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3,054,023

PLUG-IN ELECTRO-MECHANICAL DEVICES

Filed Feb. 18, 1959

2 Sheets-Sheet 1

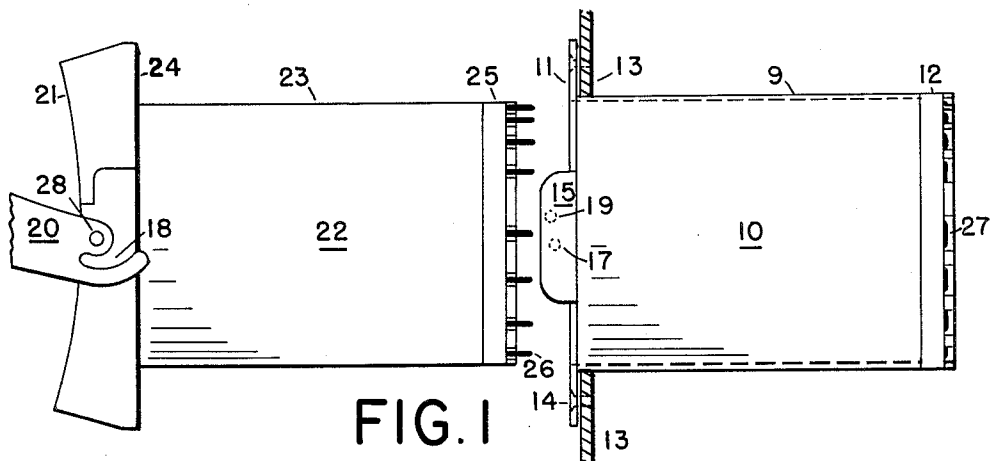


FIG. 1

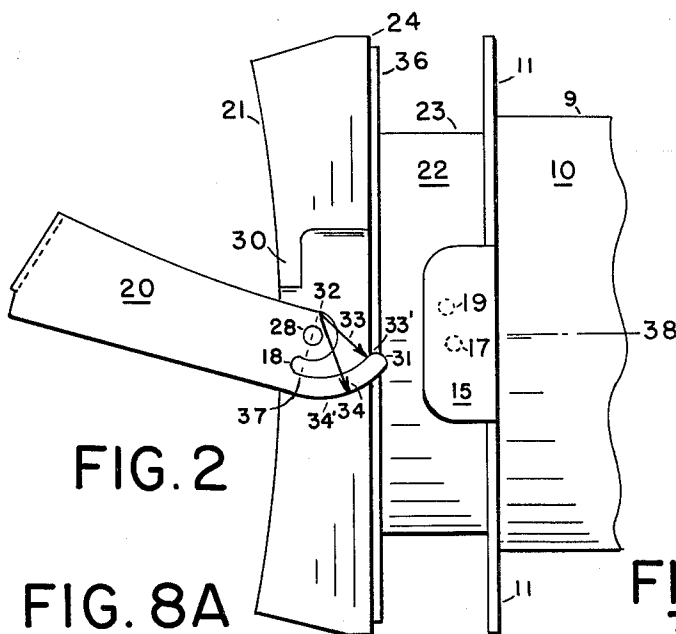


FIG. 2

FIG. 8A

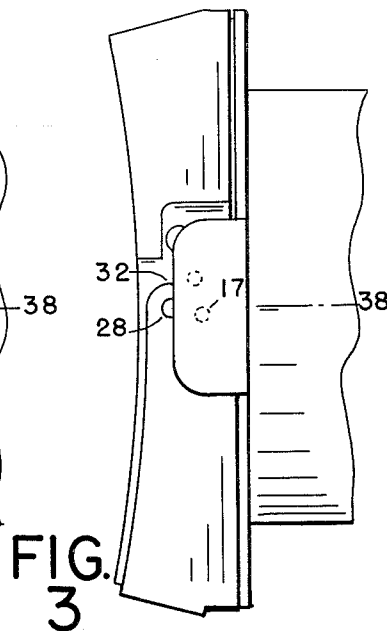


FIG. 3

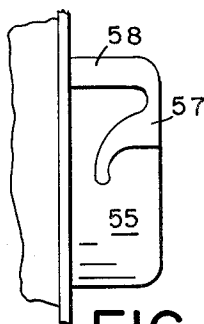
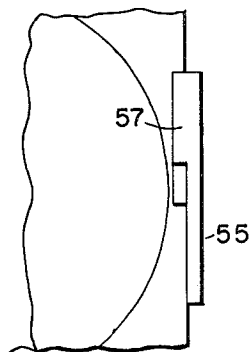


