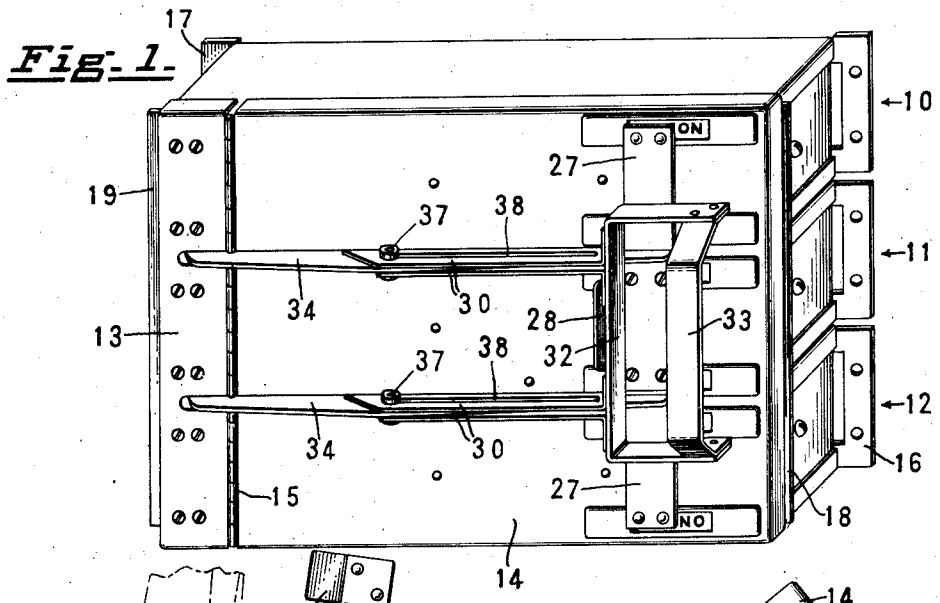
June 11, 1940. R. N. ROWE 2,204,002

ELECTRIC SWITCH

Filed July 9, 1938 3 Sheets-Sheet 1

Fig. 1.



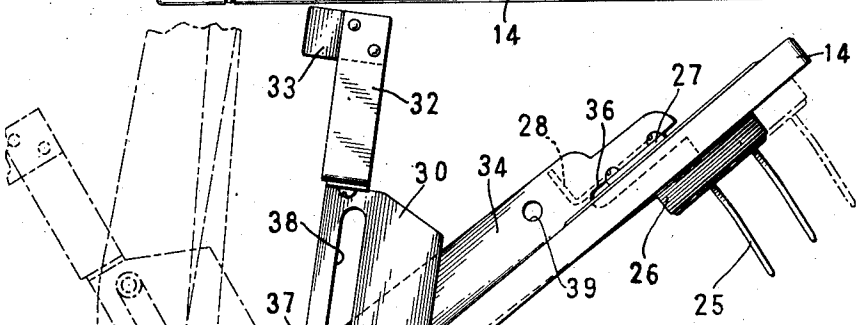
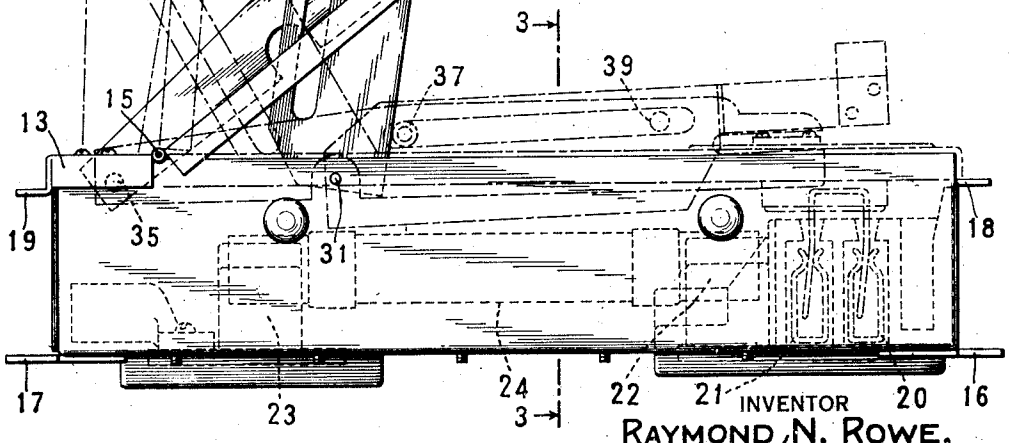


Fig. 2.



