April 10, 1951 W. W. BROCKWAY 2,547,999

RELAY MOUNTING

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Fig. 1.

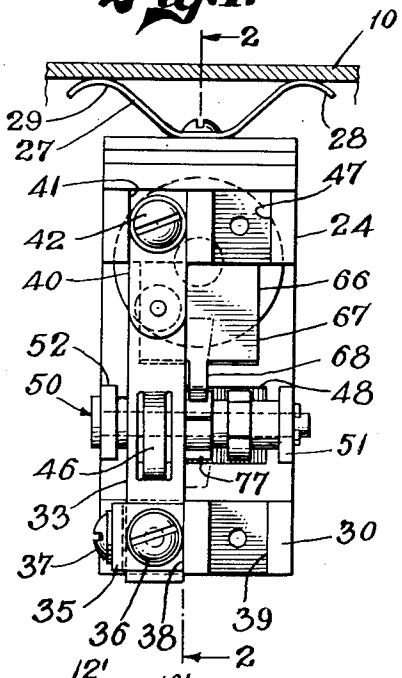


Fig. 2.

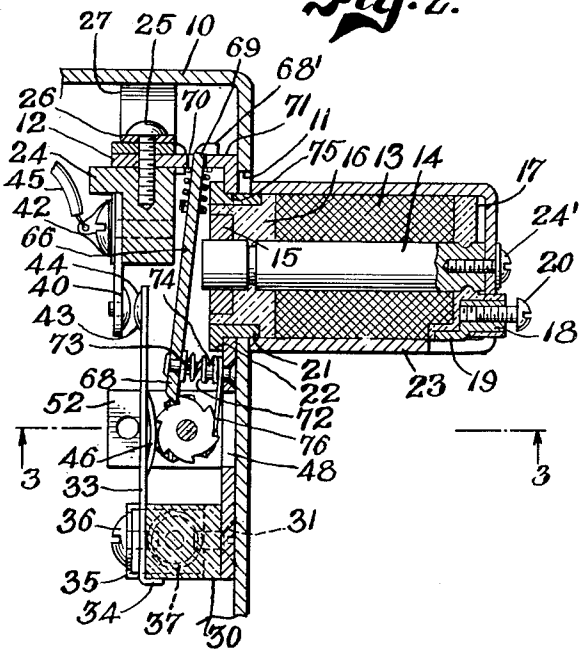


Fig. 5.

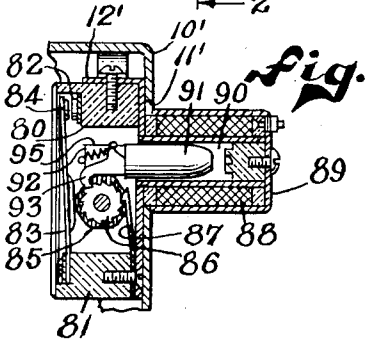
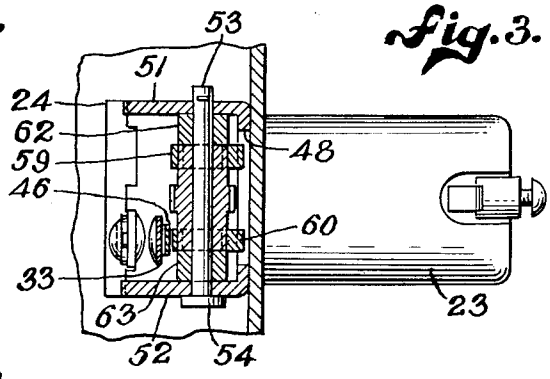


Fig. 3.



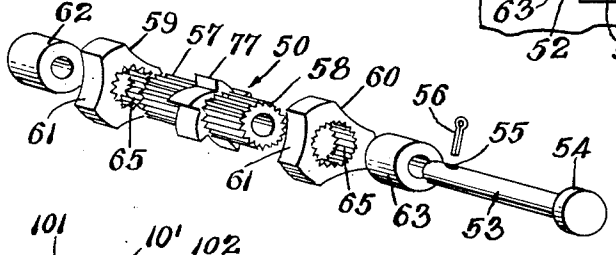


Fig. 4.

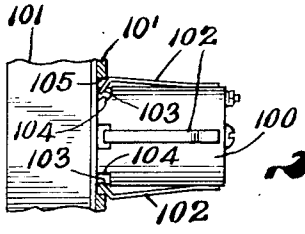


Fig. 6.

