July 29, 1952 J. H. DERBY ET AL 2,604,790

RELEASING DEVICE

Filed Aug. 5, 1950 2 SHEETS—SHEET 1

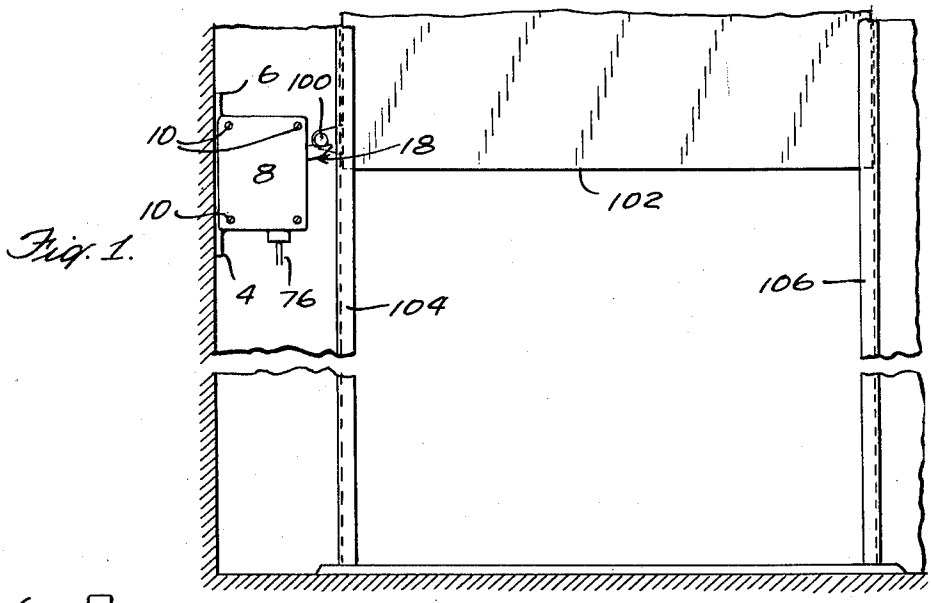


Fig. 1.

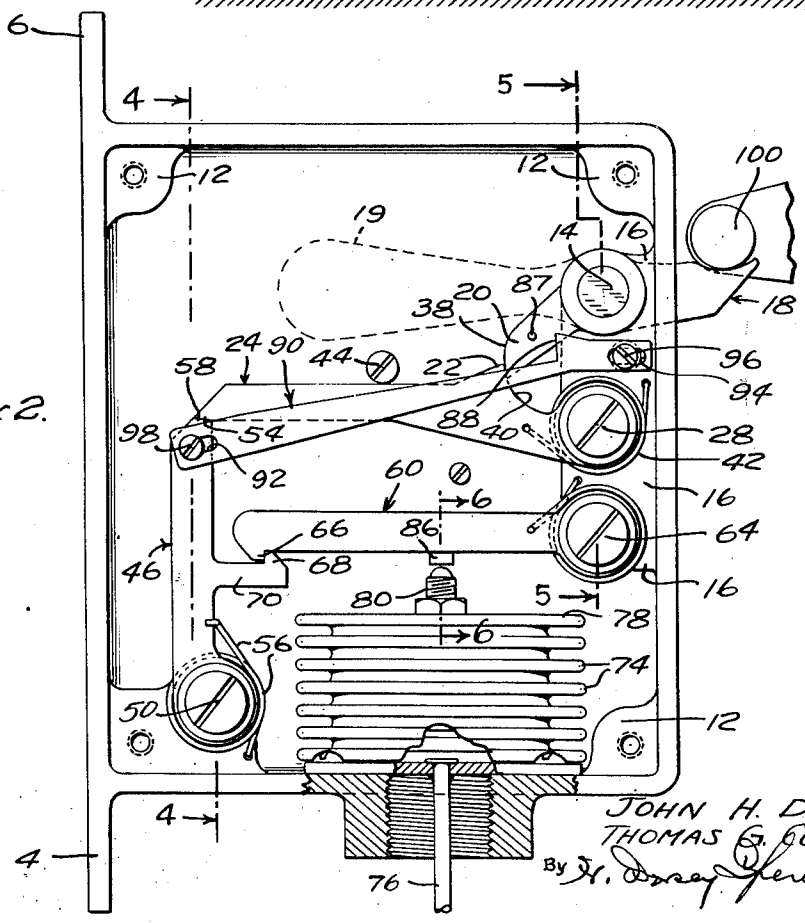


Fig. 2.

