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SOLENOID WITH PLUNGER AND LATCH

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Fig. 1.

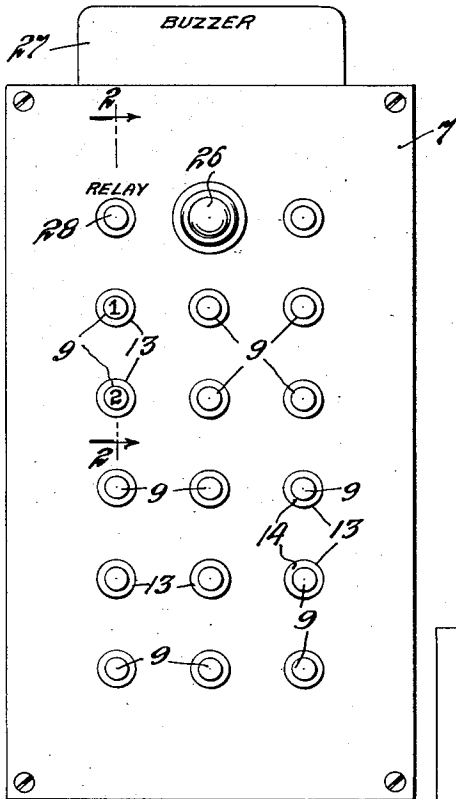


Fig. 2.

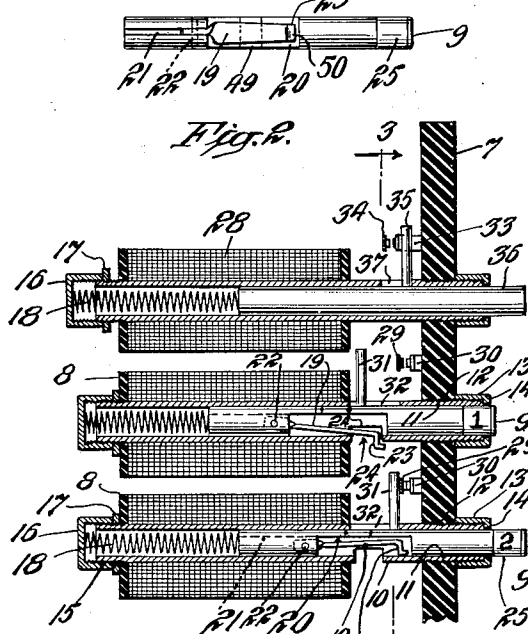


Fig. 3.

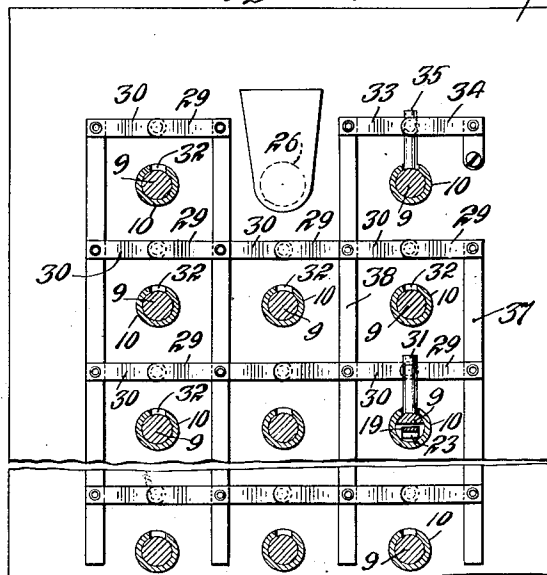
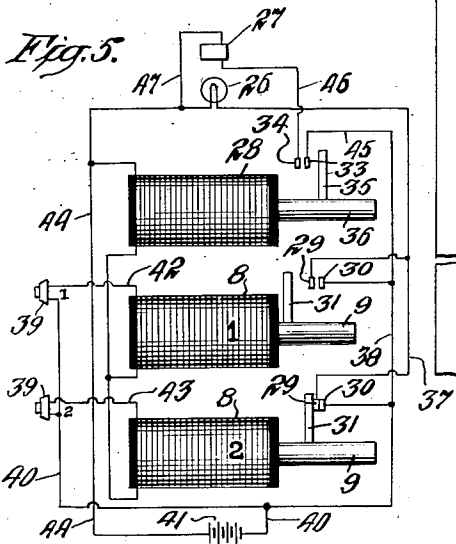


Fig. 5.



