve as the pivotal supports for the respective members, i. e., the trigger 15, the contact block 1 and the blade block 7, are the pins or studs 2, 8 and 16. Each of these studs is shown as shouldered and reduced as to the end at the right in Figure 2, the reduced portion being indicated by reference character 21, and this reduced portion is in each instance seated in a suitable aperture in the casing wall 23, the extreme end portion at the outside of the casing at the right being up set, after the manner of heading a rivet.

The contact block 1, see Figure 4, which is preferably cylindrical, though its outline is not essential to the invention in the broader conception, has a body portion 24 of insulating material which carries contact strips or members 25 and 26 of conducting material extending along the surface parallel to the axis and seated in grooves 27 formed in the insulating material for this purpose. The cylindrical body member 24 is, in the form of the invention shown, mounted on a bushing 28 which may be knurled, as shown, or otherwise formed to prevent relative rotation of the bushing and body member 24, the insulating body 24 being pressed onto the bushing. The ratchet member 10 comprises teeth 29 cut in a flange formed on the end of the bushing at the left in Figure 2. In other words this flange serves as the ratchet member.

The contact members 25 and 26 are further spaced, separated and insulated from the ratchet by an insulating washer 30 mounted on the bushing 28 between the contact block 24 and the ratchet 10. A convenient method of manufacture is to press the insulating body 1 of the contact block onto the bushing from the right, the washer 30 being first placed in position, as it is shown in Figure 2, between the ratchet flange 10 and the body 1.

At the opposite end from the ratchet 10 the bushing 28 carries pressed onto the bushing the star wheel 12, which is insulated from the contact strips 25 and 26 by still another insulating washer 31 between the star wheel and the switch body. The switch blades 3. 4, and 5, 6, are further spaced and insulated by a middle insulating washer 32 which encircles the insulating block or body member 24 of the contact block intermediately thereof and is preferably seated in suitable notches 33 in the switch contact members 25 and 26, it being understood that all the switch details described relate to the preferred form of the invention.

The ratchet 10, as aforesaid, is engaged and operated by pawl 11 pivotally connected at 34 to the trigger 15. This pawl, as shown in Figure 1, is preferably in the form of a bell crank lever having an upright arm 35 at right angles to the main arm of the pawl. A helical spring 36 is connected to the end of this upright arm 35 and to a rearwardly projecting arm 37 on the trigger member 15 back of the stud 16, the tension of the spring tending to keep the pawl in contact with the ratchet.

The pawl 11, in the form of the invention shown, is provided with a laterally projecting tooth 38 which engages the ratchet teeth 29 successively. The trigger is held normally in advanced position by means of a second coil spring 39 connected at one end to a suitable lug 40 on the inside of the casing and at the other end to the backwardly extending arm 37 of the trigger. The forward end of the pawl at 41 beyond the tooth 38 engages the boss or washer 30 to position the pawl.

The ratchet with the bushing and all the members of the contact block on the stud or pin 2 are held in position on the stud by means of a spring ring 43, which is sprung into a groove 44 encircling the pin near the end.

The motion of the contact block as it passes the points at which contact is changed, i. e., made and broken, is accelerated and the block is further centered and held in contact by means of the star wheel 12 and star wheel follower 9. The star wheel 12 is shown, Figure 3, in the form of a four point star having a point 52 corresponding to each change of contact. This star is operated by the spring pressed follower 9 which is actuated by coil spring 45 bearing at one end against a pin 47 projecting from the follower arm 46 and at the other end against a suitable abutment 48 on the inside of the casing, the intermediate portion of the coil spring being wound about the hub 49 of the follower arm 46, which hub is mounted on the pin or stud 16 which carries the trigger, the trigger and star wheel follower being held in position on the stud or pin 16 by means of spring ring 50 encircling the stud and seated in a groove 51 near the end of the same.

In addition to the function of the star points 52, already described, the star wheel and follower serve the function of centering the contact block, i. e., holding the contact block 1 in the positions of rest corresponding to the depressions or notches 53 in the peripheral surface of the star and between the points. Each of these depressions 53 when engaged by the follower 9 holds the contact block in one of the positions of rest. In two opposite positions the switch blades 3, 4, and 5, 6, engage the block in the middle or substantially the middle of the contact plates or bands 25 and 26 and in the two alternate positions the blades engage the intervening insulating material and are out of contact. In this way the star wheel serves to hold the block and position it in the four respective mid on and off positions in respect to the blades and to impart to the block a quick motion or snap as it passes from closed to

open position and vice versa, reducing the period of change of contact and consequent sparking to the minimum and otherwise accelerating the operation.