FIG. 8B

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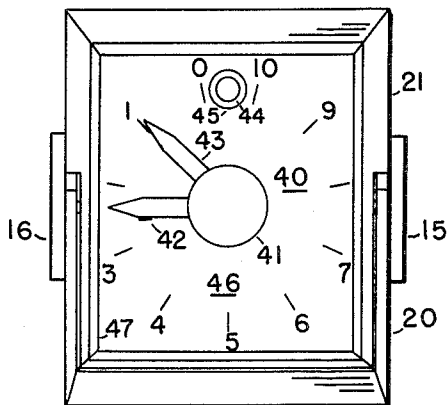


FIG. 4

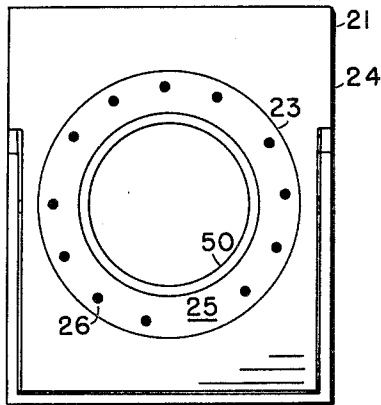


FIG. 5

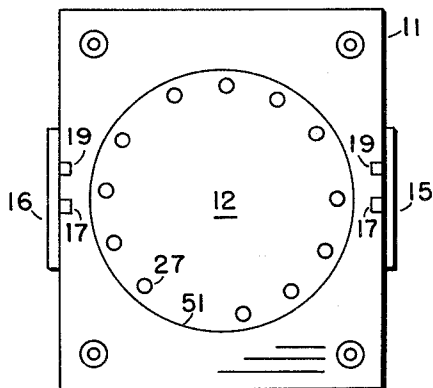


FIG. 6

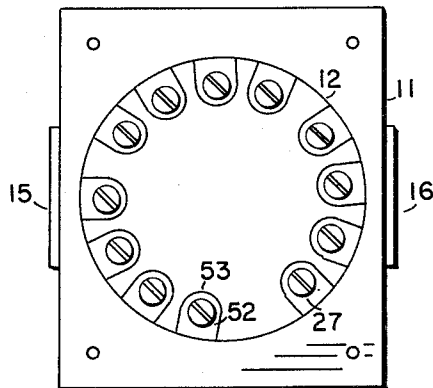


FIG. 7

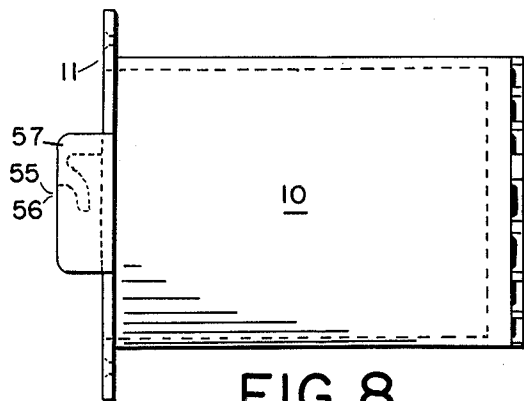


FIG. 8

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PLUG-IN ELECTRO-MECHANICAL DEVICES

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5 Claims. (Cl. 317-99)

This invention pertains to timers, counters, and related devices which can be installed and removed rapidly and easily without connecting or disconnecting the wires connected to the electric circuits controlled by the device.

The mounting case is permanently installed on the control panel and its electric terminals are permanently connected into the electric circuits. The timing or counting device is slipped into the mounting case and the handle depressed to force the electric plugs on the rear of the timer into engagement with the electric sockets in the rear of the case. The cam action of the handle implements engagement of the plug and socket contacts and the over center action of the handle locks the device in place. No keyway is required for alignment of the contacts because the handle on the device can be engaged with the four pins on the mounting case frame in only one position of the device relative to the case.

The advantages of such a mounting arrangement are obvious. The ease and speed of changing the device reduces replacement time to a minimum. This reduces down time on the machine or process controlled with a resulting saving. Spare timers or counters may be kept on hand for emergency use and the replaced timer repaired at leisure.