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ELECTRIC SWITCH

Filed July 9, 1938 3 Sheets-Sheet 2

Fig. 5.

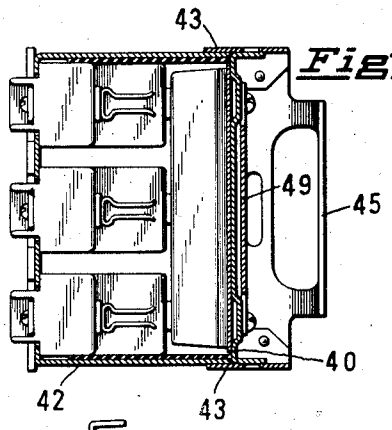
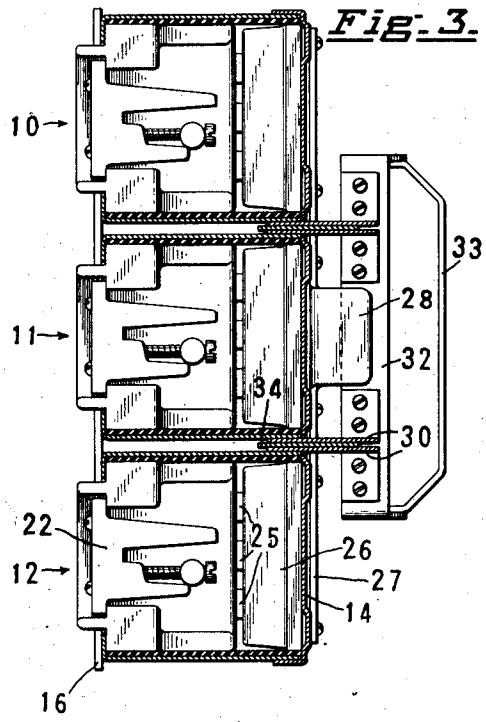


Fig. 3.



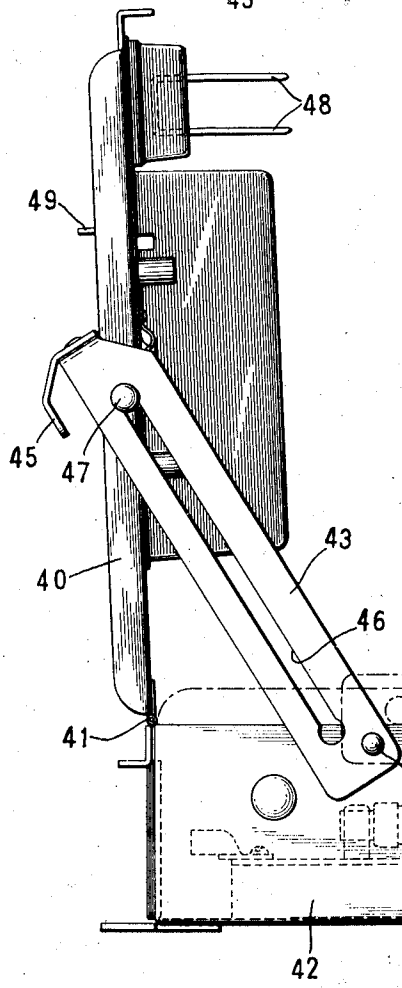
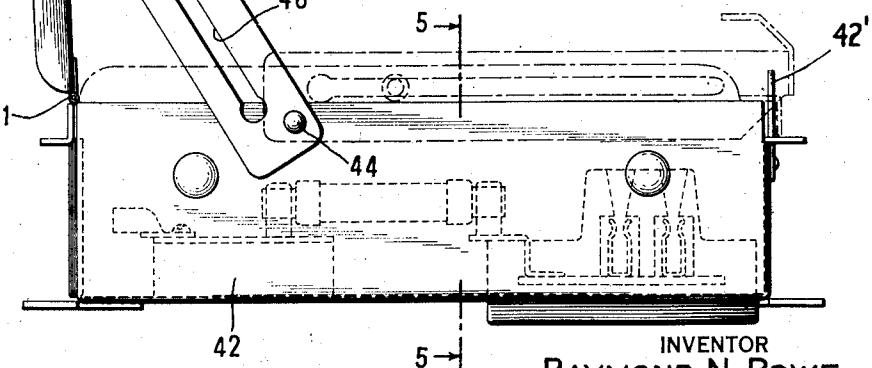


Fig. 4.



