P. T. McNALLY.

ELECTRIC CUT-OUT.

APPLICATION FILED SEPT. 30, 1909.

954,327.

Patented Apr. 5, 1910.

4 SHEETS—SHEET 1.

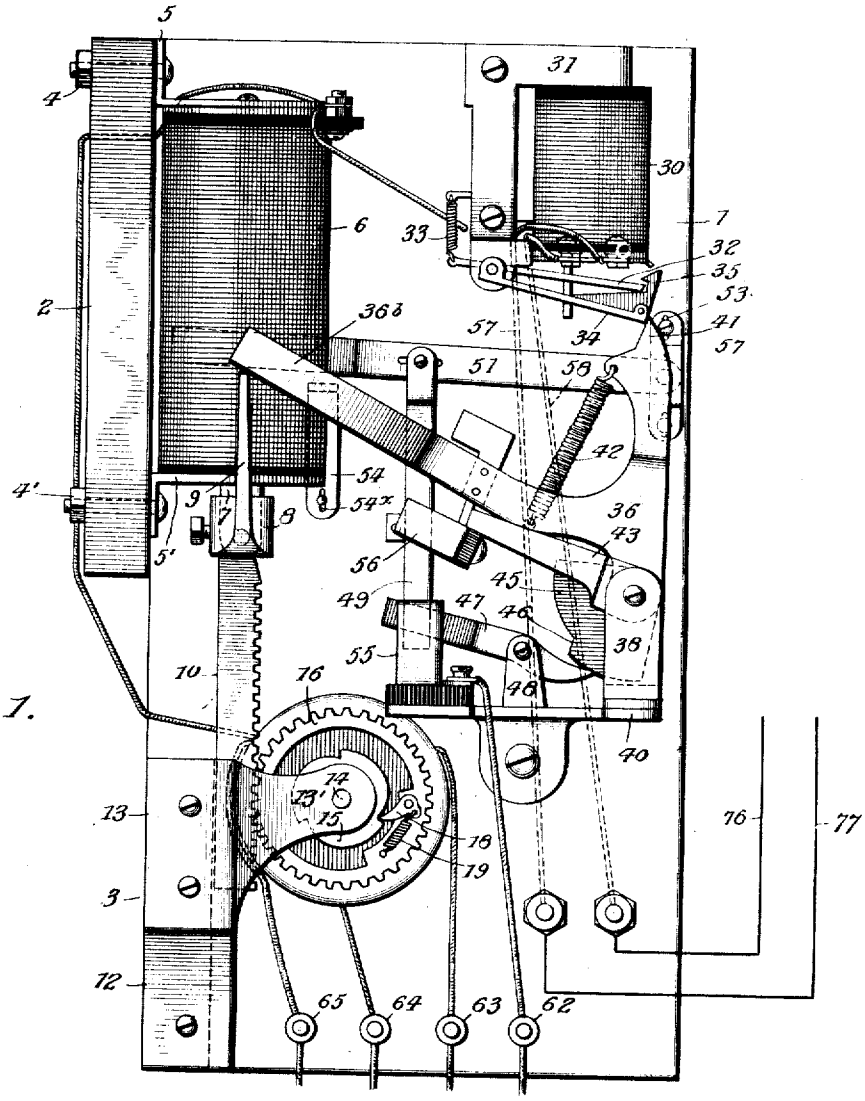

Fig. 1.

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4 SHEETS—SHEET 2.