Preventive maintenance is more likely to be performed on devices employing the mounting system disclosed herein because of the ease of replacing a unit which has operated for the prescribed number of hours. The aged unit is removed and replaced with a spare; the aged unit is then cleaned and oiled, and has its worn parts replaced, and is returned to stock to be used as a future replacement. In prior systems, the devices had to be disconnected from the wiring with resulting work stoppage and the possibility of incorrect reconnection—two things which discourage replacement before failure. A tool life indicator of the type described in United States Patent 2,735,915, issued to Paul A. Hagen, February 21, 1957, may be employed with the device to indicate when the unit is to be replaced.

A novel feature of the invention is the provision of an insulating ring at the rear of the device for supporting the plug terminals. The ring is formed of insulating plastic and encompasses the timing motor to reduce the overall length of the device. A large number of pass-through plugs are integrally molded in the ring. The plugs are separated by a distance or by an electric barrier conforming to established insulation standards. Connection to the components within the device are made at the internal end of the terminals which protrude inside the device.

The housing or canister may be fabricated of a metal cylinder for strength and economy and may have an insulating plastic end closure which contains the integrally molded pass-through terminal sockets. The external electric circuit is permanently connected to the terminal screws on the exterior of the housing. As an

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alternate, the housing could be a one piece molded construction with a reinforced front flange.

Another novel feature of the invention is the protective front cover over the dial. An extension of the cast metal front plate protects the dial face from above and below. Sides withdraw slightly to admit side light to illuminate the dial. A rectangular ring of bright metal adjacent to the dial reflects available light onto the dial making for better readability. A locking device is provided to maintain the handle in its engaged off-center position to prevent tampering or removal by unauthorized persons. In the locked position the handle is hidden below the lower flange of the bezel.

The invention will be described more fully with respect to the following figures, in which:

FIGURE 1 is an elevation of the device and its mounting case.

FIGURE 2 is an enlarged view of the anchor pins and the locking handle in the open position.

FIGURE 3 is an enlarged view of the locking handle in its locked condition.

FIGURE 4 is a front view of the timer dial and bezel.

FIGURE 5 is a rear view of the timer.

FIGURE 6 is a front view of the mounting case.

FIGURE 7 is a rear view of the mounting case.

FIGURES 8, 8A, and 8B are an alternate form of mounting case.

In the view of the timer shown in FIGURE 1 the numeral 10 indicates in general the mounting case. Case 10 in the preferred embodiment is a metal cylinder 9 having open ends. A rectangular flange 11 is rigidly attached to the front end of the cylinder 9. An insulating terminal block 12 is rigidly attached to the rear end of the cylinder 9, effectively closing it. A cross section of the panel to which the front flange 11 is attached is shown at 13, the panel having been drilled to provide a circular hole through which the case 10 extends. The front flange 11 may be attached to panel 13 with flat-headed mounting screws 14 tapped into panel 13 or by other suitable means.

Front flange 11 is provided with side plates 15, 16 secured near the periphery of the cylindrical opening. Each side plate 15, 16 has a pair of pins 17, 19 extending inwardly to engage a curved slot 18 in locking handle 20 hinged to the timer bezel 21.

The timer or counter device is generally indicated at 22. The operating mechanism within device 22 may be open or may be covered with an insulating cylinder 23. The internal mechanism of the device is mounted onto the rear surface 24 of bezel 21. An insulating terminal pin block 25 may close or encircle the rear of cylinder 23. As an alternate, the housing cylinder 9 may be fabricated of a non-conducting material or may be provided with a non-conducting liner. In that case, cylinder 23 may be omitted and the mechanism exposed.

The insulating terminal pin block 25 provides support for a plurality of male terminals 26 to which the electrical components within the device 22 are connected. A like plurality of female terminal sockets 27 are provided in insulating terminal block 12 which forms part of the case 10. In the device shown, twelve terminal pins 26 and twelve terminal sockets 27 are employed. The terminal sockets 27 are of the pass-through type; on the inside of the case 10 they form sockets for terminal pins 26, and on the outside of the case they provide a screw

terminal for external electrical connection. Terminal pins 26 are also of the pass-through type; on the inside of device 22 they form projecting terminals to which the device's internal wiring may be soldered.

