Feb. 2, 1937. E. B. NOWOSIELSKI 2,069,676

MULTIPLE IGNITION SWITCH

Original Filed Oct. 2, 1930 2 Sheets-Sheet 1

Fig. 6.

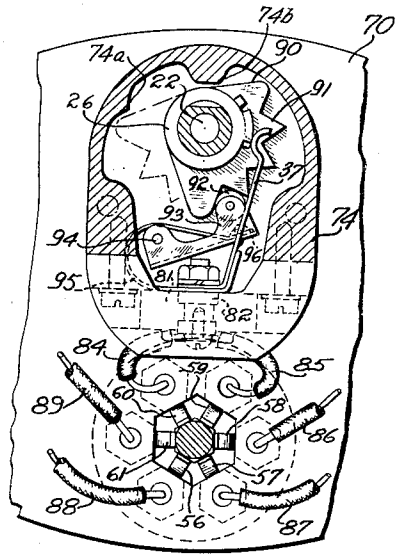


Fig. 2.

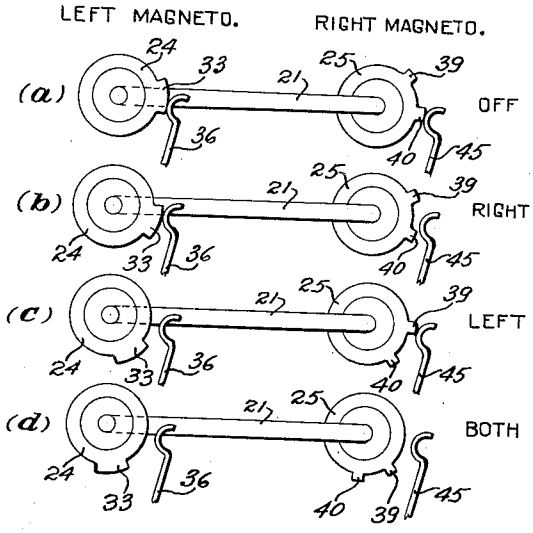
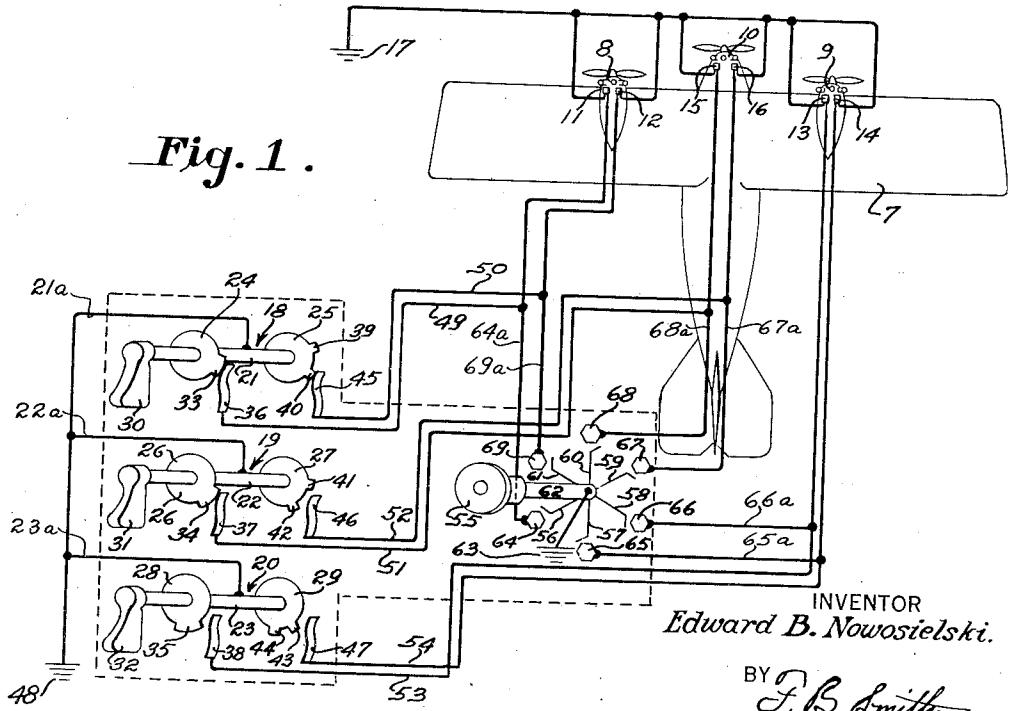


Fig. 1.