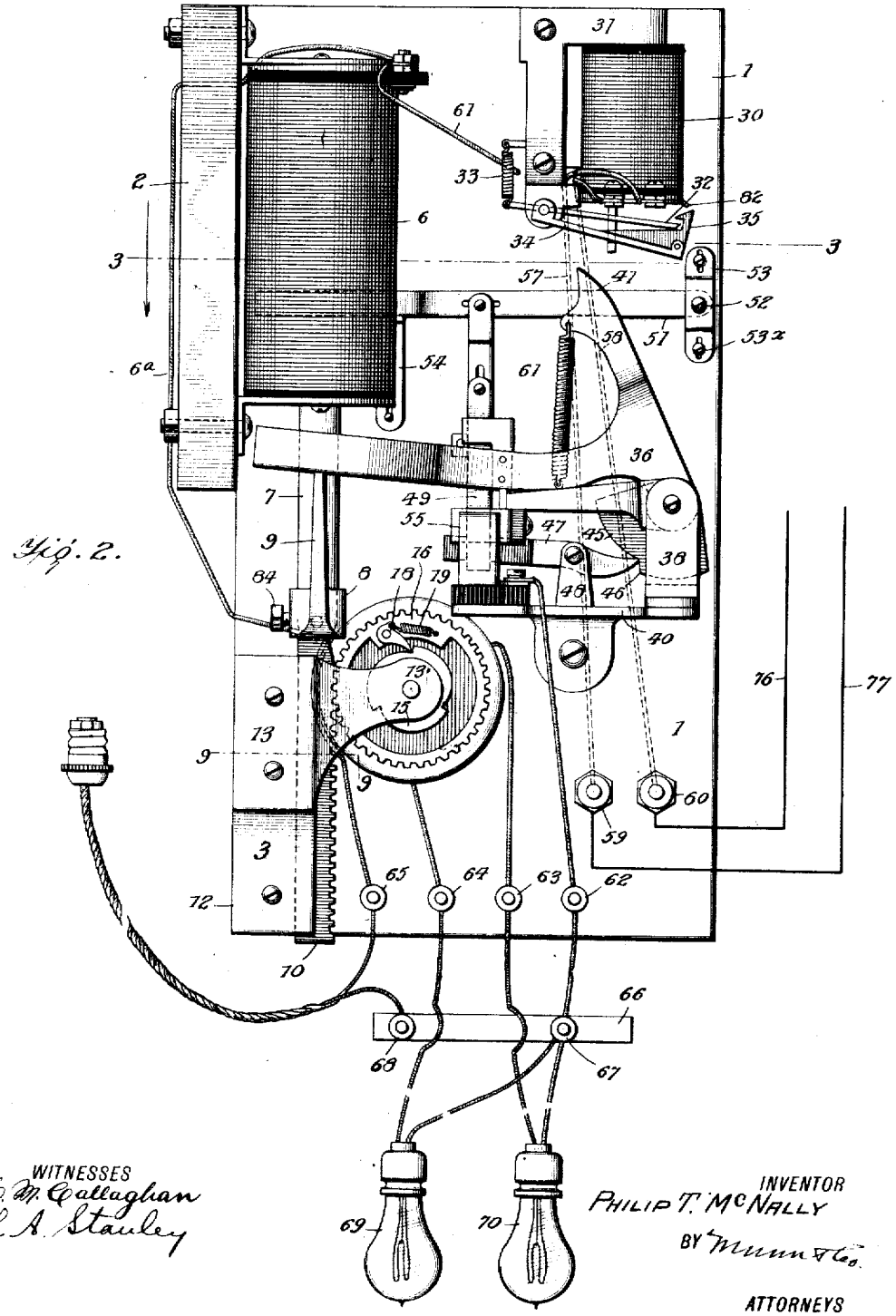

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

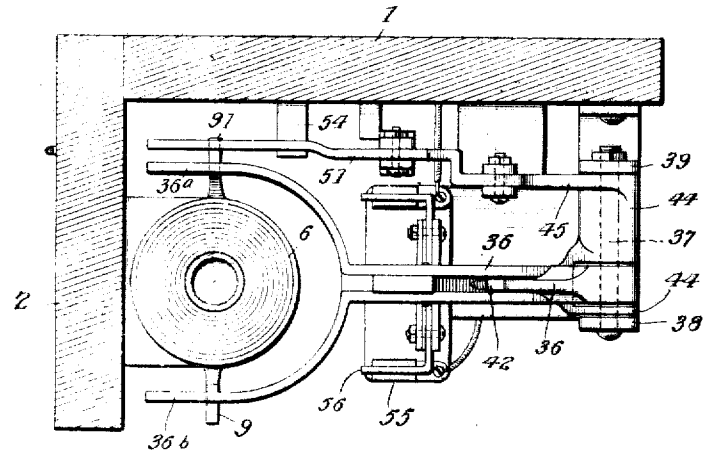


Fig. 5.