In practice, case 10 is mounted in a circular hole of proper diameter in panel 13 and secured with screws 14 tapped into the panel. The hole is circular to make drilling facile. All external electrical connections are made to screw terminals 27. Then the timing or counting device 22 is inserted into case 10 until the curved slots 18 engage pins 17. The timer is automatically aligned thereby and incorrect electric connections are impossible if the connections to the housing have been made correctly. As locking handle 20 is moved downward, the cam action of curved slot 18, pivoting around pin 28, serves to move the mechanism 22 rearward into case 10. Terminal pins 26 move into terminal sockets 27 to establish good electrical connection. When locking handle 20 reaches its lowest position adjacent to the bottom of bezel 21 the over-center portion of slot 18 becomes effective and retains the device in the case. A lock (not shown) may be provided to prevent unauthorized removal of the device. The mechanism cannot be started into the case in any but the correct position because of pins 19 and the configuration of the latching mechanism.

Details of the geometry of the latching mechanism are shown in FIGURE 2. The timing or counting device 22 is shown as partially inserted into the housing case 10. Locking handle 20 is raised slightly above the horizontal position. Bezel 21 has on each side a raised flange 30 which prevents handle 20 from being rotated about pin 28 to a vertical position. It is evident that finger 31 forming a part of handle 20 will clear the lower pin 17 fixed to side plate 15. Pin 17 extends inward toward the mechanism. It is also evident that if the mechanism 22 were accidentally inserted upside down into housing 10 the finger 31 would strike pin 19 and prevent further insertion.

The center 32 of the radical arcs 33, 34 which define the working edges of finger 31 is displaced from the center of rotation of handle 20 to create a cam action. The center 32 of arc 33 is offset from the center of pin 28 so that a line drawn from arc center 32 through the center of pin 28 will cross slot 18 some distance in advance of its end. This configuration of slot 18 in relation to pin 17 permits handle 20 to be moved past center as shown in FIGURE 3 to provide over-center latching action. By utilizing an offset arc rather than a spiral, the travel of timer 22 into housing 10 can be better controlled. A constant downward force on handle 20 results in only slight force at first as pins 26 and sockets 27 are being aligned, and in a greater force as pins 26 move into sockets 27. As the cam surface 33' defined by radius 33 engages the edge of pin 17, the movement of the timer into the case is very gradual. This permits the contact pins and sockets to be engaged slowly. As handle 20 is moved downward, the cam surface 33' draws closer to pivot 28 and draws the timer into the case with greater force. With the configuration of the handle as shown in FIGURES 2 and 3 a leverage of about 12 to 1 is obtained. The leverage thus provided is sufficient to compress gasket 36 which is applied around the rectangular periphery of bezel 21 to seal the mechanism.

Pivots 28 are inserted on the horizontal centerline of bezel 21 so that the mechanism 22 will be drawn straight into the case 10 and so that the compressive force exerted on gasket 36 will be uniform around its entire perimeter. The pins 28 need not be located exactly on the centerline of the device but are placed there for best results. If the majority of the plugs 26 and sockets 27 are located to one side of center, then the pins 28 may be located likewise to give a balanced effect.

When the handle 20 is depressed fully downward as

shown in FIGURE 3, it moves past point 37 and becomes self locking. Point 37 is defined as a point on the cam surface 33' in line with the center of pivot 28 and the center 32 of radius 33. Pin 17 in side plate 15 is located below the centerline 38 of the housing 10; the center of pin 28 is located on the centerline 38 of the device 22. Thus, as the force of the compressed gasket 36 and the compressed pins 26 tend to force the device out of its housing, the force is transmitted from pin 28 to handle 20 and thence to pin 17. The over-center action locks handle 20 against the bottom beveled surface of bezel 21.

The outer cam surface 34' defined by arc 34 comes into play when it is desired to remove the timer from its housing. Raising handle 20 breaks the lock effected by pin 17. Raising the handle 20 brings cam surface 34' into contact with the front surface of flange 11. Lifting the handle 20 upward forces the device 22 out of housing 10. After the end of finger 31 clears pin 17 the device may be easily removed from the housing. The cam action serves to disengage terminal plugs 26 from terminal sockets 27 and also serves to break the seal caused by compression of gasket 36 over an extended period of time.