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ELECTRIC SWITCH

Filed July 9, 1938 3 Sheets-Sheet 3

Fig. 6.

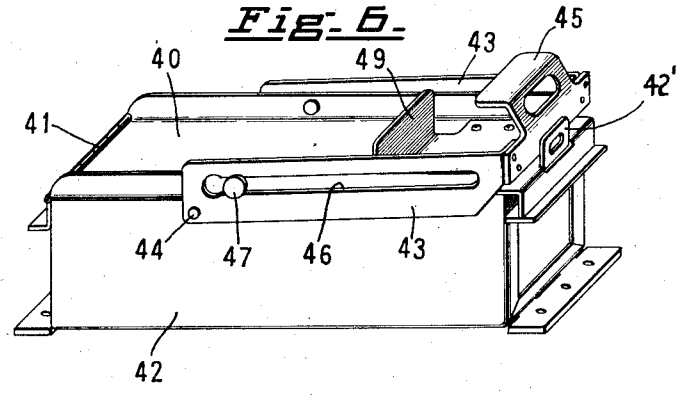
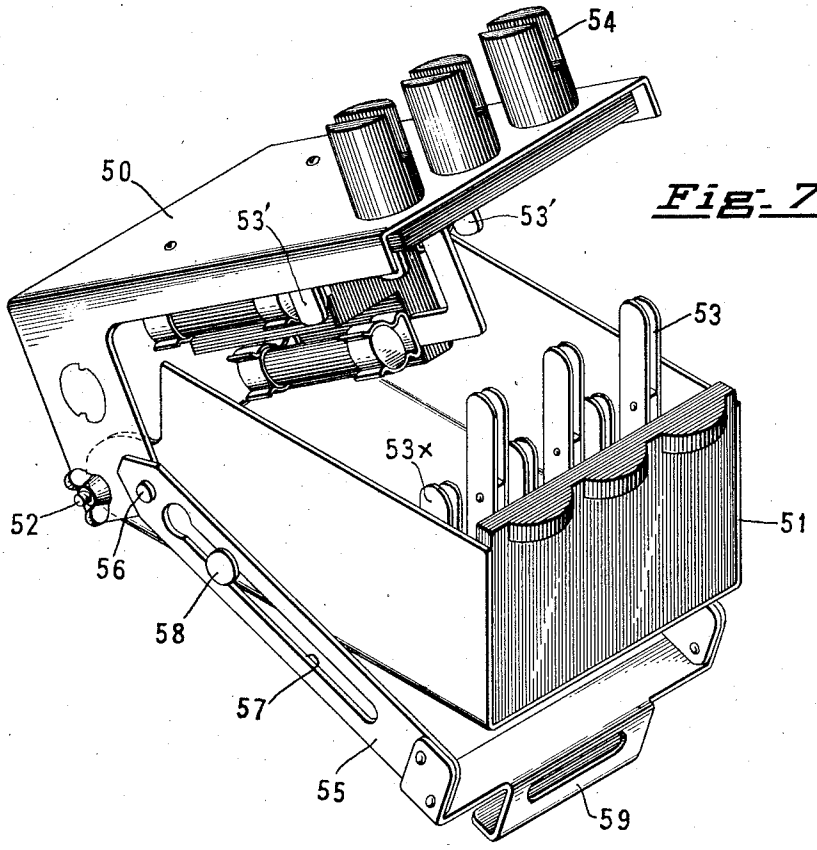


Fig. 7.



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Patented June 11, 1940 2,204,002

UNITED STATES PATENT OFFICE

2,204,002

ELECTRIC SWITCH

Raymond N. Rowe, Plainville, Conn., assignor to The Trumbull Electric Manufacturing Company, Plainville, Conn., a corporation of Connecticut

Application July 9, 1938, Serial No. 218,279

10 Claims. (Cl. 200—153)

My invention relates especially to the means for opening and closing the circuit of an enclosed or safety switch.