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SOLENOID WITH PLUNGER AND LATCH

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4 Claims. (Cl. 175—341)

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The invention herein disclosed relates to annunciators, and special objects of the invention are to provide an annunciator of particularly compact structure, adapted for use on shipboard, positive in action, adapted to be quickly read and identified as to different signals, which will require individual restoration or resetting of each signal and in which the various signal devices will all be positively held both in retracted and in released positions so as to be unaffected by vibration or other forces.

Other important objects of the invention are to provide a simple, practical and efficient form of annunciator device usable generally for signal or control purposes.

Other desirable objects and the novel features by which the purposes of the invention are attained are set forth or will appear in the course of the following specification.

The drawing accompanying and forming part of the specification illustrates a present practical embodiment of the invention. Structure, however, may be modified and changed as regards the immediate disclosure, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawing is a front or face view of an annunciator embodying features of the invention;

Fig. 2 is an enlarged broken sectional view as on substantially the plane of line 2—2 of Fig. 1 and showing particularly the buzzer controlling relay and two of the signal units, one retracted and the other in projected, signalling position;

Fig. 3 is a rear view showing the back of the annunciator panel and parts in section as on substantially the plane of line 3—3 of Fig. 2;

Fig. 4 is a detail view of one of the self-latching solenoid plungers, constituting the indicating pushbuttons and switch actuating elements;

Fig. 5 is a simplified wiring diagram.

In the annunciator form of the invention illustrated there is provided a panel 7 preferably of insulating material, supporting solenoids 8 controlling pushbuttons 9 projectable into indicating relation at the front of the panel.

The solenoids are shown in Fig. 2 as each made up of a winding mounted on a sleeve 10, usually of brass or other non-magnetic material, and which is screw threaded at the forward or outer end, at 11, to engage and extend through a corresponding screw passage 12 in the panel. The sleeve is locked in this supported relation in the panel by a collar 13 screwed over the protruding end of the sleeve exposed at the face of the panel.

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These locking collars may be finished like the face of the panel so as to conform therewith, and they are shown as having inwardly extending annular flanges 14 at the outer ends covering the ends of the threaded sleeves and serving as guides for the plungers 9.

The inner ends of the solenoid sleeves also are shown as screw threaded at 15 to receive the screw caps or covers 16 which are secured in adjusted relation by lock nuts 17. These end caps serve as abutments for springs 18 located in the solenoid sleeves in back of the plungers for projecting the latter. The compression of these springs may be regulated by securing the abutment caps in variously adjusted positions on the inner ends of the sleeves.

The solenoid cores or plungers are held back in retracted relation by magnetic latches, shown in Figs. 2 and 4 as consisting in each case of a latch lever 19 of magnetic material receivable in an elongated notch 20 in the under side of the plunger and having its inner end guided in a groove 21 in the inner end portion of the plunger and pivotally held so by a pivot pin 22.

The outer or forward end of the magnetic latch lever is shown as having a downwardly turned projection 23 adapted to drop through a hole 24 in the under side of the supporting tube and provided with an angular tip 50 to hook in under the wall of the tube.

When the solenoid is deenergized and the push-button tip of the plunger is forced inward, the latch lever will drop down and the projecting portions 23, 50 at the forward end of the same will engage back of and in under the forward edge of the slot or opening 24, as shown at the second or intermediate solenoid in Fig. 2, to lock the indicator in retracted position.

When energized, the solenoid will magnetize and draw the plunger into the coil far enough to release the hook on the end of the latch and the latter then magnetized will be lifted up into the notch in the plunger to clear the opening 24 in the under side of the tube, thus to permit the spring 18 to thrust the plunger forward, as shown at the lower solenoid in Fig. 2.

The inward magnetic pull on the core and the lifting of the latch lever are practically part of the same magnetizing operation. As long as the energizing circuit is held closed the core will be held retracted in this relation with the latch lever magnetically supported. The instant the call circuit is opened, however, the spring, put under increased tension by the core, reacts immediately, snapping the core out into projected, indicating

position. This action is so fast that the latch lever, partly held by some residual magnetism in the core, does not have time to drop down into slot 24 in this outward, spring impelled movement of the core.

The indicating tips of the solenoid plungers may be specially colored or otherwise designed to call attention to their projected position. In the illustration each button is shown as having a distinctively colored band 25 which will show beyond the ends of the guide collar when the plunger is in projected position.