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RELAY MOUNTING

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Fig. 7

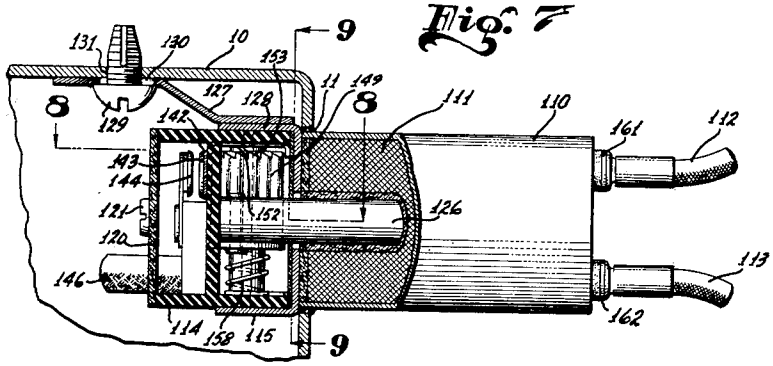
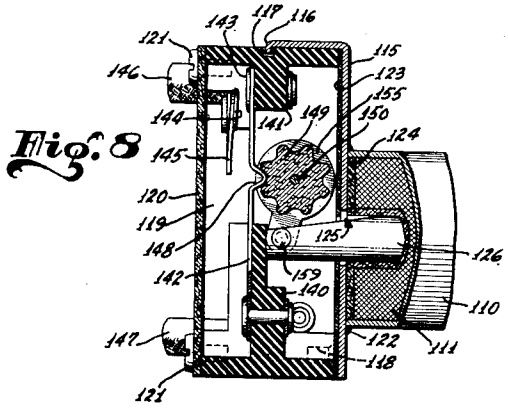


Fig. 8



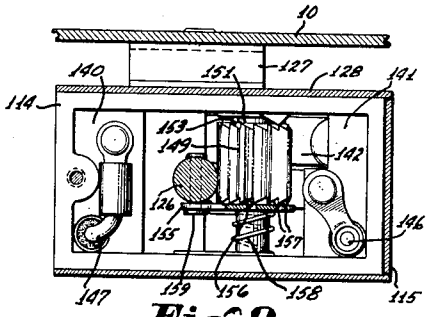
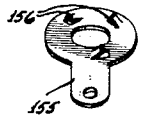


Fig. 9

Fig. 10

Fig. 13



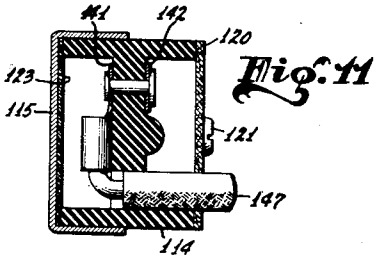


Fig. 11

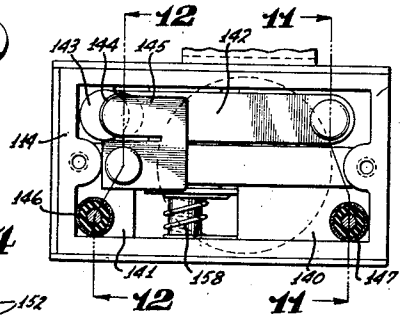
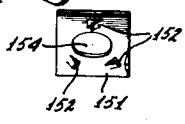


Fig. 14



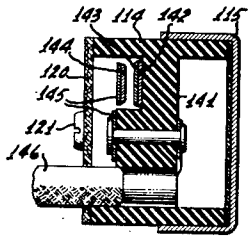


Fig. 12

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UNITED STATES PATENT OFFICE

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RELAY MOUNTING

Wilhelm W. Brockway, Los Angeles, Calif.

Application August 29, 1947, Serial No. 771,328

2 Claims. (Cl. 200—105)

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The invention relates to electric apparatus and has particular reference to an impulse relay mounted in a conventional outlet box provided with knock-out holes. Although the design of electric apparatus and particularly switches and relays has been conventionalized to a large extent, there is an ever present need of simplifying structures of this kind so that they can be made economically and can be installed with a minimum expenditure of man hours of a mechanic's time.

The invention also relates to a device incorporating sufficient protection features to the extent that devices which handle relatively high voltage of the magnitude of an ordinary lighting circuit are protected within a conventional outlet box; whereas, devices cooperating with the high voltage devices, but which are operated by low voltage, are adapted to extend outside of the conventional outlet box.