Such switches frequently have the stationary contacts mounted in the box body and the movable switch contacts carried by the cover which is hinged to the box body and adapted to be opened by hand.

The main object is to provide a simple but rugged device capable of multiplying the force of the hand by lever action.

I have shown the invention as applied to a type of switch especially adapted to be used in a panel board construction which can be closed in either the "off" or in the "on" position. Broadly it is adapted for single or multiple unit constructions.

In principle the operating handle is hinged to the box body and has a sliding connection with the cover so arranged that the handle moves much faster than the cover in the opening of the switch and consequently the force of the hand is multiplied, and vice versa the force of the hand is multiplied in closing the cover.

Fig. 1 is a perspective view of an enclosed switch of the panel board type composed of three units with a single cover and handle, the parts being shown in the closed position and viewed from the front.

Fig. 2 is a bottom view with the cover partially opened and showing the movable switch contacts in the "off" position and the fuse and stationary contacts dotted. This also shows, in dot and dash lines, the fully open and fully closed positions of the cover and handle. In the latter position the movable switch member is shown in the closed circuit position.

Fig. 3 is a sectional view of the same device with the cover closed, the section being taken generally on the plane of the line 3—3 of Fig. 2.

Fig. 4 is a bottom view of a single unit device with the cover fully opened and showing in dot and dash lines the cover closed.

Fig. 5 is a vertical section on the plane of the line 5—5 of Fig. 4.

Fig. 6 is a perspective view of the single unit device—cover closed, the view being taken looking upwardly.

Fig. 7 is a perspective view of another type—a branch connector type for a bus bar conduit system, the parts being shown in the partially opened position.

In the form shown in Figs. 1, 2 and 3 there are three switch units 10, 11 and 12 each including a box containing a switch and a circuit protecting fuse. A single front piece has a back part 13 which connects the three boxes and a cover 14 hinged at 15. Each box may have end flanges 16, 17 for securing it to a support and other flanges 18 and 19 for additional means of connection in a panel.

Inside of each unit are stationary switch contacts 20, 21 and terminals 22, 23 for a fuse 24. The circuit is connected to switch contact 20 and to fuse terminal 23, and contact 21 is connected to terminal 22. The U-shaped switch member 25 is carried by the cover and has two blades adapted to enter the jaws of contacts 20 and 21 when the cover is closed to complete the circuit. These jaws are made so as to tightly grip the blades of the switch member 25. Preferably the switch members 25 are mounted on an insulating block 26 which in turn is secured to the cross piece 27 on the outside of the cover and mounted to slide toward and from the axis of the hinge 15. This slide 27 has a handle or finger piece 28 to facilitate its movement. This switch construction is more fully disclosed in Patent No. 2,124,275.

Ordinarily the cover is provided with a handle which is secured to it near the outer edge. In the present improvement, however, I provide a handle having double side arms 30, 30 hinged at 31 and connected by a yoke 32 and a grip portion 33.

Two beam like members 34, 34 are hinged at 35 to the rear of hinge point 15 and have a slotted or sliding connection with the cover piece 27 at 36. They are also provided with a pin and slot type of connection with the handle arms 30, 30. Each connection consists of a roller 37 carried by a beam and a slot 38 in the embracing arms 30, 30. The beam is also formed with a cut-out portion to provide clearance for the hinge joint 31 when the cover is closed.

To open the switch the handle grip 33 is pulled outwardly about the axis of the hinge 31. The arm 30 thus applies force to the roller 37 carried by the beam 34 which turns on the axis of hinge 35 thus greatly multiplying the power applied since the hand grip moves much farther than the beam in a given time at the beginning of the cover opening movement and at the end of the cover closing movement. The beam 34 at its outer end engages the cover piece 27 and thus opens the cover slowly. The leverage between the handle and the moving contact of the switch is greatly increased by this arrangement. By such means greatly increased contact pressure

may be provided in switches having butt engagement contacts. With knife blade and wiping contact types substantial mechanical advantage is afforded by this construction. Powerful contact jaws may be employed and yet the switch may be easily operated to open or close the circuit on account of the extra leverage afforded by this invention.