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Fig. 3.

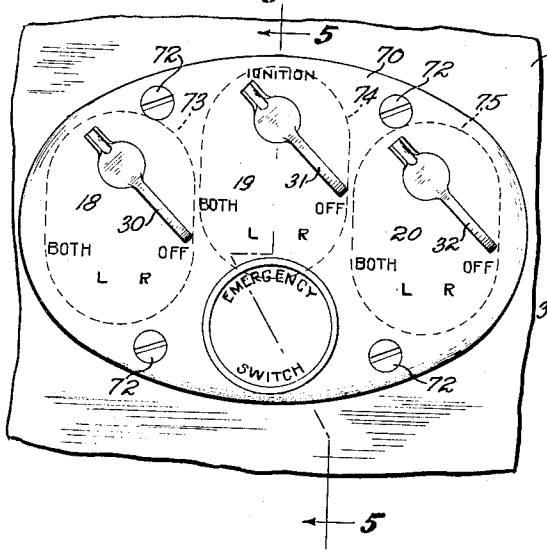


Fig. 4.

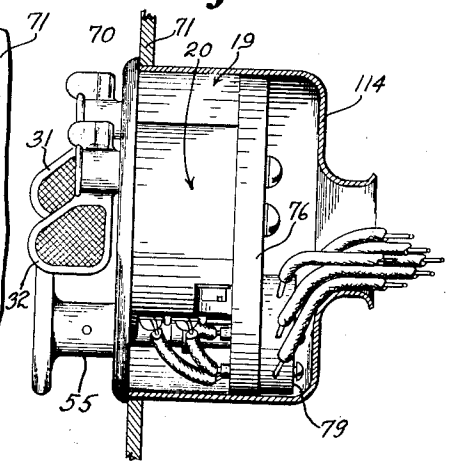
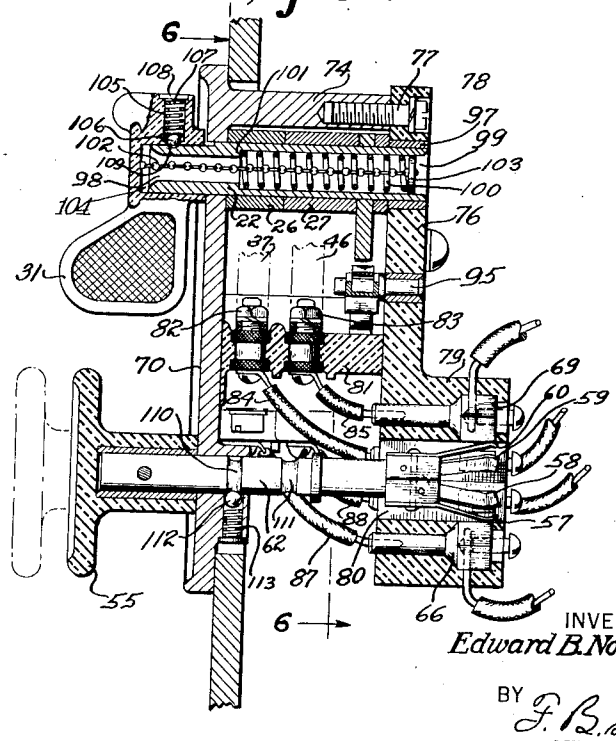


Fig. 5.



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UNITED STATES PATENT OFFICE

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MULTIPLE IGNITION SWITCH

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Application October 2, 1930, Serial No. 486,025
Renewed May 10, 1935

6 Claims. (Cl. 200—5)

The present invention relates to electrical control apparatus, and more particularly to a multiple ignition switch for controlling a plurality of ignition supply means of internal combustion engines.

One of the objects of the invention is to provide a novel unitary multiple ignition switch which is simple in construction, readily accessible, and positive in operation for controlling a plurality of ignition supply means from a common point.

Another object is to provide novel means whereby any one or all of a plurality of ignition supply means may be rendered operative or inoperative.

A further object is to provide novel control means for a plurality of ignition supply devices and embodying individual control means for rendering each of said devices operative or inoperative, and common control means for simultaneously rendering all of said devices inoperative irrespective of the operating conditions of the respective individual control means.

A still further object is to provide novel means for controlling a plurality of ignition circuits whereby said circuits may be controlled independently or in pairs or simultaneously.

Still another object is to provide a novel ignition switch for controlling a plurality of ignition supply devices and embodying means whereby said switch may be rendered inoperative to perform its controlling functions.