Pin 19 is used mainly to prevent entrance of finger 31 when the device 22 is inserted into housing 10 upside down. Housing 10 is installed in panel 13 in correct upright position because the top of flange 11 is marked "Top."

A front view of the timer dial and bezel is shown in FIGURE 4. The bezel is generally indicated at 21, and the handle in its locked position at 20. A dial 40 is divided into increments the number of which vary with the timing range of the device. A knob 41 permits setting the pointer 42 to the desired delay interval. A friction device (not shown) maintains the pointer 42 at its preset position. A second pointer 43 is a cycle progress indicator and shows the time remaining. It is rotated at a controlled rate by the timer mechanism. If the device is a counter, the scale on dial 40 is divided into units. The first pointer 42 is set to a predetermined count, and the second pointer 43 indicates either units counted or units remaining.

A neon glow bulb 44 may be inserted through a hole at the top center of dial 40 to indicate when the device is timing or counting, or is timed out or counted out. A rubber grommet 45 retains the bulb 44 in the hole. The bulb also serves as a stop to prevent the pointers 42, 43 from being turned past zero or maximum.

The rectangular slate 46 on which dial 40 is imprinted is in the preferred embodiment acid etched aluminum. Likewise, the rectangular ring 47 which borders the rectangle 46 has a light reflecting surface. These reflective surfaces, together with the cut-away sides of bezel 21, serve to capture available light and retain it on the dial face making for greater readability. The stylized cut-away sides of bezel 21 are shown more clearly in FIGURE 1.

The view in FIGURE 4 shows that tabs 15, 16 are positioned outside the ends of the locking handle 20. The ends of the locking handle 20 are in turn positioned at the outside edge of the bezel 21. This arrangement protects the handle from removal and from bending action. It also contributes to the attractive appearance of the unit.

A rear view of the timer or counter is shown in FIGURE 5. The rear surface 24 of bezel 21 forms a rectangular outline. The insulating cylinder 23 forms a circular outline. The circular cover of the motor is generally indicated at 50, and the insulating ring surrounding the motor case 50 is indicated at 25. The plurality of terminal pins 26 are arranged in spaced apart relationship around ring 25. The greatest diameter of ring 25 and cylinder 23 is less than the inside diameter of cylinder 9, FIGURE 1.

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A front view of the housing 10 is shown in FIGURE 6. The rectangular outline of the mounting flange is shown at 11. It is provided with four countersunk mounting holes for flat headed screws 14. The circular opening in flange 11 is indicated at 51. A plurality of terminal sockets ring the perimeter of the insulating terminal block 12. The side plates 15, 16 carrying the two pairs of pins 17, 19 protrude from the side edges of flange 11. The pins 17, 19 extend inward so that pins 17 may engage the curved slot 18 in locking handle 20.

A rear view of the housing 10 is shown in FIGURE 7. The rectangular outline of flange 11 is shown. Insulating terminal block 12 is shown with a plurality of terminals 27 having screws 52 recessed in wells 53 around the periphery of terminal block 12. The screw terminals 52 facilitate connection into the electric circuit controlled. Barriers between the screws 52 may be substituted for the recesses 53 to increase the electric creepage distance between terminals.

A side view of an alternate form of housing 10 is shown in FIGURE 8. The entire housing is a one piece molded plastic case with flange 11 and side plates 55, 56 molded integrally. Lug 57 takes the place of pins 17, 19, and is integrally molded with side plates 55, 56 to provide a strong latching means. Pins 17, 19 may be used but are difficult to retain in the plastic side plates. Flange 11 may be reinforced with a metal plate riveted to it. Side plate 15 would then be formed in the reinforcing plate.

FIGURE 8A is a front view of side plate 55 showing the lug 57. FIGURE 8B is an inside view of side plate 55 and lug 57. The lug has an outline of approximately the same configuration as the pins 17 and 19. One portion 58 is added to increase the strength of the lug.

Some modifications and changes in the form of the invention disclosed herein will be evident to those skilled in the art. What we desire to protect is defined in the appended claims.