It is accordingly among the objects of the invention to provide a new and improved relay device which is sufficiently compact so that it can be fitted to the knock-out hole of a standard conduit outlet box, provision being made for a low voltage connection outside and a high voltage connection sealed within the box.

Another object of the invention is to provide a new and improved impulse relay device wherein parts are held in place without the use of screws so that it may be quickly assembled and disassembled.

Still another object of the invention is to provide a new and improved impulse relay device necessitating the use of but a single screw in the initial assembly and having the parts so constructed that they are spring-located in assembled relationship permitting ready disassembly by contracting the spring to free one part from its engagement with another.

A further object of the invention is to provide a new and improved relay device and mounting therefor wherein the high voltage portion of the relay device and the low voltage portion are connected together but assembled in such a way that they can be mounted together in association with a conventional outlet box so that the high voltage portion is inside of the box and the low voltage portion is outside of the box and both portions securely anchored in place by a quick, conveniently operated connecting device.

A still further object of the invention is to provide a new and improved relay device and mounting therefor wherein one portion of the relay device for operating a high voltage circuit and another portion of the relay device for operation in a low voltage circuit have casings therefor mounted together so that the low voltage device extends outwardly through a knock-out hole in a conventional outlet box, the high and low voltage portions, however, being electrically separated from one another so that the box when equipped with the high and low voltage portions continues to form an effective seal for the high voltage portion which is retained within its interior.

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With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in the claims and illustrated in the accompanying drawings, in which:

Figure 1 is an end elevational view of the device.

Figure 2 is a longitudinal sectional view of the device taken on the line 2—2 of Figure 1.

Figure 3 is a cross-sectional view of the device taken on the line 3—3 of Figure 2.

Figure 4 is an exploded view of an adjustable composite shaft incorporating a ratchet wheel and cam wheels.

Figure 5 is a longitudinal sectional view of a modified form of the device.

Figure 6 is a side view, partly in section, of a modified form of a coil cover.

Figure 7 is a longitudinal view of a modified form of the device partly broken away.

Figure 8 is a sectional view taken on the line 8—8 of Figure 7.

Figure 9 is a cross-sectional view taken on the line 9—9 of Figure 7.

Figure 10 is a left end view of the device illustrated in Figure 7.

Figure 11 is a cross-sectional view taken on the line 11—11 of Figure 10.

Figure 12 is a cross-sectional view taken on the line 12—12 of Figure 10.

Figure 13 is a perspective view of one ratchet element.

Figure 14 is a perspective view of another ratchet element.

This is a continuation-in-part of my co-pending patent application, Serial No. 626,513, filed November 3, 1945.

Although considerable attention in the past has been directed to the simplification of manually operated electric switches, there has been considerable resistance to changes in devices de-

signed for automatic operation. Much of this resistance has been due to the feeling that unless automatic devices are of rugged construction they do not incorporate a sufficient safety factor to be installed in remote or inaccessible places where servicing may be difficult and infrequent. To provide an automatic switch which incorporates a sufficient safety factor and at the same time is of simple and inexpensive construction requires that careful attention be given to operating parts so that they have a freedom of operation while at the same time are so designed and are so assembled that they cannot readily get out of order. It is also highly desirable in apparatus of this kind to provide a simple assembly process so that the parts fit more or less automatically into their proper places with respect to each other and need be secured by only one or two tightening devices such as screws so that the likelihood of placing undue strain upon delicate parts when assembling or mounting is reduced to a negligible quantity.

An important application of a device of the kind described herein is its use in a normal house lighting circuit. It is contemplated that the impulse relay will be located in the light fixture box and connected to a push button switch adapted to momentarily close the circuit such. for example. as the push button switch disclosed in my co-pending application, Serial No. 626,512, filed November 3, 1945.

Used in this manner the impulse relay eliminates conduit and high voltage wires between the light outlet and the switch. Inasmuch as only a normal door bell transformer circuit is needed to operate the impulse relay carrying no more than 24 volts, ordinary doorbell wire may comprise the only connection between the push button switch and the relay. The 110 volt wires can be led directly to the relay terminals within a suitable outlet box.