In the form of the invention shown, the contact blades 3, 4, 5, 6, are mounted on a block of insulating material 7, known as the switch blade block or blade block. In the preferred form of the invention shown, this block is cast with the supported ends of the blades embedded therein and offset as to their extreme ends at 63. Contact screws 54 seated in the block are passed through these offset ends and the parts are preferably so related that the screws may be counter-sunk in the block as indicated, the wires or flexible electric conductors 55 being connected to the screws 54 in the usual manner. The wires thus bear at their ends on, and are connected directly to, the blades and at the same time the connections are fully insulated and protected by the counter-sink.

To give close contact with the block the blades 3, 4, 5, 6, are bent inwardly so that they are normally spaced by less than the diameter of the block, but sprung out slightly by contact with the block. The block and blades, in the form of the invention shown, are enclosed within and protected from contact with the casing by a sheet of insulating material 56 which is wrapped around the block on three sides, the fourth side, which is that toward the cover 19, and the cover opening being left open. This insulating material is secured to the blade block 7 and extends forward, i. e., toward and partially enclosing the contact block 1. The description relates to the preferred form.

The operation of the switch is believed to have been fully described in connection with the description of its construction. The spring 36 holds the pawl in contact with the ratchet or in engaging relation with the teeth 29. The trigger is normally advanced by the spring 39 and when withdrawn or pressed by the finger it operates the pawl a single stroke and hence the ratchet a single step in right handed rotation as seen in Figure 1. As the blades approach the intersection of the the conducting and non-conducting surfaces of the block, one of the points 52 of the star 12 which rotates with the contact block, passes the follower 9 and the pressure applied to the follower arm 46 imparts a snapping action to or accelerates the motion of the block, giving a quick change of contact and when the block reaches the mid position of contact—either on or off position, the follower 9 enters one of the depressions 53, centering the block or holding it in mid position.

The on and off positions of the switch are indicated by any suitable markings on and spaced outwardly from the center of the ratchet, which it will be noticed is next to the cover, the ratchet in Figure 1 being shown as bearing the words "On" in two diametrically opposite positions at 57, the cover being further provided with an aperture 58, see Figure 5, through which the indicating markings 57 are exposed in the corresponding positions of the contact block.

Important details of the new switch reside in the combination just described whereby the ratchet motion of the contact block is accelerated and controlled by the star wheel and in the arrangement of these features in connection with the trigger, also in the arrangement of the blades and blade block whereby the blades are fully protected and are also mounted in the block for direct connection to the conducting wires. Other features of importance consist in the arrangement of the switch parts within the casing, which may serve as the pistol grip, whereby they are mounted independently of the cover and thus easily accessible by removing the cover without disturbing their operative relation and likewise so mounted that any and all of the parts may be conveniently removed and replaced.

Another detail of interest consists in the provision of indicating means showing the on and off position of the switch without any indicating device which extends through the cover.

Other novel details of the switch form part of the invention and will be claimed and numerous details have been specifically described in order that the operation of the device shown may be clearly understood, however, these details relate merely to the preferred form of the device, being capable of wide variation within the scope and intent of the invention.

What I claim as new and desire to secure by Letters Patent is:

1. An electric switch for portable tools and the like comprising a contact block mounted to rotate therein, contact blades bearing on the contact block, means for supporting the blades, means in the form of a ratched and pawl for imparting a step by step rotation to the block, a casing for the switch having a cover opening and a cover closing said opening, pivotal means in line with said opening for carrying the said switch members removably mounted thereon, said pivotal means and switch members being supported in said casing independently of the cover, the switch members being removable through the cover opening.

2. An electric switch for portable tools and the like comprising switch members including a contact block and a contact blade bearing on the contact block, means for imparting a making and breaking contact motion to the block, a casing for the switch having a cover opening and a cover closing said opening, pivotal means in line with said opening for carrying one of said switch members, said pivotal means being supported in said casing

independently of the cover, and removable holding means mounted on the ends of the pins adjacent the cover, said latter switch member being removable through said cover opening.

3. An electric switch for portable tools and the like comprising a casing, a contact block mounted to rotate therein, a contact means bearing on the contact block, means for imparting a limited rotation to the block, the casing having a cover opening and a cover closing said opening, pivotal means for supporting said members secured to said casing independently of the cover and disposed toward said opening, the block being adjacent the cover and having position indicating means, the cover being apertured to expose the indicating means inside the casing in the position to be indicated.

4. An electric switch for portable tools and the like, comprising a switch casing in the form of, and serving as a pistol grip, a trigger-like actuating lever, the following members in their operative relation being enclosed in the pistol grip, the same comprising a rotary contact block, a ratchet thereon, switch blades bearing on the block and means for supporting the blades, the casing being open at one side, a cover to close said casing, the ratchet and trigger having pivotal supports mounted in the casing opposite the cover opening and independently of the cover, the ratchet being adjacent the cover and having position indicating means, the cover being apertured to expose the indicating means in the position to be indicated.