The above and other objects and advantages will appear more fully hereinafter from a consideration of the detailed description which follows, with reference to the accompanying drawings, wherein is illustrated one embodiment of the invention. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

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

Fig. 1 is a schematic wiring diagram showing the control means embodying the present invention employed on a multi-engined airplane;

Fig. 2 is a diagrammatic illustration of the sequential positions of the control members of one of the individual control devices;

Fig. 3 is a front elevation of one mechanical embodiment of the invention mounted upon a panel, portions of the latter being broken away;

Fig. 4 is a side elevation thereof, partially in section;

Fig. 5 is an enlarged sectional view taken on line 5—5 of Fig. 3; and

Fig. 6 is another sectional view, taken on line 6—6 of Fig. 5.

Referring now to the diagrammatic illustration shown in Fig. 1, the invention is shown employed on a multi-engined airplane 7 powered by left and right outboard engines 8 and 9 and center engine 10. Double ignition is employed, and to this end the engines are each provided with two magnetos 11 and 12, 13 and 14, and 15 and 16, respectively. Each of said magnetos is connected to a common ground, as indicated at 17.

Means are provided for controlling said magnetos in pairs so that they may be selectively turned on and off. In the form shown, said means comprise switching mechanisms 18, 19, and 20, each of which is adapted to control a pair of magnetos connected thereto. The mechanisms include shafts 21, 22, and 23 of some suitable conducting material, to which are rigidly secured and in electrical contact therewith, cams 24 and 25, 26 and 27, and 28 and 29, arranged in pairs as indicated. The pairs of cams are adapted to be rotated as by means of levers 30, 31, and 32 secured to their respective shafts. Cams 24, 26, and 28 are each provided with a peripheral projection 33, 34, and 35 which are adapted to engage spring contacts 36, 37, and 38, respectively; while cams 25, 27, and 29 are each provided with a pair of peripheral projections 39 and 40, 41 and 42, and 43 and 44, which in turn are arranged to engage spring contacts 45, 46, and 47 as the shafts on which the respective cams are mounted are rotated. Shafts 21, 22, and 23 are all connected to a common ground, as indicated at 48, by means of conductors 21*a*, 22*a*, and 23*a*.

Switching mechanisms 18 and 20 are arranged to control the ignition devices of the left and right outboard motors 8 and 9, respectively; while the center mechanism 19 is arranged to control the ignition devices of the center motor 10, and for this purpose the spring contacts 36 and 45 of mechanism 18 are connected to magnetos 11 and 12 by means of leads 49 and 50, and contacts 37 and 46 are connected to magnetos 15 and 16 by means of leads 51 and 52; while contacts 38 and 47 are connected to magnetos 13 and 14 by means of leads 53 and 54.

It will be apparent from the diagram in Fig. 1 that when the cams 24 and 25 of mechanism 18 are in the positions shown, the projections

33 and 40 thereon are in electrical engagement with the spring contacts 36 and 45, thereby grounding the magnetos 11 and 12 and rendering them inoperative. The position of the cams 26 and 27, as indicated, is such that projection 34 on the former is in electrical engagement with spring contact 37, thereby grounding magneto 15, while projections 41 and 42 on the latter cam are disengaged from the spring contact 46, thus rendering magneto 16 operative; while cams 28 and 29 are rotated in such a position that neither the projection 35 nor the projections 43 and 44 are in engagement with spring contacts 38 and 47, thereby leaving magnetos 13 and 14 in operation.

By simple rotating the lever 30, 31, or 32, the respective pair of cams operated thereby may be rotated so that either one or both of each pair of magnetos may be grounded or both may be left in operation. This is more clearly brought out in Fig. 2, wherein is represented diagrammatically one pair of cams in the various positions. As indicated, when the cams are in position (*a*), both magnetos are grounded, and therefore off, since projection 33 is in engagement with spring contact 36 and projection 40 is in engagement with spring contact 45. In position (*b*) projection 33 is still in engagement with contact 36, but projection 40 is now disengaged from contact 45, thus grounding or cutting off the left magneto while the right magneto is turned on. In position (*c*) projection 33 has moved away from the contact 36 and is disengaged therefrom, while projection 39 on cam 25 is now in engagement with spring contact 45, thereby turning on the left magneto and grounding or turning off the right magneto. In position (*d*) both magnetos are on, since none of the projections 33, 39, and 40 is engagement with the respective spring contacts 36 and 45.