Assuming that the speed of handle movement is fairly constant, the present arrangement provides that the switch contacts will move much slower than the handle when in their closed or nearly closed position, and will move much faster than the handle when approaching their full open position. This speed of movement, especially in the opening sequence, means that the contacts are never snapped open initially. As is well known, this slow initial opening reduces arcing of the contact when interrupting alternating current, and the subsequent rapid movement to full open position after the arc has ceased is not objectionable.

The above remarks apply to the broad aspects of the invention, which may include operating mechanisms for open switches as well as for enclosed switches.

When the invention is used in an enclosed panel construction with switch units as shown mounted inside of a box, there is an outer cover (not shown) on the box which comes very close to the operating handles when the units are in fully closed position. The present invention insures that the outer cover cannot be closed unless the switch contacts are fully engaged; because otherwise the operating handle, or handles, would prevent the outer cover from being closed. This is so because the last few inches of movement of the operating handle result in only a fractional amount of that movement in the switch contacts. Therefore if the switch contacts are open only a fraction of an inch, the operating handle is open about nine or ten times that amount so as to prevent the outer cover from being closed.

When used in a panel board construction it is also true that the switch contacts cannot be opened accidentally by vibration or fuse-explosion within the switch, as long as the outer cover is closed. Any slight movement of the switch contacts toward open position will result in a tendency for a large movement of the operating handle. Because the operating handle is closely adjacent the outer cover, the handle will engage the cover and therefore prevent movement of contacts.

In the form shown the slide 27 with the attached movable switch members 25 may be moved from the position shown in full lines to those shown in dotted lines so that when the cover is closed the inner blade of member 25 will engage in the jaw 20 while the outer blade will overlap (out of contact) thus leaving the cover closed but with the switch "off."

In the form shown in Figs. 1 and 2, the switch and the cover may be locked in the closed position by a seal or padlock through a slot 38 in the handle lever and through a hole such as 39 in an adjacent beam member or by connecting any two of the moving parts together or by connecting one of the moving parts to a stationary part.

The form shown in Figs. 4, 5 and 6 is a single box unit but with contacts for three lines. The cover 40 is hinged at 41 to the box 42. The handle has two side arms 43 hinged at 44 to the box body and has a grip portion 45 located at the outer edge of the cover when closed. The arms have slots 46 in which the rollers 47 secured to the edges of the cover slide. The movable switch member 48 may be actuated by a slide 49 if desired as set forth in said patent above referred to.

In this construction, it will also be seen that a substantial leverage is provided which makes it possible to open and close the cover slowly with a maximum of effectiveness. The handle may be sealed or locked by connecting the grip 45 to the stationary part 42' or in any other suitable manner.

The form shown in Fig. 7 embodies a main body portion 50 adapted to be secured to a bus bar duct (not shown). The cover portion 51 is hinged at 52 and carries contact stabs 53 adapted to pass through the arc suppressors 54 to engage the bus bars in the bus duct (not shown) and contacts 53' to be engaged by stabs 53x. The operating handle 55 is hinged at 56 to the body of the enclosure and has a grip portion 59 and a slot 57 in which the pin or roller 58 slides when the handle is operated. This arrangement also affords substantial leverage to enable the operator to apply great force to open the circuit slowly or to easily close the contacts into tightly fitting jaws. This arrangement also assists greatly in opening a tightly fitting or sticking cover.

The smaller size unit shows the simplest form, in which the cover puller works directly on the cover. In the larger size the cover puller works on separate pieces which are pivoted near the cover pivot and have a sliding connection with the cover. The effect in both forms is the same.

In switches embodying my present invention, it is highly desirable when the cover is intended to be kept closed that the handle lever itself be sealed or locked because of the danger of straining the parts when the lever is not itself locked due to the powerful leverage afforded by the invention.

In constructing and arranging the handle member and connecting it to the body of the box and to the cover (or the intermediate beam) it is desirable to locate the sliding bearing 37 (Fig. 2) or the bearing 47 (Fig. 4) as near as practical to the movable switch contact and the pivot (31 or 44) for the handle close to the bearing and the handle grip (33 or 45) remote from the pivot and bearing. Restrictions of size result in arrangements such as shown.

Other changes in details of construction may be made within the broad aspect of my invention.

