Jan. 11, 1949. M. L. JEFFREY 2,459,077

QUICK ACTION SWITCH

Filed June 28, 1945 2 Sheets-Sheet 1

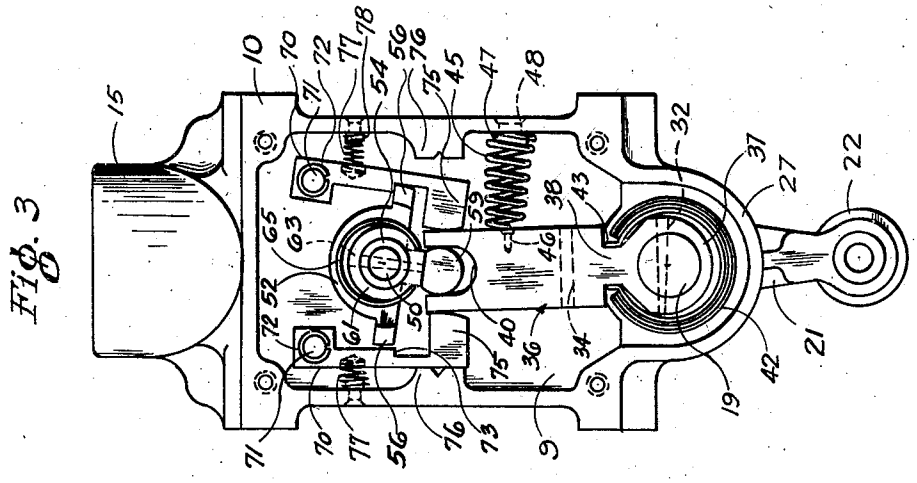


Fig. 3

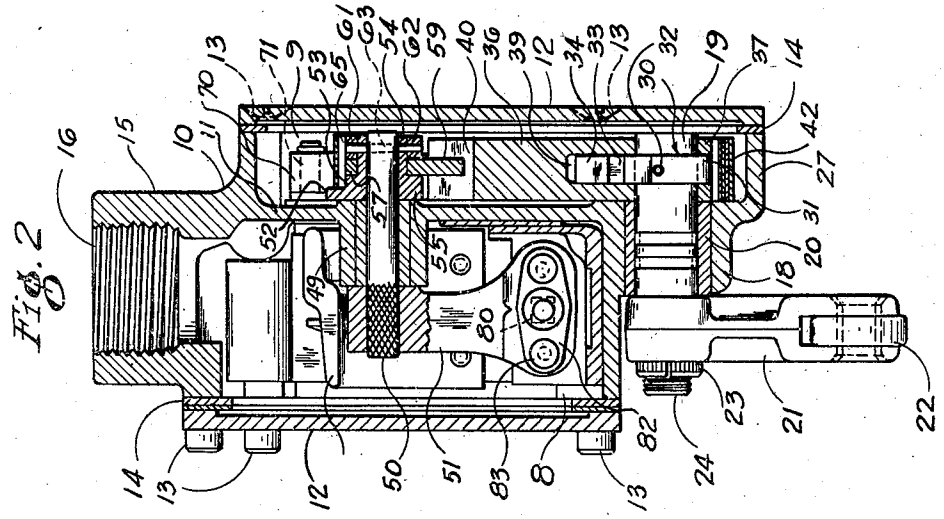


Fig. 2

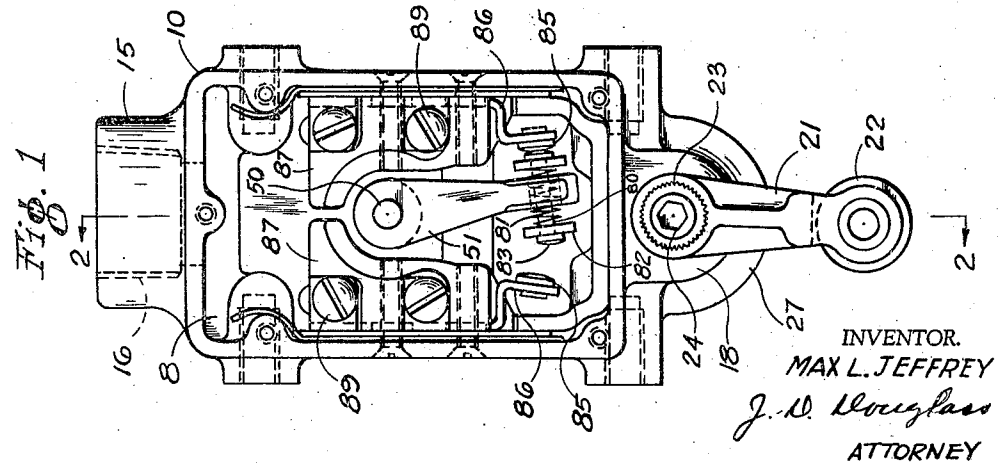


Fig. 1

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Fig. 4

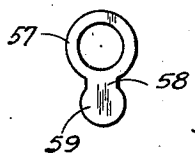


Fig. 5

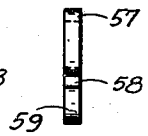


Fig. 9

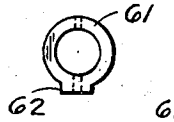


Fig. 10

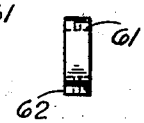


Fig. 6

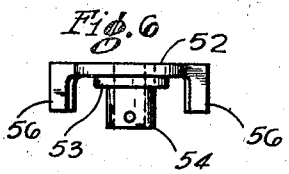


Fig. 11

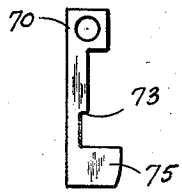


Fig. 12

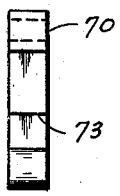


Fig. 8

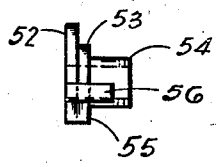


Fig. 7

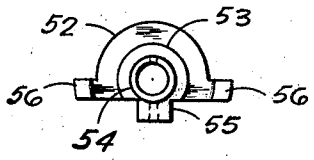


Fig. 13

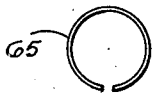


Fig. 14



Fig. 15

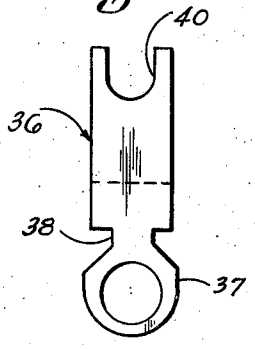


Fig. 16

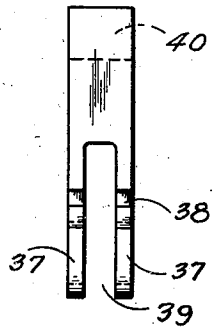


Fig. 17

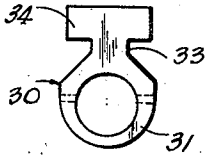


Fig. 18

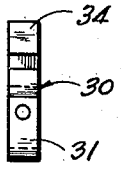


Fig. 19

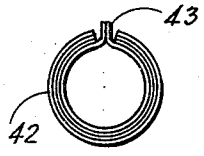
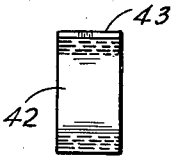


Fig. 20



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UNITED STATES PATENT OFFICE

2,459,077

QUICK ACTION SWITCH

Max L. Jeffrey, Cleveland, Ohio

Application June 28, 1945, Serial No. 602,035

9 Claims. (Cl. 200—70)

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My invention relates to electric switches, and more particularly to a switch mechanism wherein the contacts are opened and closed quickly, as well as improved type of mechanism permitting over-travel for the operating means.

The invention contemplates an improvement over my Patent No. 2,294,559, of September 1, 1942, and No. 2,270,951, of January 27, 1942. In the switches of the class about to be described, it is desirable to provide a mechanism which allows it to be disposed in various places and used in connection with different types of machines. It is also desirable to have a mechanism which will operate with a relatively short travel and which will operate quickly, thus enabling the contacts to be made and broken quickly, eliminating arcing and its accompanying corrosion of the contacts. It is also desirable to provide means whereby the movements are transmitted through over-travel means, thus eliminating breakage.