It is desirable, in an emergency, to render all of the ignition devices inoperative, and to this end means are provided for simultaneously grounding all of the magnetos. In the form shown, said means comprises a push-pull switch 55 provided with a plurality of spring contacts 56, 57, 58, 59, 60, and 61 secured to a rod or shaft 62, the latter being grounded as indicated at 63. All of said spring contacts are movable with the rod 62 when the switch 55 is pushed in or pulled out, and upon an inward motion of said rod the spring contacts are adapted to engage fixed contacts 64, 65, 66, 67, 68, and 69, the latter being connected to magnetos 11, 14, 13, 16, 15, and 12, respectively, by means of conductor leads 64*a*, 65*a*, 66*a*, 67*a*, 68*a*, and 69*a*. It will be seen that when the switch 55 is pushed in so that the movable contacts engage the fixed contacts, all of the magnetos will be grounded by means of the rod 62 and ground connection 63, irrespective of the positions of the cams of the individual mechanisms 18, 19, and 20.

In the mechanical embodiment illustrated in Figs. 3 to 6, inclusive, the novel switch embodying the present invention comprises an escutcheon plate 70 which is adapted to be secured to an instrument panel 71 in any suitable manner, as by means of screws 72, and which has formed integral therewith rearwardly projecting portions 73, 74, and 75, the latter forming casings for the various elements of the individual switching mechanisms 18, 19, and 20, respectively. The plate may be made of any suitable conducting material, preferably aluminum.

A rear plate 76 of some suitable insulating material, such as bakelite, is secured to the casings 73, 74, and 75, in any suitable manner, as by means of screws 77, which are countersunk as indicated at 78, and serves as a supporting plate for the various elements of the mechanisms 18, 19, and 20. Centrally located on said plate and at the lower part thereof, a boss 79 is provided which serves as a terminal block for connecting the switch to the ignition devices. For the latter purpose there are provided the terminal contacts 64, 65, 66, 67, 68, and 69 hereinbefore described, which may be countersunk in the boss or molded thereinto as indicated in Fig. 3. The boss is provided with a central bore 80 for the reception of the movable spring contacts 56, 57, 58, 59, 60, and 61 secured to the rod 62.

Each of the switching mechanisms 18, 19, and 20 is provided with a supporting shelf 81 secured between the escutcheon plate 70 and the rear plate 76 on which are mounted the spring contacts 36—45, 37—46, and 38—47 by means of the binding posts 82 and 83, the latter being connected to the various fixed contacts as by means of conductors 84, 85, 86, 87, 88, and 89.

As hereinbefore stated, the spring contact members 37 and 46 are arranged to contact with the projections on cams 26 and 27, respectively. Means are provided for preventing the cams from moving out of the positions into which they are rotated by means of their respective shafts and levers, and in the form shown comprise a pawl and ratchet arrangement which includes a plate 90 secured to the shaft 22 and rotatable therewith and provided with peripheral notches 91 into which is adapted to extend a roller 92 of the pawl member 93, the latter being pivoted at 94 and arranged to engage plate 90 in the notches 91 by means of the spring member 95 secured to the pawl as indicated at 96 and to the supporting shelf 81. The number of notches 91 which is necessary depends upon the number of positions into which the cams are to be moved, and in the present instance four are provided so that the cams may be moved into the four positions indicated diagrammatically in Fig. 2. Projections 74*a* and 74*b*, which may be formed integral with or secured to casing 74, serve as stops to limit the motion of plate 90 in the positions indicated in full lines and in dot-dash lines.

The shafts 21, 22, and 23 are journaled in the escutcheon plate 70 aranged to provide a direct electrical contact therewith for the purpose of grounding said shafts, and in the rear insulating plate 76 by means of a metallic bushing 97.

Means are provided for detachably securing the levers 30, 31, and 32 to the respective shafts so that the mechanisms may be rendered inoperative, and to this end each of the shafts is provided with a central bore 98 having an enlarged portion 99 into which is inserted a coil spring 100, the latter abutting an annular wall 101 formed by the smaller bore 98. A chain 102 secured at one end to the lever 31 is provided at its other end with a washer 103, the latter abutting the opposite end of the coil spring 100. Each of the levers 30, 31, and 32 is provided with a longitudinal bore 104 into which their respective shafts are adapted to extend, and with a transverse bore 105 in which are located a ball member 106 and a coil spring 107 for holding the ball member in position. A cap 108 is provided for holding spring 107 against the ball member 106. Each of the shafts 21, 22, and 23 is provided with an indentation 109 in which the ball member 106 is

adapted to be seated and serves to lock the levers to the shafts.