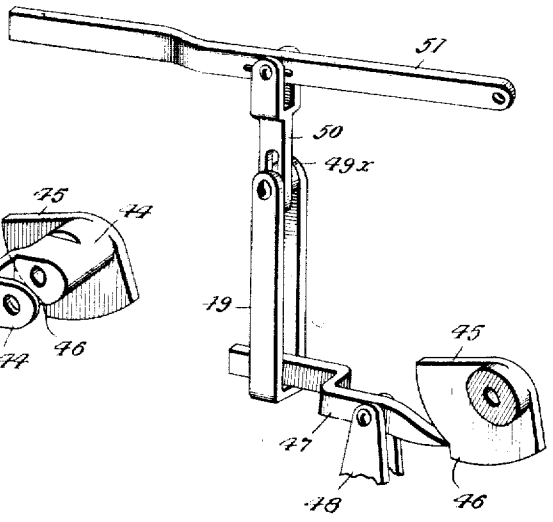
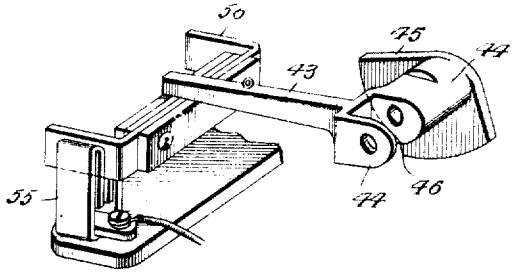


Fig. 4.



WITNESSES

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4 SHEETS—SHEET 4.

Fig. 6.

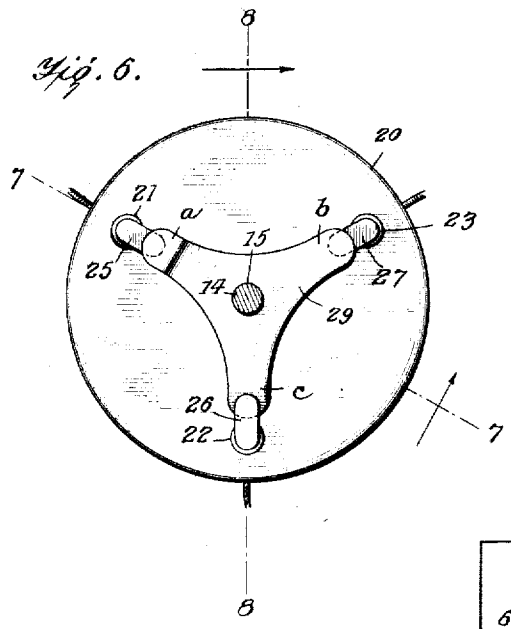

Fig. 7.

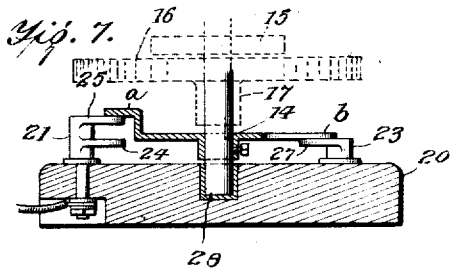

Fig. 8.

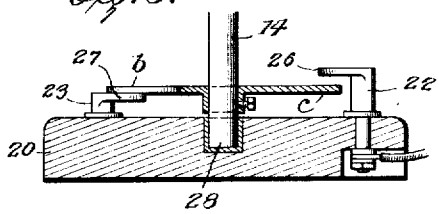

Fig. 9.

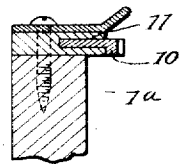

Fig. 10.

WITNESSES

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UNITED STATES PATENT OFFICE.

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ELECTRIC CUT-OUT.

954,327. Specification of Letters Patent. Patented Apr. 5, 1910.

Application filed September 30, 1909. Serial No. 520,354.

To all whom it may concern:

Be it known that I, PHILIP T. McNALLY, a citizen of the United States, and a resident of Mandan, in the county of Morton and State of North Dakota, have invented certain new and useful Improvements in Electric Cut-Outs, of which the following is a specification.

My invention relates to devices for operating at a distance, electric switches in branch lines of electric circuits whereby the current may be cut in or out in said branch lines either from the power house or any remote station, thus controlling the current on said branch lines without cutting off the current in the main line leads.

The invention has some features which have already been disclosed in my prior patents Nos. 856,085, of June 4, 1907 and 887,501, of May 12, 1908, but has certain changes and improvements which will be hereinafter described and the novel features of which will be particularly pointed out in the appended claims.

I have shown my device as operating on alternating current circuits, though it will work equally as well on direct current circuits and is so intended.

My invention is illustrated in the accompanying drawings in which similar reference characters indicate like parts in the several views and in which—

Figure 1 is a front view of the device showing one position of the operative mechanism; Fig. 2 is a similar view showing the mechanism in another position; Fig. 3 is a horizontal section along the line 3—3 of Fig. 2 looking in the direction of the arrow; Fig. 4 is a detail perspective view of the knife switch; Fig. 5 is a detail perspective view of the dog and stirrup for releasing the knife switch; Fig. 6 is a detail plan view of the contacts of the snap switch; Fig. 7 is a section along the line 7—7 of Fig. 6; Fig. 8 is a detail section along the line 8—8 of Fig. 6; Fig. 9 is a section along the line 9—9 of Fig. 2; and Fig. 10 is a diagrammatic illustration of the operating circuits.