We claim:

1. A rapidly replaceable timer mechanism and housing including in combination, a rectangular bezel, a substantially cylindrical timer mechanism attached to the back of said bezel and supported thereby, said mechanism having an insulating ring attached at its rear having a plurality of terminal pins extending rearward and electrically connected to said mechanism, said bezel having a dial plate mounted to its front and having a knob-controlled pointer concentric with said dial plate, a U-shaped handle pivoted near its open ends to the sides of said bezel and adapted to be manually raised above a horizontal position and lowered to a vertical position, said handle having arcuate shaped fingers on both of its ends, a mating housing having cylindrical side walls and having one end closed and one end open, a rectangular flange extending outwardly from said open end, said flange having substantially the same outline as said rectangular bezel, said flange having forward protruding side edges each having a pair of pins extending inwardly, one of each of said pairs of pins adapted to cooperate with said arcuate shaped fingers on said handle, the other one of each of said pairs of pins located to interfere with said fingers on said handle when said mechanism is inserted in said housing upside down, and a plurality of terminal sockets in said one closed end having socket openings protruding forward and arranged to receive said plurality of terminal pins, said terminal sockets extending through said closed end wall for attachment to an external circuit.

2. A substantially sealed enclosing system comprising, in combination, a housing having a front flange, two spaced apart side plates near the center of the sides of said flange, a pair of pins mounted in each of said side plates and extending inwardly toward the central axis of said housing, one of each of said pairs of pins mounted slightly below the horizontal center line of said housing, the other of each of said pairs of pins being mounted

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above the horizontal center line, a device adapted for insertion into said housing, said device having a front flange provided with spaced apart sides generally coinciding with the inside surfaces of said side plates, a pin mounted on each of said sides on the horizontal center line of said device and projecting outwardly, a U-shaped locking handle having its free ends pivoted on said last-mentioned pins and having an arc-shaped finger on each free end extending beyond said pivots, said arc-shaped fingers being defined by an inside arc and an outside arc, the centers of said arcs being disposed from the center of said pivots, the inside arc of said fingers engaging said pins located on said housing slightly below said center line when said handle is moved downwardly and inwardly toward said housing flange, said handle being rotatable downwardly to thereby draw said device into said housing, the outside arc of said fingers engaging the front surface of said flange on said housing when said handle is moved outwardly and upwardly to thereby force said device out of said housing, and the other of each of said pairs of pins being located so as to engage the outside arc of said fingers and prevent further movement of said device into said housing when an attempt is made to insert the device into the housing upside down.

3. An instrument mounting assembly comprising, in combination, a canister having an open end and a closed end, electrical sockets in said closed end, an outwardly extending flange around the periphery of said open end, an instrument adaptable for insertion into said canister and having electrical connecting prongs on its rearward end adapted to be inserted into the sockets in the closed end of the canister, a flanged portion connected to and surrounding the forward end of the instrument, a compressible gasket on the side of said flanged portion facing the open end of said canister, said gasket being compressed to provide a seal when the prongs on the instrument extend into the sockets in the closed end of the canister, spaced apart side plates on the first-mentioned flange extending substantially parallel to the central axis of said canister, projections extending inwardly from said side plates toward said central axis, pins projecting outwardly from either side of said flanged portion of the instrument, locking arms each having one end pivotally connected to an associated one of said pins, and an arc-shaped finger on said one end of each arm extending beyond its associated pin on the flanged portion of the instrument, said arc-shaped fingers being adapted to engage said projections on the aforesaid side plates and being defined by an inside arc and an outside arc, the centers of said arcs being displaced from said latter-mentioned pins to provide a non-spiral offset arcuate configuration of the fingers, the arrangement being such that the arms may be rotated in one direction whereby the inside arc of each finger will engage its associated projection on one of said side plates to move the prongs on the instrument into their sockets in the canister while providing slight force as the prongs and sockets are being initially aligned and a greater force as the prongs are moved into the sockets and the aforesaid gasket is compressed, said projections on the side plates being spaced from the flange on said canister whereby the outside arcs on the fingers will engage said flange on the canister upon rotation of the arms in the opposite direction to move the instrument and its prongs out of the sockets.

4. The combination claimed in claim 3 wherein the projections extending inwardly from said side plates each comprise a pair of pins, one pin in each pair being adapted to engage the inside arc of an associated one of said fingers while the other pin of each pair serves to prevent said instrument from being inserted into the canister upside down by engaging the outside arc of an associated one of said fingers.

5. The combination claimed in claim 3 wherein the projections extending inwardly from the said side plates

comprise arcuately-shaped fingers having an arcuate surface adapted to engage the inside arcs of said first-mentioned fingers.

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