With this construction it will be seen that when the levers are pulled outward or to the left (Fig. 5) the coil spring **100** will be compressed by means of the chain and washer connection, and ball **106** will be forced into the bore **105** against the tension of spring **107**, thereby disengaging the levers from the shafts, rendering the latter inoperative to rotate the cams mounted thereon until such time as the levers are brought back into normal position by the action of the spring **100** to cause a locking engagement between the levers and the shafts by means of the ball **106** and spring **107**.

The rod **62** which carries the movable spring contacts is adapted to be moved inward and outward, or to the left and right, as indicated in Fig. 5, and arranged to be held in either of said positions after it is moved thereinto. For this purpose the rod is provided with a pair of adjacent circumferential grooves **110** and **111** which are adapted to be engaged by a ball member **112** under the action of a coil spring **113** located in a bore formed in the lower portion of the escutcheon plate **70**. It will be apparent that when the knob **55** is pulled to the left as indicated in dotted lines in Fig. 3, the ball member **112** will be forced into the bore until the rod **62** has moved into such a position that the groove **111** will be in alignment with the ball member **112**, at which time the ball member will be forced into the latter groove by the action of the spring **113**, causing the rod to be locked in the position into which it has been moved.

An electrical shield **114** of some suitable material such as copper or aluminum is provided which encloses all of the elements of the switch and prevents radiation of energy when the contacts are closed and opened.

The operation of the switch is as follows: When it is desired to turn on all of the magnetos **11** to **16** inclusive, the knob **55** is pulled outward to break the circuit between the various movable contacts carried by the rod **62** and the fixed contacts with which they are associated, so that the grounding connection is removed, and then the levers **30**, **31**, and **32** are moved to the left as viewed in Fig. 1, until they point to the mark "Both" inscribed on the escutcheon plate, at which time the pairs of cams carried by the shafts controlled by the levers are in the position (*d*) indicated in Fig. 2 and out of engagement with their respective spring contacts. If it is desired at any time to cut out any one of the magnetos, the lever **30**, **31**, or **32** is moved until it points to the marks "L" or "R", at which time the cams will be in the positions (*c*) or (*b*) shown in Fig. 2, causing one or the other of each pair of magnetos to be grounded. If it is desired to cut off both of each pair of magnetos, the levers are moved to the "off" position, at which time the cams will be in position (*a*) and both of the magnetos will be grounded.

If it is desired at any time, as for example in an emergency, to render all of the magnetos inoperative, all that is necessary is to push the knob **55** inward, thereby causing the movable spring contacts to engage the fixed contacts, thus grounding the magnetos through the rod **62** and the escutcheon plate **70** by means of the electrical contact formed by the ball **112** and spring **113**. It will be apparent that the magnetos will be grounded when the knob **55** is in the position indicated in Fig. 5, irrespective of the positions of the levers **30**, **31**, and **32**.

The novel ignition system per se is claimed in copending application Serial No. 731,969, filed June 22, 1934, which is a division of the present case and is assigned to the same assignee.

There is thus provided a novel multiple ignition switch for controlling a plurality of ignition devices, particularly adapted for use on multi-engined aircraft, which is simple in construction, positive in operation, inexpensive to manufacture, and readily accessible when mounted on an instrument panel. The novel arrangement of the cooperating mechanisms provides a structure which may be easily and quickly secured or detached to or from an instrument panel as a single unit.

Although the switch has been illustrated for cutting off the various ignition devices by grounding them, which is generally the practice when magnetos are used, it will be obvious that the switch is adapted for use with battery ignition employing ignition coils, in which case the conductor leads **64***a*, **65***a*, **66***a*, **67***a*, **68***a*, and **69***a* and the ground connection **48** may be eliminated and the leads **21***a*, **22***a*, and **23***a* from the shafts **21**, **22**, and **23** may each be connected to separate ones of the fixed contacts **64**, **65**, **66**, **67**, **68**, and **69**, while the source of direct current, such as a battery may be connected between the ground **63** indicated in Fig. 1 and the conductor leading to the rod **62**, thereby causing the cams to close the circuit of the battery when the projections on the cam engage the spring contacts and knob **55** is in the "in" position. In this case the operation of the switch will then be reversed and knob **55** will have to be pushed in to cause the movable spring contacts thereon to engage the fixed contacts to close the battery circuit, and in an emergency will have to be pulled outward to break the circuits and render the ignition coils simultaneously inoperative irrespective of the positions of the cams on shafts **21**, **22**, and **23**.