By my present invention, I have provided a switch which is very compact, adapted to be mounted in nearly any place where such a switch is desirable. The contacts are operated in a separate compartment from the switching means, which enables the switching means, or switch operating means, to be lubricated without danger of such lubricant getting on the contacts; means is also provided whereby the operating lever can be moved further than ordinarily contemplated without endangering the other mechanism. Further advantages consist in an improved construction of snap operating mechanism which has but a relatively few parts and are not subject to wear, as in previous devices. These, and still other advantages of the invention, will become more apparent from the following description of an embodiment thereof, which description is illustrated by the accompanying drawings and forms a part of this specification.

In the drawings:

Fig. 1 is a view of the switch in elevation with one of the housing plates removed and looking into that portion of the compartment which houses the contacts;

Fig. 2 is a sectional view, being a vertical medial section taken on the line 2—2 of Fig. 1 looking in the direction of arrows;

Fig. 3 is a view similar to Fig. 1 taken from the other side of the device with the other cover removed;

Figs. 4 and 5 are front and side elevations respectively of a rocker shaft operating lever removed from the assembly;

Figs. 6, 7 and 8 are top plan, front elevational

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and side elevational views respectively of a rocker;

Figs. 9 and 10 are front and side elevational views of a spacer used in conjunction with the levers of Figs. 4 to 7 inclusive.

Figs. 11 and 12 are front and side elevational views respectively of a pawl used in conjunction with the rocker;

Figs. 13 and 14 are front and side elevational views of a spring used in conjunction with the levers of Figs. 4 to 12 inclusive;

Figs. 15 and 16 are front and side elevational views respectively of the interior operating lever;

Figs. 17 and 18 are views of the shaft lever used in conjunction with the lever of Figs. 15 and 16; and

Figs. 19 and 20 are front and side elevational views respectively of a spring used in connection with the levers of Figs. 15 to 18 inclusive.

Throughout this specification, like parts have been designated by like reference characters.

In carrying out my invention, I preferably provide a housing which is divided into two compartments by a partition, one of the compartments is adapted to house the lever carrying the contacts which operate between the fixed contacts and is connected to a rock shaft which extends into another compartment which houses the operating mechanism for moving the contact lever. An operating lever is provided exteriorly of the housing, adjustably secured to a shaft which extends into the last mentioned compartment and carries thereon a swingable lever that is connected to the shaft through an over travel mechanism. The swingable lever is provided with an end which engages a second lever which is a part of a composite lever comprising a member fixed to the other end of the rock shaft and which has a resilient connections with a rocker. The rocker has a pair of projections which extend into engagement with pawls which are adapted for alternate engagements with the projections, holding the member against movement until released by the swingable member.

More particularly, the invention comprises, referring to Fig. 1, the housing indicated at 10, which is of generally rectangular formation and is provided with a longitudinally extending partition 11, dividing the housing into a contact lever compartment 8 and a mechanism housing compartment 9. The housing is closed on opposite sides by cover plates 12, a suitable gasket, such as 14 being interposed between the cover plate and the housing which is held onto the housing by screws 13. The upper end of the

housing is provided with a boss 15 which opens into the contact compartment and is threaded as indicated at 16 for the reception of a conduit or the like. The lower end of the housing as viewed in the figures is provided with a boss 18, in which a shaft 19 extends, being journalled in a bearing 20. The shaft extends from the exterior of the housing into the chamber 9. The outer end of the shaft is serrated at 23 and carries thereon an operating arm comprising a lever 21 provided with a roller 22 on its end. The serrated shaft is adapted to be secured to the lever 21 by an Allen set screw 24 which is threaded into the end of the shaft, which is split, and expands the shaft into contact therewith. The shaft 19 extends into the compartment 9, which is provided with a semi-circular portion at the lower end, as indicated at 27, and carries thereon, in said compartment, a short lever 30, more clearly shown in Figs. 17 and 18. The lever comprises a ring shaped body 31 providing a close fit with the shaft and is secured onto the shaft by a taper pin 32 which extends through openings in the lever and the shaft. Extending from the body of the lever is a neck 33 which terminates in a rectangular head 34. A swing lever 36 is also journaled on the shaft 19, and comprises a construction best shown in Figs. 15 and 16. It includes a ring shaped end 37, adapted to be journaled on the shaft 19, provided with a neck 38, and which end is provided with a slot 39 permitting the same to be disposed with its portions on either side of the lever 30. The portions 38 and the body of this lever above the neck 38 are complementary to the neck 33 and the head 34 on the short lever.