In carrying out my invention I provide a main base 1 made of insulating material such as slate or wood. At one side of the base plate 1 are the laterally extending supports 2 and 3. Secured to the support 2, by means of the screws 4 and 4′, are the upper and lower brackets 5 and 5′ respectively, preferably of metal, to which the solenoid 6 is fastened. This solenoid is provided with an iron core 7, at the lower end of which is adjustably secured a collar 8, provided with a pair of upwardly extending arms 9 and 9′. A rack member 10 is secured to the solenoid core 7 at its lower end and is arranged to reciprocate in a groove 11 in the edge of a plate 12 secured to the support 3. A bracket 13 is fastened on the outside of the plate 12 and has an arm 13′ which forms a bearing for the shaft 14 of the snap switch. The latter comprises a ratchet 15 having a number of teeth. The ratchet is secured firmly to the shaft 14, while a pinion 16 is loosely mounted on the shaft 14 and is held in place between the ratchet on one side and a collar 17 secured to the shaft on the other side, (see Fig. 7). The pinion 16 is provided with a pivoted pawl 18 normally held in contact with the ratchet 15 by means of the spring 19.

The construction of the snap switch is clearly illustrated in Figs. 6, 7, and 8. It consists of the usual insulating base 20 to which are secured the uprights 21, 22 and 23, respectively. The upright 21 has a lower contact member 24 and an upper contact member 25. The upright 22 has a single contact member 26 on a lever with the high contact member 25 on the upright 21, while the upright 23 has a contact 27 on a level with the lower contact 24 on the upright 21.

Secured to the shaft 14 is the switch member 29 which, as shown in Fig. 6 is provided with three arms *a*, *b*, and *c*. The arm *a* is bent upwardly and then outwardly at its end as shown in Fig. 7 to engage the high contacts 25 and 26, while the arms *b* and *c* are on a lower level to engage the lower contacts 24 and 27.

A control magnet 30 is mounted on the L-shaped support 31, see Figs. 1 and 2. Pivotally secured to the bottom of the support 31 is an armature 32 which is kept away from the magnet 30 by means of a spring 33. A trigger-plate 34 is also pivoted on the support 31 and is provided at its forward end with a trigger 35 of the shape shown in Figs. 1 and 2. Below the control magnet 30 is an elbow lever 36 which is pivotally mounted on a shaft 37 between the ears 38 and 39 carried by the bracket 40. The elbow lever 36 has a toe 41 at its upper end arranged to engage the outer end of the trigger plate 34. A spring 42 is attached to the vertical arm of the lever 36 and its lower

end is attached to a lever arm 43 of the knife switch, the lever 36 being slotted to permit the spring 42 to pass through, in the manner shown in Fig. 3. The arm 43 which, as shown, is pivoted on the same shaft 37 as that on which the elbow lever 36 is mounted, has a bearing 44 which straddles the bearing of the lever 36 as shown in Fig. 3. Supported on the bearing 44, on one side of the lever 43, is a stop 45 provided with a shoulder 46 arranged to engage a dog 47 which is pivotally mounted on bracket 48 carried by the supports 40. The dog 47 may be operated by means of the stirrup 49 which is adjustably secured to a slotted rod 50 suspended from a lever 51 which in turn is pivotally mounted at 52 in the adjustable bracket 53 secured to the base 1. The opposite or free end of the lever 51 is arranged to engage the adjustable stop 54 which may be moved upwardly or downwardly to limit the movement of the lever. It will be observed that the lever 51 is bent so that its free end may lie parallel with the free ends 36^a and 36^b of the elbow lever 36, these ends being bent around the solenoid 6 in the manner clearly shown in Fig. 3.

In Fig. 4 I have shown the spring jaws 55 of the knife switch. These jaws are arranged to receive the conducting member 56 which is secured to the lever 43, both the jaws 55 and the connecting member 56 being suitably insulated from the parts upon which they are supported.