Light and sound signals may be provided for calling attention to actuation of one or more of the pushbutton signals.

In the illustration a lamp is provided at the head of the board at 26 and a buzzer at 27. The lamp is controlled by switches adapted to be closed by any one of the indicator solenoids and the buzzer is controlled by a special relay solenoid shown at 28 and adapted to close the buzzer circuit and hold it closed only so long as a call button switch is held closed.

The light switches are shown as comprising normally separated spring switch levers 29, 30, adapted to be pressed together by studs 31 projecting from the solenoid cores up through guide slots 32 in the tops of the solenoid sleeves.

The switch actuating studs 31 on the solenoid cores are shown as set back far enough not to engage the spring switch levers 29 until after the magnetically actuated latch levers have been cleared from holding engagement with their abutment shoulders at 24. This, as will be clear from the No. 1 and No. 2 indicating solenoids shown in Fig. 2, assures a full clearing action of the latches before actuating the light closing switches.

These spring switches 29, 30, cushion the outward throw of the spring impelled indicating plungers, as shown at the lower, No. 2 indicating pushbutton in Fig. 2. The slots 32 through which the switch actuating studs 31 project may be designed, however, so as to positively limit and thus determine the final projected position of the indicating plungers.

The switch for controlling the buzzer is shown as made up of normally separated spring contacts 33, 34, positioned to be closed by a stud 35 carried by the movable core 36 of the relay solenoid 28 and projecting up through a slot 37 in the top of the supporting sleeve of that solenoid. As shown in Fig. 2, these parts act reversely to those previously described in that the stud 35 is located in front of the movable switch lever 33 so as to close the latter against switch contact 34 when the solenoid core 36 is drawn inward into the relay solenoid 28.

Since the purpose of the relay 28 is merely to hold the buzzer circuit closed while the call button is being pressed, no latch is required with this relay. Otherwise and except for the distinguishing features as to switch operation, the structure of the relay solenoid may be substantially the same as that of the signal solenoids and corresponding parts have therefore been so numbered.

The light switches and buzzer switch may be directly mounted on the back of the panel board, substantially as indicated in Fig. 3 with bus bar strips 37, 38, or the equivalent connecting the light switches in parallel and all the switches for proper connection with the call pushbuttons and a suitable source of power.

A simplified form of circuit arrangement is in-

indicated in Fig. 5 where two of the call buttons are shown at 39 connected by wiring 40 with one side of the power source 41 and by separate leads 42, 43, with the No. 1 and No. 2 solenoids 8, the latter having a common return 44 to the other side of the power source. The No. 2 solenoid is shown as having been tripped, closing the light switch, the contacts 29, 30, of which are connected with the bus bars 37, 38, previously referred to.

In the diagram the relay solenoid 28 is shown connected in the common return 44 of the indicator solenoids so as to be energized each time a call button is actuated and for only so long as a call button is held. The contacts 33, 34, of the buzzer switch are shown connected at 45 and at 46 with the supply lead 38 and with the buzzer, the other side of the buzzer being connected with the supply source through connections 47, 44.

To avoid the possibility of residual magnetism affecting the operation of the magnetically controlled latches, the cores of the latch solenoids may have a section of non-magnetic material such as brass, interposed mid-length, substantially as indicated at 49, Fig. 4. The interruption in the magnetic lines of force thus provided, particularly in the thinned or reduced notched portion of the core, over the latch, prevents accumulation of magnetic effects which otherwise might possibly affect proper operation of the latch.

The latches positively hold the plungers in the retracted, non-signalling position and the springs hold these plungers in the projected signalling position, thus adapting the invention particularly to use on ships and other carriers or in other places where vibration or shock might shake the indicators out of their true positions.

The solenoids take up small space, enabling an annunciator of considerable capacity to be made up in relatively small size. The indications are clear and unmistakable and easily read from practically any position in front of or at one side of the board. The light comes on when any signal is actuated and remains on until all the pushbuttons are restored. The buzzer, on the other hand, only sounds when and for only so long as any call button is pressed.

The switch actuating studs projecting from the solenoid cores through the slots in the upper sides of the supporting sleeves keep the cores lined up so that the latch levers will register with and drop down through the abutment openings 24 in the lower sides of the sleeves. In this relation gravity can be relied upon to effect the tripping and catching of the latch levers. However, if considered desirable, light springs may be provided to thrust the latch levers through the openings 24 into engagement with their abutment shoulders.