The end of the lever 36 is provided with a U-shaped slot 40, the legs of which are parallel to each other. A connection between the short lever and the swing lever is provided in the form of a C-shaped spring, shown in Figs. 19 and 20. This spring comprises a circular body indicated at 42, adapted to surround the rings 31 and 37 of the levers 30 and 36 respectively, and provided with neck engaging portions 43 which seat on the necks 33 and 38 of the two levers.

The spring is shown as being of a liminated structure comprising the inner portion having the outwardly bent parts 43 forming the seating parts, and the reinforcing spring elements encircling the inner spring member. It will be appreciated, however, that one single spring could be used if desired without departing from the scope of the invention.

The lever 36 may be held biased to one side or the other of the compartment 9, by a spiral spring 45 which is provided with a point 46 extending into a hole in the side of the lever, and the other end of which is seated on a boss 47 riveted into the sidewall as indicated at 48. Although this spring is shown biasing the lever in one direction, it will be appreciated that the spring can be on the other side if desired, or, in some instances, it may be omitted from the structure entirely.

The rock shaft 50 is journalled in a bearing carried by a boss 49 on the partition 11 in the upper part of the housing. The end of the rock shaft which extends into the compartment 8 is knurled and carries thereon the contact lever 51. The rock shaft extends through the bearing into the compartment 9 and carries on its end the rocker, shown in Figs. 6 to 8 inclusive. The rocker includes a body 52 of semi-circular form, provided with a cylindrical step as indicated at 53 and a shank 54 of reduced diameter, the shank and body being provided with a bore permitting the same to be journaled on the shaft 50. The body is also provided with a downwardly extending short lever arm indicated at 55, the sides of which are parallel to each other and flat. Rotatably journalled on the shank 54 is a short lever which comprises a ring shaped body 57 having a neck 58, the dimensions of which correspond to the arm 55, and the end of which terminates in a circular disc 59, figures 4 and 5.

The disc 59 is of a diameter which permits it to enter into the U-shaped slot on the lever 36, and provides a sliding but close fit with the sides of the slot 40. The lever 57 is held on the shank 54 by a ring 61 best shown in Figs. 9 and 10, which is provided with a projection 62 of similar shape and dimensions to the neck 58 on the lever 57 and the lever 55. The ring 61 is provided with holes therethrough, as is the shank 54, through which a taper pin 63 may extend for locking the ring and the member 52 onto the rocker arm. Under these conditions, it will be seen that the lever 57 is free to reciprocate on the rocker body, but that the rocked body must move together with the shaft 50. Movement between the two parts is transmitted by a C-shaped spring 65, the open end of which engages with the necks 58 and arms 55 and 62 of the members 57, 52 and 61 respectively, the spring being sufficiently wide to engage all three elements simultaneously.

Although the spring 65 is shown comprising but one part, it will be obvious that if greater tension is required, more than one part may be used as was stated in connection with the spring 42. The rocker body is provided with a pair of laterally extending arms 56 which are adapted for alternate engagement by pawls, shown in Figs. 11 and 12.

Each pawl comprises a base 70, which is journalled on a pivot pin 71 secured in the partition and may be locked thereon by a split ring 72. The pawls are each provided with shoulders 73 adapted to engage the upper surface of the rocker arms 56 and prevent the rocker from moving. As shown in Fig. 3, the pawl to the right is in engagement with the right hand arm. The lower end of each pawl is provided with a projection 75 which extends laterally therefrom into engagement with the sides of the lever 36. These projections may remain in contact with the lever 36 at all times during the operation thereof. The movement of the pawls outward towards the sides of the casing is limited by abutments, such as 76. Springs indicated at 77 are provided for urging the pawls against the lever 36, being seated in recesses in the sides of the pawls and upon pins 78 disposed in the side of the housing.

The contact lever 51 is provided with a contact carrying bar 80, secured in the end of the lever and which bar projects from opposite sides of the lever and has heads on the opposite ends. The bar guides the contact strips 82 which are disposed on opposite sides of the lever 51. The strips in turn carry the contact 83. The bars are held away from the sides of the lever against said heads by springs 81 disposed between the strips and extending through openings in the lever 51. The contact lever is adapted to be swung between pairs of fixed contacts 85 carried on strip 86, which strips in turn are secured to insulating blocks 87. The connector screws for the strip are indicated at 89.