It will be apparent, also, that complex two, three and four way light switching circuits involving multiple wire connections and conduit may be replaced with equal facility by open run bell wire. In this set-up push buttons may be in parallel at the respective control points in the house. Normal prohibitive multiple switch costs are minimized, and any number of light control points can be used with only the added cost of extra switches.

Another important consideration is the fact that high voltage light circuits are connected to the relay within the outlet box. A low voltage circuit, although connected to the device, is secured to binding posts on the exterior. Insertion of the relay in a knock-out hole plugs the knock-out hole and satisfies necessary safety requirements.

In an embodiment chosen to illustrate a simplified device incorporating requisite safety factors, there is shown an impulse type relay assembly adapted to fit into outlet box **10** which has a conventional knock-out hole **11** of the usual size, as small as, in some instances, 7/8". The relay device consists of two main operations, one constituting a mechanical device mounted upon a frame **12** and the other constituting an electric coil assembly **13**.

The electric coil comprises a core **14** having a shaded pole **15** at one end held in place with relation to the core and coil by a molded plastic disc **16**. At the other end of the coil is a similar molded plastic disc **17** in which is molded a terminal post **18** having a lateral extension **19** and a terminal screw **20**.

A mounting ring **21** is secured in place around the shaded core from which it is insulated by a portion of the plastic disc **16**. The ring is provided with a flange **22** for mounting purposes. It will be noted that the diameter of the flange is slightly smaller than the diameter of the knock-out hole **11** so that the mounting ring may be passed through the hole. A coil cover **23** surrounds the coil and extends into a position surrounding the small end of the mounting ring and is held in place by a screw **24'** which extends into the core **14**. When the coil and cover are mounted upon the box the cover, together with the other metallic parts of the device, complete a magnetic circuit around the coil. It should be borne in mind, however, that the cover is preferably not applied to the coil until after the parts of the device are assembled.

The remaining parts of the impulse relay construction are all supported by the frame **12**. Included among the parts is a mounting block **24** of dielectric material which is attached to the upper side of the frame by means of an assembly screw **25**. Also attached to the frame by means of the same screw is a spring keeper **26** and a spring **27**. It will be noted that the spring is provided with arcuately extending wings **28** and **29** designed to contact the inside surface of the top wall of the box **10**.

At the other end of the frame is a similar mounting block **30** likewise of dielectric material which may be held in place by a flathead screw **31**. Mounted upon the block **30** is a contact arm **33** having an overhanging portion **34** pressed against the lower side of the block. The contact arm is retained by an angle element **35** held in place by screws **36** and **37**. The block is provided with a recess **38** for the contact arm so that it cannot slip from its proper place. A second recess **39** is also provided within which another contact arm may be placed whenever desired.

On the other block **24** there is mounted a contact arm **40** received in a recess **41** and retained therein by a screw **42**. A similar recess **47** is provided in the event a second set of contact arms may be used. The contact arm **40** has a point **43** adapted to engage a corresponding point **44** on the other contact arm so that a suitable electric contact can be made whenever the points are brought together. The screw **42** serves as a binding post for an electric lead **45**, and the screw **37** provides a binding post for a lead on the opposite side of the points. The contact arm **33** has a central depressed portion **46**, the purpose of which will be described later.

Associated with the contact arm **33** is a composite shaft **50**, shown in detail in Figure 4, and adapted to be supported by brackets **51** and **52**, at the sides of the frame intermediate the mounting blocks. The composite shaft comprises a shaft pin **53** having a head **54** at one end and a cotter pin aperture **55** at the other end in which may be inserted a cotter pin **56**. The pin **53** extends through suitable holes in the brackets **51** and **52**.

Mounted upon the pin is a ratchet wheel **77** which has serrated lateral extensions **57** and **58**. At the sides of the ratchet wheel are cam wheels **59** and **60** having flats **61** three in number in this example for the sake of illustration, spaced equidistant about the circumference of the wheel. The number of teeth on the ratchet wheel normally will have a direct relation to the number

of flats on the cam wheels. A cut-out portion 48 in the frame provides a space in which the cam wheels may rotate unrestricted. Collars 62 and 63 are adapted to fit between the respective cam wheels and adjacent brackets thus completing the composite shaft. The cam wheels are provided with serrated interiors 65 so that they may be adjusted upon the cam wheel with respect to each other and with respect to teeth on the ratchet wheel. The construction just described contemplates the substitution of a ratchet wheel or cam wheels or both having a different number of teeth or flats to allow a variation in the operating effect.