While only one embodiment of the invention has been illustrated and described, various changes in form, arrangement, and substitution of parts, which will now appear to those skilled in the art, may be made without departing from the scope of the invention, and reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A control switch for a plurality of circuits, comprising a mounting plate having a plurality of surfaces projecting therefrom to form separate housings in conjunction with a rear plate having a terminal block, switching mechanisms in said housings each of which includes a rotatable shaft journaled in said mounting plate and said rear plate, a plurality of cam members carried by and rotatable with said shafts and cooperating with a plurality of fixed contacts, a plurality of terminals in said terminal block having connections with said fixed contacts and arranged for connection to external circuits whereby upon rotation of said shafts the cam members are adapted to open and close said circuits through the fixed contacts, and a member having a plurality of contacts arranged upon movement thereof to engage the terminals in the terminal block whereby said external circuits may be controlled simultaneously and independently of said switching mechanisms.

2. A control switch for a plurality of circuits, comprising a metallic mounting plate having a plurality of surfaces projecting therefrom to form separate housings in conjunction with a rear insulating plate having a terminal block, switching

mechanisms in said housings each of which includes a rotatable shaft journaled in said mounting plate and having electrical contact therewith and in said rear insulating plate, a plurality of cam members carried by and rotatable with said shafts and cooperating with a plurality of fixed resilient contacts, a plurality of terminals in said terminal block having connections with said fixed contacts and arranged for connection to external circuits whereby upon rotation of said shafts the cam members are adapted to ground said circuits through the fixed contacts and the mounting plate, and a member having a plurality of contacts arranged upon movement thereof to engage the terminals in the terminal block whereby said external circuits may be grounded simultaneously and independently of said switching mechanisms.

3. A control switch for a plurality of circuits, comprising a casing, a rotatable hollow shaft journalled therein, a plurality of cam members carried by and rotatable with said shaft, a plurality of resilient contacts carried by a supporting member within said casing and adapted to be engaged by said cam members upon rotation of said shaft, an operating lever for actuating said shaft, and means including a resilient connection between the shaft and lever normally maintaining them in operative relation and whereby said lever may be disconnected from the shaft to render the latter inoperative.

4. A control switch for a plurality of circuits, comprising a mounting plate having a plurality of surfaces projecting therefrom to form separate housings in conjunction with a rear plate having a terminal block, switching means in said housings each of which includes a rotatable shaft journaled in said mounting plate and said rear plate, a plurality of cam members carried by and rotatable with said shafts and cooperating with a plurality of fixed contacts, a plurality of terminals in said terminal block having connections with said fixed contacts and arranged for connection to external circuits whereby upon rotation of said shafts the cam members are adapted to open and close said circuits through the fixed contacts, and a member having a plurality of contacts arranged upon longitudinal movement of said member to engage the terminals in the terminal block whereby said external circuits may be controlled simultaneously and independently of said switching mechanisms.

5. A control switch for a plurality of circuits, comprising a metallic mounting plate having a plurality of surfaces projecting therefrom and integral therewith to form separate housings in conjunction with a rear insulating plate having a terminal block, switching mechanisms in said housings each of which includes a rotatable shaft journaled in said mounting plate and having electrical contact therewith and in said rear insulating plate, a plurality of cam members carried by and rotatable with said shafts and cooperating with a plurality of fixed resilient contacts carried in said housings, respectively, a plurality of terminals in said terminal block having connections with said fixed contacts and arranged for connection to external circuits whereby upon rotation of said shafts the cam members are adapted to ground said circuits through the fixed contacts and the mounting plate, and a member having a plurality of contacts arranged upon longitudinal movement of said member to engage the terminals in the terminal block whereby said external circuits may be grounded simultaneously and independently of said switching mechanisms.

6. A control switch for a plurality of circuits comprising a casing, a rotatable hollow shaft journaled therein, contact means carried by and rotatable with said shaft, a plurality of fixed contacts carried by said casing and adapted to be engaged by the first contact means upon rotation of said shaft, an operating lever for actuating said shaft, and means including a spring within said shaft compressible longitudinally thereof and forming a resilient connection between the shaft and lever and means releasably locking said lever to said shaft for normally maintaining them in operative relation and whereby upon outward longitudinal movement of said lever against the compression of said spring said lever may be disconnected from the shaft to render it inoperative to actuate said shaft.

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