The operation of the device is as follows; the contacts may be used to open or close a circuit as desired. The lever 21 is disposed in such a

manner that the roller 22 may be operated upon by the mechanism which the switch is to control. It can be a moving part or a cam in the event that it is to be used as a limit switch. Movement of the lever 21 transmits movement through the shaft 19 to the short lever 30. It will be noted that the neck 33 of the lever 30 is in alignment with the neck 38 of the swing lever 36, although the swing lever can move independently of the short lever 30. When the short lever is moved, movement is transmitted to the swing lever through the medium of the spring 42 which is wide enough to engage the neck on both levers simultaneously. In this manner, the short lever may move the swing lever, but both levers are capable of movement relative to each other in event either one meets with a predetermined amount of resistance.

The swing lever 36 being swung, the notched end 40, which is in engagement with the circular portion 59 of the lever 57, causes this lever to be swung about its pivot, the circular portion 59 sliding in the U-shaped slot 40.

The lever 57, as previously stated, has the neck 58, which is in alignment with the projections 55 and 62, on the rocker body 52 and spacer 61. The ends of the spring 65 engage the necks of the rocker body and the short lever in a manner similar to the operation of the spring 42, and when the lever 57 is rotated, the movement is transmitted through the spring 65 to the two necks of the rocker body 52. This would cause the rocker body to be rocked counterclockwise as viewed in Fig. 3 if the pawl 70 was not holding the rocker against movement; but since the rocker cannot move, being held by the pawl 70, the ends of the spring are spread apart due to the member 57 moving relative to the rocker increasing the spring tension on the necks 53 and the arm 55 which are now out of alignment with each other. Therefore, a considerable amount of tension is placed on the rock lever due to this action through the spring 65. It will be noted, however, that the lever 36 is in contact with the projection 75 on the end of the pawl, and that as the swing lever 36 is swung, increasing the tension on the spring 65, the latch is gradually being moved to the right, moving the shoulder 73 off the arm 56 of the rock lever. Eventually, the lever 36 moves the pawl to a point where the shoulder 73 of the pawl disengages from the arm 56 of the rock lever. At this time, the spring tension tending to realign the rocker member 52 and the lever 57 is greatest due to the misalignment of the two parts, and when the latch shoulder 73 slips off the arm of the rock lever, the spring 65 brings these parts back together, and the rock lever is snapped counterclockwise to the opposite position from that shown in Fig. 3. The spring 77 moves the latch on the left side over into engagement with the other arm of the rock lever.

It will be thus seen that the rock lever does not move until the shaft 36 has attained sufficient movement to release the latch, but when the movement does occur, it is with a snap action. This, obviously, causes the shaft 50 to rotate, carrying with it the contact arm 51 and the contact points 83 which are snapped quickly into or out of contact with the stationary contact 85.

It should be particularly noted that the movement necessary to cause a snap action of the lever 21 is relatively small as compared with the previous devices. The latch is started to release as soon as the lever 36 starts to move, and it

does not have the problem of carrying a roller past center on the rocker arm as in my prior patent. It is, therefore, possible to provide a snap action switch, which is quick in its operation and rugged in construction enabling it to carry a high current and has a minimum of movement at the switch arm. The over throw connection between the switch arm and the lever 36 is substantially the same as that described in the prior patent.

It should be particularly noted that the mechanism is considerably simplified, making the machining operations much simpler than were previously required, and that the wearing parts are fewer in number, and require less movement, and therefore wear less.

It should also be noted that the spring 45 in some instances may be placed on the other side of the device, or, in some cases, may be eliminated entirely. This in event that it is desired to operate the switch first in one direction to close one set of contacts, and then in the other direction to close the other set of contacts. In this case, the springs necessary for the operation could be springs 77 operating on the latches 70.

Having thus described my invention, I am aware that numerous and extensive departures may be made therefrom without departing from the spirit or scope of the appended claims.

I claim:

1. An apparatus of the class described comprising an operating arm and a shaft secured thereto, a lever carried by said shaft and movable therewith, a second lever having a forked end swingable by said first lever and spring means providing a driving connection therebetween, a contact carrying lever and a rock shaft secured thereto, a rocker connected to said rock shaft having arms extending therefrom on opposite sides of the shaft, pawls adapted for alternate engagement with each one of sad arms, a lever having a projection engageable with said fork and movable thereby and spring means connecting said rocker and said last mentioned lever.