A combination actuator and armature 66 is adapted to rotate the composite shaft by means of the ratchet wheel. The armature consists of a relatively wide section 67 and a narrow actuating end 68 having a tapered edge which is adapted to engage the teeth of the ratchet wheel one by one. At its other end the armature is provided with a finger 69 which extends through a suitable hole in the end of the frame not shown but of a size substantially larger than the finger so that there is a certain amount of freedom of movement of the armature with respect to the frame. In order to hold the armature in proper position there are provided a pair of extensions 68' located one on each side of and spaced from the thin finger 69. The extensions are designed to fit loosely within holes 70. The extensions are spaced a sufficient distance on each side of the finger so that a spring 71 may be fitted around the finger between the finger and the extensions. The spring presses at one end against the end of the frame and at the other end longitudinally against the armature at the bottom of the spaces separating the finger from the extensions. The thrust of the spring, therefore, tends to urge the armature endwise in a downward direction, as viewed in Figures 1 and 2, and thus presses the end of the finger against the ratchet wheel.

A second coiled spring 72 is located at the opposite end of the armature, retained in position by spring keepers 73 and 74, and tends to rotate the armature in a clockwise direction as viewed in Figure 2.

When the device is initially assembled, all of the parts which are to be attached to the frame 12 are secured in place so that the frame and its numerous parts comprise one unit in the assembly, and the parts of the coil which include the core, shaded pole, mounting ring and plastic discs comprise another unit. The frame unit 12 and its sundry parts and the coil unit are preferably secured together initially before application to the conduit box. The coil unit may readily be extended through the hole 75 of the frame before the switch elements are mounted thereon. By providing a pressed fit between the exterior of the mounting ring and the wall of the hole 75, these parts will effectively maintain their relative positions until the frame and coil units thus assembled are applied to the conduit box. After this operation the coil cover 23 may be applied and held in place by the screw 24'. As illustrated, the edge of the coil cover nearest the frame will be held in a position spaced from the adjacent wall of the frame by a distance approximately equal to the thickness of the wall of the conduit box in which is the knock-out hole 11. When the combined frame and coil units are to be applied to a conduit box, it is necessary only to extend the coil in its cover 23 outwardly

through the knock-out hole 11 until the bottom of the frame is pressed against the bottom of the conduit box. During this operation the spring 27 will be slightly depressed. When the coil unit is finally extended all the way through the knock-out hole, the frame and coil unit together may be pressed downwardly so that the space between the inner end of the coil cover and the adjacent face of the frame receives the lower edge of the knock-out hole. The frame and coil units will be maintained in this locked position with respect to the conduit box by pressure of the spring 27 upwardly against the frame unit.

To release the frame and coil units from the box it is necessary to do no more than press the frame upwardly against the tension of the spring 27 until engagement with the edge of the knock-out hole is released and then to draw the coil unit outwardly through the knock-out hole.

In operation, an electric lead, of voltage as low as 24 volts such as that from a doorbell transformer, is connected to one coil terminal by the screw 20. The other coil terminal may be grounded through the coil cover and the metal cable of the electric lead. When the coil is energized the armature 66 is drawn against the end of the shaded pole against the pressure of spring 72 and likewise against the pressure of spring 71. The armature thus moves in two directions, both lateral and in an endwise upward direction. The throw of the armature is sufficient to advance the ratchet wheel one notch. When advanced the ratchet wheel will be held in its new position by a detent 76. As soon as the coil is de-energized, the springs 71 and 72 return the armature to the position shown in Figure 2. The corner of the mounting block 24 adjacent the armature will block movement of the armature toward the left, as viewed in Figure 2, and thus prevent the spring 72 from moving the armature too far when the coil is de-energized.

As the ratchet wheel is rotated it rotates the composite shaft and likewise the cam wheels 59 and 60. At initiation of operation one of the flats 61 of the cam wheel 59 may be located beneath the depressed portion 45 of the contact arm 33. In this position it may be presumed that the contact points 33 and 34 are separated from each other. As the cam wheel rotates a high portion of the cam adjacent the flat will be pressed against the depressed portion of the contact arm and lift the arm so that the contact points are engaged, thus closing a circuit through the relay. Continued operation of the armature continues the rotation of the composite shaft and periodically makes and breaks contact between the points. By adjusting the cam wheel 59 with respect to the position of the teeth on the ratchet wheel the points may be retained either separated or in contact for any given position of the ratchet wheel.