The terminals 57 and 58 of the solenoid 30, of the control magnet are brought out to the binding posts 59 and 60 respectively. The terminal 61 of the solenoid 6 is brought to the side 55^x of the knife switch while the opposite side 55^y is connected with the binding post 62, see Fig. 10. The standard 23 of the snap switch is connected to the binding post 63, standard 22 to the binding post 64 and the standard 21 to the binding post 65. The terminal 6^a of the solenoid 6 is connected with the standard 21. In Fig. 2 I have shown a common connecting bar 66 provided with binding posts 67 and 68 to which the lamps 69 and 70 are attached, this being merely for convenience of explanation and not at all necessary to the apparatus.

The circuit connections are illustrated in Fig. 10, in which the generator is shown at G, the line wires at 71 and 72, the transformer at 73 and the secondary wires 74 and 75 leading from the transformer. The control circuit of the magnet 30 comprises the battery B and key K and the conductor 76 leading to the magnet 30. The other terminal of the magnet may be grounded as shown or it may have a metallic return 77.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

Let us assume that the parts are in the position shown in Fig. 10. The elbow lever 36 will be in the position shown in Fig. 1 with the toe 41 engaging the trigger plate 34 to hold the lever in position, such that no current can pass through the solenoid 6. The arm 43 of the knife switch will be held up by the spring 42. The rack 10 however, and the arms 9 and 9′ will be in the position shown in Fig. 2, *i. e.*, in a lower position. In Fig. 10 it will be noted that the arm *a* is in engagement with the high contact 25 on the standard 21, the arm *b* being in engagement with the low contact 27 on the standard 23. The arm *c*, however, is below the high contact 26 on the standard 22 as may be seen by an inspection of Fig. 8. The lamp 70, therefore, is the only lamp in circuit, the secondary circuit from the transformer 73 being through the conductors 75, 62, lamp 70, 63, 23, 27, *b*, *a*, 25, 21, 65 and 74. If now the key K be pressed the control magnet 30 will be energized, the current flowing from battery through 76 and 30, ground, (if the circuit has a ground return, or 77 if the metallic return is used) 80, key K, 81 and battery. The control magnet pulls up the armature 32 which catches the trigger 35 thereby raising the trigger plate 34 and permitting the elbow lever 36 to drop. This elbow lever has considerable weight and it forces down the arm 43 of the knife switch and the connecting member 56 falls between the spring jaws 55^x and 55^y thereby completing the following circuit: 75, 68, 62, 55^y, 56, 55^x, 61, solenoid 6, conductor 6^a, 21, 65, 74 back to the transformer. The energization of the solenoid 6 causes the core 7 to be drawn upwardly. The arms 9 and 9′ each are attached to the core and engage the end of the lever 36 thereby stretching spring 42 as the lever 36 moves upwardly. The knife switch, however, will not immediately respond to the tension of the spring 42 because it is held locked by the dog 47 which engages the shoulder 46 on the cam 45. The purpose of locking the switch is to give the solenoid 6 time to act before its own circuit is broken. The arms 9 and 9′ on their upward movement finally engage the lever 51 to which the stirrup 49 is attached by means of the link 50 and as the stirrup moves upward it engages the extended end of the dog 47, thereby throwing the latter downwardly and permitting the shoulder 46 upon the cam 45 to move upwardly with the arm 43 and the contacting member 56 of the knife switch. The position of the parts at this state of the operation is shown in Fig. 1. It will be seen that the elbow lever 36 is thrown past the trigger plate 34 which has fallen down into its original position by the camming of the trigger off from the end of the armature by the stud 82 on the bottom edge of the solenoid 30. The upward move-

ment of the rack turns the pinion 16 and (through the pawl 18) the ratchet 15 approximately a third of a revolution, thereby bringing the high arm *a* above the low contact 27 on the standard 23, the low arm *b* below the high contact 26 on the standard 22, and the arm *c* into engagement with the low contact 24 on the standard 21. It will be observed that neither the arms *a*, *b*, or *c* are in engagement with their continuous contacts. Therefore, both of the lamps 69 and 70 are extinguished. As soon as the pressure is relieved from the key K, the control circuit is broken and the armature 32 drops back camming the trigger 35 outwardly by its beveled edge so that the trigger remains hooked over the armature ready for the next operation. As soon as the solenoid 6 is deenergized the core 7 together with the rack 10 drops downwardly carrying the pinion 16 backward, the spring pawl 18 riding over the teeth, into position and ready for a subsequent movement.