5. In a portable electric tool a pistol grip serving as a switch casing, a trigger-like lever for actuating the switch members in their operative relation being enclosed within the pistol grip the same comprising, a pawl carried by the trigger, a rotary contact block, a ratchet secured to the contact block and engaged by the pawl, contact blades engaging the block, rocking means carrying the blades, the casing having an opening at one side, a cover for said opening, the switch, the ratchet and the blade block having pivotal supporting means disposed toward the cover mounted in the casing opposite the opening and independently of the cover and removable holding means at the end of said pivotal supporting means permitting said pivotally mounted members to be removed through said cover opening.

6. An electric switch for portable tools comprising a rotary contact block, a switch blade engaging the block, a rocking blade block carrying the blade and an insulating covering secured to the blade block and enclosing the blades including the portions thereof projecting beyond the blade block.

7. In an electric switch for portable tools, a rotary contact block comprising a cylindrical member of non-conducting material and having a central bore, a contact member mounted on said cylinder, a shaft for the block and a sleeve rotating on said shaft and seated in the bore of the cylindrical member which is secured thereto, the sleeve having a flange at one end serving as a ratchet, an insulating washer between the flange and the cylindrical member, an insulating washer at the opposite end of the cylindrical member and a star wheel mounted on the sleeve and bearing against the washer on the side opposite the cylinder, a pawl for actuating the ratchet and a follower engaging the star wheel.

8. In an electric switch for portable tools, a rotary contact block comprising a cylindrical member of non-conducting material, a contact member mounted on said cylinder, a pivotal support for the block and a sleeve rotating on said support and carrying the cylindrical member secured thereto, the sleeve having a flange at one end serving as a ratchet, an insulating washer between the flange and the cylindrical member, an insulating washer at the opposite end of the cylindrical member and a star wheel mounted on the sleeve outside of the latter washer, a pawl for actuating the ratchet and a follower engaging the star wheel, a finger lever carrying the pawl, a pivot on which the finger lever is mounted, the finger lever having a rearwardly projecting arm substantially at right angles to the lever and the pawl being in the form of a bell crank having an arm projecting toward said rearward arm, a tension spring connecting the rearwardly projecting arm to the said arm of the pawl and a second spring connected to the rearwardly projecting arm and to a stationary member to retract the finger lever and pawl.

9. In an electric tool, a hand grip projecting downwardly from the tool casing, the grip being hollow, a trigger lever mounted at the upper end of the grip and having a rearwardly projecting arm, a pawl carried by the trigger lever near its swinging end, the pawl having a projecting arm, a tension spring connecting the rearwardly projecting arm of the finger lever and the projecting arm of the pawl, a tension spring connecting the rearwardly projecting arm of the trigger lever to a stationary point on the grip to retract the lever and the pawl, a rotary contact block pivotally mounted in the grip and carrying a ratchet to be engaged by the pawl, a blade block mounted below the contact block and carrying upwardly projecting blades engaging the contact block, a pivotal support for the finger lever and a shaft for the contact block seated in the grip at one side, the grip having an opening at the other side opposite said pivotal support and shaft and opposite said contact block, and a removable cover independent of said pivotal support and shaft closing said opening.

10. In an electric tool, a hand grip projecting downwardly from the tool casing, the grip being hollow, a finger lever mounted at the upper end of the grip and having a rearwardly projecting arm, a pawl carried by the finger lever near its swinging end, the pawl having an upwardly projecting arm, a tension spring connecting the rearwardly projecting arm of the finger lever and the upwardly projecting arm of the pawl, a tension spring connecting the rearwardly projecting arm of the tension lever to a stationary point in the grip to retract the lever and the pawl, a rotary contact block pivotally mounted in the grip and carrying a ratchet to be engaged by the pawl, a blade block mounted below the contact block and carrying upwardly projecting blades engaging the contact block, a pivotal support for the finger lever and a shaft for the contact block seated in the grip at one side, the grip having an opening at the other side opposite said pivotal support and shaft and opposite said contact block, and a removable cover independent of said pivotal support and shaft closing said opening, the contact block carrying indicating marks and the cover having an opening disclosing said marks and indicating the position of the contact block.

11. In a portable electric tool a pistol grip, a trigger switch lever, the grip being hollow and serving as a switch casing, a pawl member connected to and operated by the trigger switch lever, a contact block mounted in the grip and operated by the pawl member, switch blades also mounted in the grip and cooperating with the block, the contact block and blades being pivotally mounted, the grip casing having a cover opening and removable cover therefor, the pivots being secured to the casing independently of the cover and disposed toward the cover opening whereby the contact block and switch blades are removable through the cover opening.

Signed by me at Towson, Maryland, this 21st day of February, 1928.

ALONZO G. DECKER.