Should an additional number of contacts be desired by operation of the relay, another pair of contact arms may be applied to the mounting blocks on the opposite side in the space provided, and the second set of contact arms could then be operated by the cam wheel 60. This cam wheel likewise may be adjusted as desired with respect to the ratchet wheel or the cam wheel 59. To change the adjustment of either cam wheel it is necessary only to withdraw the cotter pin 66 and the pin 53 and then separate either one or both of the cam wheels from the ratchet wheel, rotating them a desired amount to provide the new adjustment and then re-apply them to each

other followed by again mounting them upon the pin 53. The serrations will retain the cam wheels in fixed position with relation to the ratchet wheel. It will be obvious that a great variety of combinations of contacts may be incorporated as, for example, by selecting two cam wheels on one of which a low side or flat is followed by two high side intervals preceding another flat while on the other cam wheel a low side or flat is followed by one high side interval preceding two low side intervals or flats. With a combination such as this wherein the contact points close 110 volt lighting circuits of similar magnitude, rotation of the composite shaft one interval will close both circuits, rotation of the shaft a second interval will open one of the circuits but leave the second circuit closed following which rotation of the composite shaft still another interval will open both circuits. In this way a battery of lights could be turned on full, then diminished by one-half and finally turned out. It will be obvious that the cam wheels can be constructed with high sides and low sides in a wide variety of combinations and sequences to secure any one of a wide variety of effects. Although the low voltage coil connection may be exposed, high voltage lighting connections may safely be sealed within the outlet box.

In a modified form of the device illustrated in Figure 5 there is incorporated a moving core solenoid instead of the stationary core solenoid illustrated in the embodiment first described. In the modified form an outlet box 10' provided with a knock-out hole 11' is designed to house a frame 12'. Secured to the frame are insulated mounting blocks 80 and 81. A switch contact point 82 is shown on the block 80, and on the block 81 is mounted a switch arm 83 bearing a contact point 84 adapted to close upon the point 82. For shifting the contact arm between open and closed positions there is provided a cam wheel 85 rotatably mounted upon the frame by means similar to that described in the first form. The cam wheel provides a lift for elevating the arm to a position wherein the contact points are separated. Non-rotatably secured to the cam wheel is a ratchet wheel 86 which is engaged by a one-way detent 87. A low voltage coil 88 secured within a cover 89 has an axial bore 90 within which a moving core 91 is adapted to reciprocate.

Mounted on the outside end of the moving core is a bracket 92 and a hook 93 pivoted to the bracket and adapted to engage the ratchet wheel. A coiled spring 95 anchored at one end to a projection on the hook and at the other end to a pin secured to the frame serves the combined purpose of drawing the core outwardly again after it has been retracted by a magnetic impulse and also holding the hook releasably in engagement with the ratchet wheel. In other respects the modified construction has the same general characteristics as the first described form which permits it to be readily removed from the outlet box.

A second modified form of the device, shown in Figure 6, incorporates a modified means of attaching the assembly to an outlet box 10''. The particular means of attachment may be used, with suitable modifications, with the device illustrated in either of Figures 1 or 5.

In particular, the device comprises a coil unit 100 having permanently attached at one end a frame unit 101. These units are substantially the same with regard to their working parts as the coil and frame portions of the previously described forms.

A special means of attachment is provided which consists of a series of spring clips 102 spaced about the circumference of the exterior of the coil unit and are adapted normally to spring outwardly. The spring clips have end portions 103 bent over at a slight angle. The exterior of the coil unit contains recesses 104 adapted to receive the end portions when they are pressed inwardly. It should be noted, also, that the diameter of the exterior of the coil unit, including the added thickness of the clips, will be slightly less than the diameter of a knock-out aperture 105. It will be appreciated, however, that the exterior of the coil unit itself may be slit so as to provide the necessary spring clips.

When the form shown in Figure 6 is assembled, the coil unit is pushed through the knock-out aperture, and during this portion of the assembly the spring clips will be pressed inwardly against the outer surface of the coil unit. As soon as the assembled coil and frame units reach the position shown in Figure 6, the clips will spring outwardly to the positions shown and firmly secure the parts in place. To remove the device from the outlet box it is necessary only to grasp the frame unit firmly and pull with sufficient force to force the bent over end portions of the clips inwardly sufficient to permit the coil unit to be pulled back through the knock-out aperture into the outlet box.