I claim:

1. Electrical apparatus including a box having a cover hinged at one edge and engaging the other edges when closed, said cover having projections extending laterally from portions of the cover intermediate the hinged edge and the opposite edge and a handle having two spaced side arms hinged to the box between the cover hinge and the opposite edge of the cover, said side arms having slots in which said projections slide when the handle is moved to open or close the cover and a cross piece connecting the side arms and lying parallel and close to the end of the cover when the cover is closed.

2. In an electric switch, a box having a cover hinged at one end and adapted when closed to engage the box at the opposite end and sides, slotted lever arms hinged to the opposite sides of the box near the edges thereof and at points nearer to the hinged end than to the opposite end, pins carried by the opposite edges of the cover and slidable in the slots of said arms and a cross bar connecting the ends of the arms remote from the hinged ends and serving as a

handle which lies substantially parallel with the end of the cover, said arms extending substantially parallel with the edges of the cover when the cover is closed and said arms serving to limit the opening of the cover.

3. A box having two parts connected by a hinge at one end, a pair of lever arms hinged to one part near the hinge and having a pin and slot connection with the other part between the hinge and the opposite end of the box, said arms lying substantially parallel with the side edges of the box when the box is closed and a cross piece connecting the outer ends of the lever arms and lying close to the adjacent surface of a box part when the box is closed, all of the parts being so proportioned and located that one box part may be swung to an angle of at least 90° with respect to the other part when the box is opened.

4. In a device of the character described, a box having a cover hinged at one end and having two parallel slots, two beams hinged in the box and extending respectively through said slots and having sliding connection with the cover, two levers hinged to the box and having pin and slot connections with the respective beams and a handle connecting the outer ends of the two levers.

5. In a device of the character described, a box having a hinged cover with a slot, a beam hinged in the box and extending at least partly through said slot and having a sliding engagement with a part of the cover remote from its hinge, an actuating lever hinged to the box and having a pin and slot connection with said beam and a handle on said lever for actuating the same.

6. In an electric switch construction, a box having a cover hinged near one end and adapted to be closed, a beam hinged at one end within the box at a point between the hinge of the cover and the adjacent end of the box and having a sliding engagement with the cover adjacent the end opposite the hinge, a lever arm hinged to the box between the previously mentioned hinges and the opposite end of the box, a pin and slot connection between said lever arm and said beam between the hinge of the beam and its opposite end and a handle at the end of the lever arm opposite its hinged end.

7. In an enclosed electrical apparatus, a box containing an electrical unit, a cover hinged to said box at its rear and coacting with the opposite edge of the box at its front end, a lever device hinged to the box and formed with an elongated slot, a pin on the cover coacting with said slot and being positioned adjacent the lever hinge whereby upon pivotal movement of the lever the pin rides along the slot to change the point of application of pressure of said lever, said cover and the front end of the lever being adapted to be moved rearwardly of the cover hinge joint, the end of the slot in the lever remote from the hinge of the lever serving as a stop to limit the opening movement of the cover.

8. In an enclosed electrical apparatus, a box having a plurality of units, a cover hinged to said box near one end and coacting with the box at its swinging end, elongated spaced beams having their ends hinged to the box adjacent the cover hinge joint and other parts in slotted engagement with the cover, pins on said beams at points near the center of the box and a lever device including spaced arms having ends hinged to the box and being formed with elongated slots to receive said pins whereby movement of the arms is imparted to said beams for opening and closing said cover.

9. In an enclosed electrical apparatus, a box having an electrical device therein, a hinged cover for the box, pins on the sides of said cover and a lever device for opening and closing the cover, including spaced arms hinged to the box and having elongated slots of limited length for coacting with said pins whereby movement of the lever may be imported to the cover to open it 90° and a hand grip portion formed on the free ends of the arms and extending close to the surface of the cover when the cover is closed.

10. In an enclosed electrical apparatus, a box containing an electrical device, a hinged cover for the box, a perforated lug on the front end of the box, pins on the sides of said cover and a lever device for opening and closing the cover including spaced arms hinged to the box and having elongated slots closed at their ends for coacting with said pins whereby movement of the lever is imparted to the cover to swing it through approximately 90°, and a hand grip portion formed on the free ends of the arms and provided with an opening adapted to register with the perforation in the lug for receiving a sealing number.

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