2. An apparatus of the class described comprising a swingable lever having a bifurcated end, a rock shaft and a rocker thereon, a lever rotatably journalled on said rock shaft and having a portion engaged by said bifurcated end, spring means for connecting said last mentioned lever and said rocker.

3. An apparatus of the class described comprising a swingable lever having its free end formed to provide a slot the side walls of which are parallel, a rock shaft and a rocker carried hereby, a lever rotatably journalled on said shaft and having a curved portion disposed for tangential engagement with said parallel side walls, spring means for connecting said last lever to said rocker lever and permit relative movement therebetween upon the rocker lever meeting a predetermined resistance, said spring means adapted to rock said rocker upon release of said resistance.

4. An apparatus of the class described comprising an operating member, a shaft for supporting said operating member, a drive lever and a driven lever carried by the shaft and spring means connecting said levers, said driven lever being swingable and formed with a pair of spaced arms on its end; a rock shaft, a contact lever carried on one end of the rock shaft, a rocker member secured to the other end of said rock shaft, and having pawl engaged arms thereon, pawls disposed for alternate engagement with said arms, and having projections disposed for

pawl releasing contact with said driven lever, means to rock said rocker comprising a lever rotatably journalled relative to the rocker and spring means connecting said last mentioned lever and said rocker, said last mentioned lever having a portion disposed between said spaced arms and movable thereby.

5. A switch comprising a housing, a partition dividing the housing into separate compartments, an operating shaft rotatably journalled in the housing and extending into one of said compartments and a latch operating lever carried thereby, an operating lever carried by said shaft outside the housing, spring means connecting said lever in the housing to said shaft and permitting relative movement between the lever and the shaft upon either the lever or shaft meeting with predetermined resistance, a rock shaft journalled in said partition and a contact carrying lever carried thereby in said other compartment, means for rocking said second shaft and swinging said contact carrying lever comprising a rocker secured to said shaft in said first compartment and having a pair of pawl engaging arm carried thereby, pawls supported by the housing movable for alternate engagement with said pawl engaging arms, extensions for said pawls extending opposite to said latch operating lever and spring means for holding said pawls into engagement with said latch operating lever; and means for rocking said shaft by said latch operating lever through said rocker comprising a lever rotatably mounted on said rock shaft and having a projection thereon, said rocker being provided with a projection and a C shaped spring engaging said projections and providing a resilient driving connection therebetween said rocker.

6. An apparatus of the class described including a rocker, a lever, spring means for connecting said rocker and lever together, a pair of arms extending from said rocker, pawls each having a surface for alternate engagement with one of said arms, an extension of each pawl, a second lever in interlocking engagement with the first lever and swingable to move said first lever, said pawls adapted to hold said rocker against movement and said extensions being disposed in the path of travel of said second lever, said second lever adapted to release a pawl from locking engagement with said rocker and said spring means adapted to move said rocker upon release of said pawl.

7. An apparatus of the class described including a rocker and a lever journalled upon a common axis, spring means operably connecting said rocker and lever together, a pair of arms extending laterally from said rocker on opposite sides thereof, a pair of pawls each having a surface for alternate latching engagement with one of said arms, an extension on each pawl, a second lever having a pair of spaced parallel arms on its end, the first lever having a curved end disposed between said arms adapted to be swung by said first lever, said pawls adapted to hold said rocker against movement and said extensions being disposed in the path of travel of said second lever, said second lever adapted to alternately engage an extension for the pawl holding the rocker to move said pawl from locking engagement with said rocker and said spring means adapted to move said rocker upon release of said pawl.

8. An apparatus of the class described, a rock shaft, lever means for rocking said shaft including a first portion connected to the shaft and a second portion having spring means connecting it to the first portion, means for swinging said second portion including a swingable lever, a pivotal connection between said second portion and said swingable lever, and holding means for engaging said first portion and holding it against movement until a predetermined force is exerted by said spring between said first and second portions.

9. An apparatus of the class described, a rock shaft, lever means for rocking said shaft including a first portion connected to the shaft and a second portion having spring means connecting it to the first portion, means for swinging said second portion including a swingable lever, a pivotal connection between said second portion and said swingable lever, and holding means for engaging said first portion and holding it against movement until a predetermined force is exerted by said spring between said first and second portions, and means on said swingable lever for releasing said holding means.

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