The screw mounting of the solenoids in the supporting panel is particularly advantageous in that it enables quick removal and replacement of any solenoid that might develop any kind of a fault. The duplication of parts as between all the signalling solenoids and of many parts as between those and the relay solenoid 28 is also of advantage. The relay solenoid may in fact be an exact duplicate of the other solenoids, except for the core or plunger. While it is not necessary that the core of the relay plunger project at the front of the board, this may be left to project to serve as a means for manually closing the buzzer switch 33, 34, for test or other purposes.

Because of its small size but large capacity and easily read signalling possibilities, the invention

is especially adapted for use in elevators for signalling calls from different floors.

Many other uses will be apparent and it will be clear that the switch actuating effects of the solenoid plungers may be utilized for various control purposes other than the simple signalling functions, such as the visual and audible signal actuating effects disclosed.

The hook-forming lips on the ends of the latches hold the plungers against accidental release from shock and concussion, such as occasioned by the firing of guns on shipboard. The solenoids, on the other hand, are strong enough to overcome the power of the projecting springs and to pull the plungers in enough to clear the hooks from holding engagement with the edge portions of the openings in the supporting tubes. Once unhooked, the latches, magnetized by the solenoid windings are lifted and held up in the clear, so as not to interfere with the projection of the plungers by the springs, the instant pressure on the call button is released. The plungers can work with a close sliding fit through the guides in the ends of the supporting tubes so that the structure can be moistureproof. In practice, strands of packing material or packing rings may be held by the flanges 14 of the guide collars 13 to seal the plungers in sliding engagement in the solenoid tubes.

To increase their magnetic efficiency the solenoids may be ironclad as by enclosing the windings in shells of magnetic material.

Instead of making the plungers with two magnetic end sections separated by an intermediate non-magnetic section, the entire inner section, say starting with the non-magnetic portion 49 in Fig. 4, may be of non-magnetic material, thus to concentrate all magnetic pull on the outer magnetic portion of the plunger, entering the field of the solenoid.

What is claimed is:

1. Apparatus of the character disclosed comprising a tubular support, a solenoid winding about the same, a solenoid plunger operable in said tubular support, a magnetic latch pivoted on said plunger, an abutment on the tubular support engageable by the end of said pivoted latch to hold the plunger in retracted relation, a spring confined in said tubular support in back of said plunger for projecting the latter when the latch is released and means for limiting the projecting movement of the plunger.

2. Apparatus of the character disclosed comprising a tubular support, a solenoid winding about the same, a solenoid plunger operable in said tubular support, a magnetic latch pivoted on said plunger, an abutment on the tubular support engageable by the end of said pivoted latch to hold the plunger in retracted relation, a spring confined in said tubular support in back of said plunger for projecting the latter when the latch is released and means for limiting the projecting

movement of the plunger, said magnetic latch being disposed longitudinally in the intermediate portion of the plunger and said intermediate portion of the plunger in the region of said latch having a non-magnetic section.

3. Apparatus of the character disclosed comprising a tubular support, a solenoid winding about the same, a solenoid plunger operable in said tubular support, a magnetic latch pivoted on said plunger, an abutment on the tubular support engageable by the end of said pivoted latch to hold the plunger in retracted relation, a spring confined in said tubular support in back of said plunger for projecting the latter when the latch is released and means for limiting the projecting movement of the plunger, said tubular support having an opening in one side of the same, with one edge of said opening providing the abutment for the latch and said latch having a hooked end portion adapted to pass through said opening and into hooked engagement over the edge portion of said opening.

4. Apparatus of the character disclosed comprising a tubular support, a solenoid winding about the same, a solenoid plunger operable in said tubular support, a magnetic latch pivoted on said plunger, an abutment on the tubular support engageable by the end of said pivoted latch to hold the plunger in retracted relation, a spring confined in said tubular support in back of said plunger for projecting the latter when the latch is released and means for limiting the projecting movement of the plunger, said tubular support having an opening in one side of the same, with one edge of said opening providing the abutment for the latch and said latch having a hooked end portion adapted to pass through said opening and into hooked engagement over the edge portion of said opening, a lateral projection on said plunger and the tubular support having a slot therein receiving said lateral projection and thereby limiting the extent of movement of the plunger in opposite directions.

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