As heretofore described, the parts of the relay and coil mechanism have been illustrated as having a spring-retained engagement with the outlet box. An alternative construction is illustrated in Figure 7 and the figures following wherein the coil and switch mechanisms are adapted to be rigidly attached to the box.

In Figure 7 the outlet box 10 is provided, as previously described, with the knock-out hole 11. In this embodiment there is provided a coil casing 110 enclosing a coil 111 which is adapted to operate on a relatively low voltage by current supplied through leads 112 and 113.

In this embodiment there is provided a switch housing or frame 114 comprising a non-conducting material, and the housing is shown attached to a mounting plate 115. The mounting plate and housing are secured together at one side by interposition of a flange 116 of the mounting plate in a recess 117 of the housing and at the other end by means of a screw 118. The interior of the housing may be said to comprise a chamber 119 which is closed by a cover 120 of dielectric material held in place by screws 121.

As indicated more particularly in Figure 8, the coil casing 110 and the mounting plate 115 are secured together by means of a weld 122. It will be apparent, therefore, that the switch housing and the coil casing when assembled are, in effect, a single unit.

Adjacent the mounting plate 115 is a second sheet 123 of electric insulating material which forms what may be considered as a bottom for the chamber 119. A disc 124, also of insulating material, serves to separate the coil 111 from the mounting plate 115. In effect, the mounting plate 115, the sheet 123 and disc 124 in combination form elements of a partition which separates the coil from the chamber 119 both physically and electrically. The insulating materials form an electric insulation, and the metallic material forming the mounting may be considered as extending the bottom of the outlet box over the

knock-out hole except for that small central portion occupied by a core 126.

It will be noted, however, that the mounting plate 115, the sheet 123 and disc 124 have concentric apertures, herein designated generally by the reference character 125, the aperture serving to receive the moving core 126 which extends through the central portion of the coil 111.

As indicated in Figure 7, the mounting plate 115 has a tab or lug 127 attached to it at one of its long sides 128, and the tab is fastened to a side of the box 10 by means of a self-tapping screw 129. The tab is made of such length and an aperture 130 therein is so located that it fits snugly against the inside of the wall of the outlet box when the casing 110 is centered in an adjacent knock-out hole 11 of the outlet box, the aperture 130 being opposite a conventional fixture mounting hole 131.

In the specific mechanism shown in detail in Figures 7 through 14, inclusive, the switching mechanism and the mounting therefor within and in association with the outlet box is maintained as simple as possible and utilizes relatively few parts. As is clearly indicated in the sectional views of Figures 7 and 8, the housing 114 incorporates shelves 140 and 141 of electrically insulating material extending into the interior of the housing. On the shelf 140 is mounted a resilient switch arm 142 which extends over and is designed to rest upon the shelf 141, and at that location is provided with a switch point 143. A second switch point 144 is carried on the end of a resilient arm 145, the shape of which can best be seen in Figure 10. A high voltage lead 146 is connected to the switch point 144, and a second high voltage lead 147 is connected to the end of the switch arm 142. As best shown in Figure 8, the arm 142 has a somewhat V-shaped configuration 148 which is adapted to engage a star wheel 149, the star wheel being composed of an electrically insulating material.

The star wheel is designed to rotate about a shaft 150 and is actuated by the core 126 previously referred to. The core is reciprocated when the coil is charged, and one reciprocating stroke is sufficient to advance the star wheel an amount measured by the distance between the hollow between successive teeth and the crown of the next tooth. Operated in this manner, when the V-shaped configuration 148 rests in a hollow, the switch points 143 and 144 are separated from each other. When the wheel is advanced by the next stroke of the core, the crown of the tooth engages the configuration 148, thereby lifting the switch arm 142 an amount sufficient to bring the switch points into engagement. The next succeeding stroke of the core again brings a hollow between the teeth into alignment with the configuration, and the points are again separated.

A ratchet arrangement is designed for holding the star wheel in one or another of its set positions. To this end there is provided a ratchet plate 151 provided with ratchet points 152 which are adapted to engage depressions 153 on one end face of the star wheel. The ratchet plate is provided with a central aperture 154 through which the shaft 150 passes.