If it is desired to switch on both of the lamps 69 and 70, the key K is depressed and the switching action which has been described causes the turning of the snap switch a third of a revolution, bringing the high arm *a* into engagement with the high contact 26 on the standard 22, the low arm *b* into engagement with the low contact 24 on the standard 21 and the low arm *c* into engagement with the low contact 27 on the standard 23. In this position contacts are effected at the ends of each of the arms *a*, *b* and *c* and currents through the lamps will flow to the return connected with the standard 21 thereby lighting both lamps. A subsequent closure of the key K will bring the snap switch into its initial position with one of the lamps lighted as before explained.

It will be observed that I have provided for the vertical adjustment of the arms 9 and 9′ by means of the set screws 84 and of the stop 54 by the slot and pin arrangement 54^x. The lever 51 may also be adjusted by the slot and screw arrangement 53^x of the bracket 53 while the vertical adjustment of the stirrup 49 may be accomplished by a similar arrangement at 49^x.

While I have shown the operating device for the snap switch in connection with a particular kind of switch it is obvious that it may be used merely to turn off or on circuits by successive closures effected by means of the key K in the control circuit, the essential feature consisting in the reciprocatory movements of the actuating rack which operates the switch in a given direction to a predetermined distance.

I claim:—

1. The combination with the electric circuit of a main switch, provided with a loose pinion, in said circuit, a solenoid arranged to be thrown across the main circuit, a core for said solenoid, having at its lower extremity a rack arranged to engage the pinion on the main switch and a pair of upwardly extending arms adapted to straddle the solenoid, an auxiliary knife switch for controlling the circuit of the solenoid, a pivotally mounted elbow lever, provided with extended arms at one end arranged to straddle the solenoid and to be engaged by the upwardly extending arms on the core, a control magnet, a pivoted trigger-plate arranged to engage one end of the elbow lever and to be drawn out of engagement with said elbow lever when the control magnet is energized, an integral stop member associated with said knife switch, a dog arranged to engage said stop, a release lever, a stirrup suspended therefrom and arranged to engage the dog for releasing the knife switch, one of said upwardly extending arms being arranged to engage the free end of said release lever subsequently to its engagement with the elbow lever, means for adjusting the vertical height of the upwardly extending arms, means for adjusting the throw of the release lever and means for adjusting the movement of the dog.

2. The combination with an electric circuit, of a main switch in said circuit provided with a loose pinion, a solenoid in the main circuit, arranged to be thrown across said circuit, a core for said solenoid, having at its lower extremity a rack arranged to engage the pinion on the main switch and a pair of upwardly extending arms adapted to straddle the solenoid, an auxiliary knife switch for controlling the circuit of the solenoid, a pivotally mounted elbow lever adapted to be engaged by the upwardly extending arms on the core, a control magnet, a pivoted trigger-plate arranged to engage one end of the elbow lever and to be drawn out of engagement with said elbow lever when the control magnet is energiz ed, an integral stop member associated with said knife switch a dog arranged to engage said stop, a release lever, a stirrup suspended therefrom and arranged to engage the dog for releasing the knife switch, one of said upwardly extending arms being arranged to engage the free end of said release lever subsequently to its engagement with the elbow lever, and means for adjusting the throw of the release lever.

3. The combination with an electric circuit, a main switch in said circuit, a solenoid in a branch circuit arranged to be thrown across the circuit controlled by the main switch, a core for said solenoid, having a pair of upwardly extending arms, an auxiliary switch for controlling the circuit of the solenoid, a pivotally mounted elbow lever for operating the last named switch, adapted to be engaged by the upwardly extending arms on the core, a control magnet,

a trigger-plate associated with said control magnet for keeping the elbow lever in initial position, means for locking the auxiliary switch, a release lever, means associated with the release lever for releasing the locking means, said release lever being arranged for engagement by said upwardly extending arms subsequently to their engagement with the elbow lever.

4. The combination with a main circuit, of a main switch therefor, a branch circuit from the main circuit provided with a solenoid, an auxiliary switch for controlling the solenoid circuit, a core for the solenoid provided with upwardly extending arms, means for locking the auxiliary switch, a weighted lever for operating the auxiliary switch adapted to be engaged by said arms for resetting the auxiliary switch, a release lever for unlocking said auxiliary switch, said release lever being actuated by the upward movement of the arms of said core subsequently to their engagement with the operating and resetting lever.

5. The combination with a main circuit, of a main switch therefor, a branch circuit provided with a solenoid, an auxiliary switch for controlling the solenoid circuit, means for locking the auxiliary switch, means for operating the auxiliary switch adapted to be engaged by the core of the solenoid for resetting the auxiliary switch and a release lever for unlocking said auxiliary switch.

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Witnesses:
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EDWARD McHUGH.