On the other side of the star wheel there is provided a crank 155 likewise provided with ratchet points 156, and these are adapted to engage in depressions 157 on the adjacent face of the star wheel. A coiled spring 158 serves two purposes, namely, that of pressing the crank

155 into engagement with the adjacent face of the star wheel and also that of biasing the crank rotationally in a direction which lifts the core 126 to an uppermost position as shown in Figure 8. In that position the end of the core abuts against the shelf 140. The outside end of the core is pivotally attached by means of a pin 159 to an extension of the crank.

In using the device herein described, it may be found advisable to extend the leads 112 and 113 into the outlet box 10 through the knock-out hole 11, allowing a sufficient length of wire so that the leads can be conveniently attached to appropriate binding posts 161 and 162 on the coil casing 110. These leads ordinarily will be designed to carry a relatively low voltage which, in ordinary signal circuits, would be somewhere in the neighborhood of 25 to 30 volts. At the same time leads 146 and 147 may be connected to the lighting circuit. After the leads have been properly attached, the coil casing 110 is extended from the inside of the outlet box outwardly through the knock-out hole 11 until the mounting plate 115 is pressed against the bottom of the box. Positioning of the mounting plate in this manner is sufficient to substantially close the knock-out hole by means of the mounting plate.

The positioning of the coil casing in the knock-out hole assists in anchoring the combined switch housing and coil casing in place, the anchoring being made secure by application of the self-tapping screw through the tab 127 in order to hold the tab to the side of the box. By this arrangement only one screw is necessary to firmly fix the combined coil and housing in place. By this arrangement, also, the coil which is a low voltage element is maintained outside of the outlet box and insulated and isolated from the interior of the box, respectively, by the disc 124 and mounting plate 115. The switching device contained within the housing 114 is entirely enclosed within the outlet box, and consequently the high voltage current which it carries is isolated within the box. The housing also forms a completely encompassing insulation for the contacts.

The high voltage circuit is alternately opened and closed by charging the coil 111. That is to say, in effect, each time the coil is charged the star wheel is advanced one-half notch. The star wheel is prevented from rotating in a reverse direction by means of the ratchet plate 151; whereas, the crank is permitted to rotate in a reverse direction after advancing the star wheel by virtue of the resiliency of the coiled spring 158 permitting the crank 155 to move in a reverse direction before re-engaging the ratchet points 156 with the adjacent end of the star wheel.

In all forms of the device, because of the fact that all of the working parts may be removed from the front of the box, the box in either case can be plastered in the ceiling or wall without in any way interfering with the accessibility of the interior of the box from the room side. Normally a light fixture will be so located as to cover the outside of the box on the room side.

By the construction just described there has been provided a compact impulse relay mechanism wherein moving parts have been held to a minimum and so designed that parts of the device perform a multiple function, thereby making it possible to reduce the number of parts without reducing the number of functions. By constructing the device in separate units the units can be applied to a stationary structure such as an out-

let box and a great deal of time saved in both installing and servicing. The device is further so designed that it is capable of a great number of contact combinations which can be changed at will in the field without it being necessary to entirely disassemble the relay apparatus.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures.

The invention having been herein described, what I claim as new and desire to secure by Letters Patent is:

1. In a remotely controlled relay for operating the lighting circuit of a building, adapted to be mounted in an electrical conduit box having at least one knock-out aperture in a wall thereof: a tubular metallic coil casing having a diameter slightly less than that of said knock-out aperture, a solenoid coil in said casing, an elongated metallic switch mounting plate secured to an end of said casing, an elongated switch housing of insulating material secured to said mounting plate, a switch mounted in said housing, said switch including a movable switch arm extending longitudinally of said housing, said mounting plate including a web portion closing said end of the core casing and interposed between said core and said switch and a pair of side flanges closely embracing and supporting said switch housing, said web portion having an opening coaxial with said coil, switch actuator mechanism including

an armature extending through said opening and into said coil, and means for transmitting movement from said armature to said switch arm, and means detachably securing said mounting plate within said conduit box and against said wall thereof with said coil casing extending through said knock-out aperture said last mentioned means comprising a bracket secured to one of said flanges and having an end portion bearing against another wall of said conduit box, and a securing element extending through said end portion and anchored to said other wall.

2. A relay assembly as defined in claim 1, wherein said switch housing is of H-shape cross section, including a centrally disposed partition spaced from said web portion to define an actuator chamber in which said movement transmitting means is disposed, said partition being spaced from the opposite side of the housing to define a switch chamber, said movable switch arm being mounted upon said partition and disposed within said switch chamber, said partition having an opening providing communication between said operating means and said switch arm.

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