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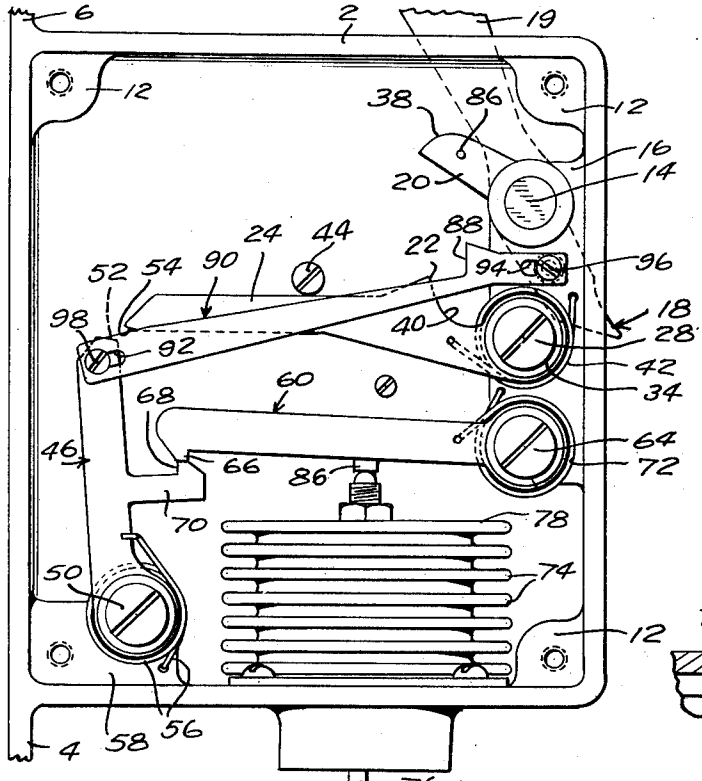


Fig. 3.

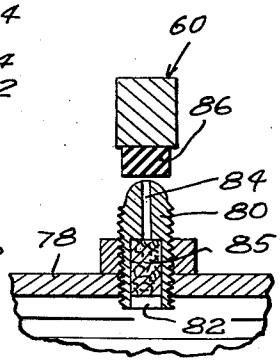


Fig. 6.

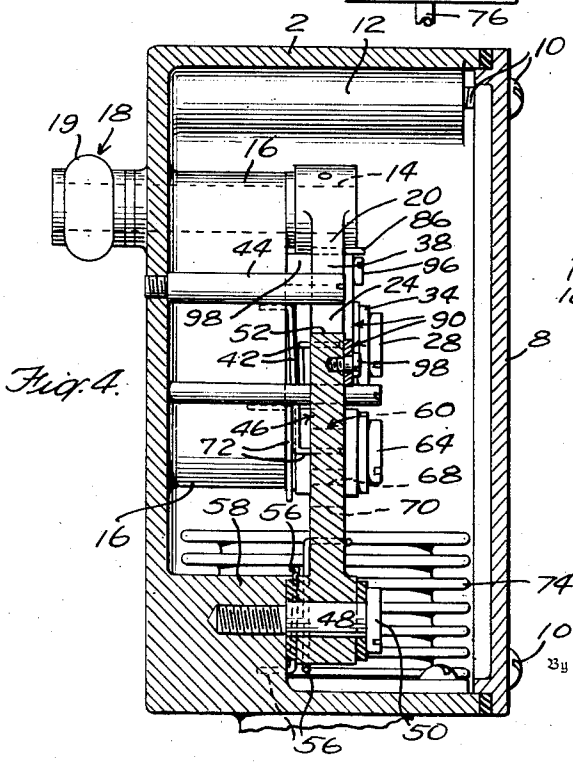


Fig. 4.

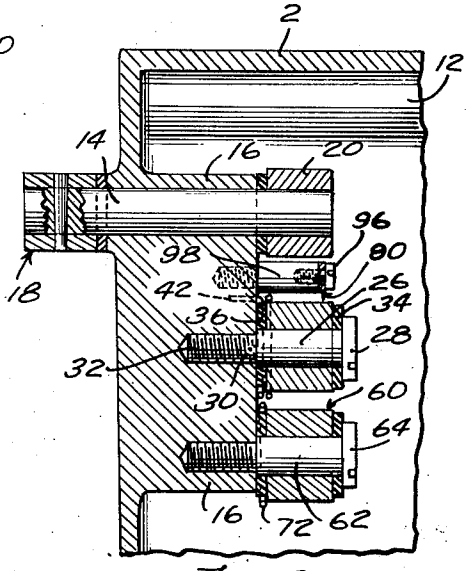


Fig. 5.

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RELEASING DEVICE

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5 Claims. (Cl. 74—2)

1

This invention relates to devices which can be operated from a distance to release something held against operation or movement such, for example, as fire doors, fire dampers, theatre fire curtains, dip tank covers, valves which control the release of liquids or gases used for fire extinguishing, etc. These devices, since the trip mechanism is usually enclosed in a protective box-like casing, are commonly known in the trade as "release boxes." Although such release boxes find their most important field of utility in the fire prevention art, they are also useful for other purposes where it is desirable that the operation or movement of some device held against operation or movement be controlled from a distance.

Release boxes have been used extensively in fire prevention systems of the type in which thermostatically operated circuit closers close an electric circuit through electromagnetically actuated trip mechanism in the release box. There is in quite extensive use, however, another type of fire prevention system in which the fire alarm and the fire controlling means are actuated by the thermally induced expansion of a fluid in a tubular system at a rate greater than the normal rate of expansion which occurs with normal rises in room temperature. These are known to the trade as "rate-of-rise" fire control systems.

An object of the present invention is to provide a release box for use in such so-called rate-of-rise systems which will operate effectively and surely.

A particular object of the invention is to provide a release box, operable upon a sudden increase of the fluid pressure in fluid operated motive means constituting a part thereof, in which a simple system of levers and detents, such as catches, latches, etc., are so interrelated that the load, while positively held by the box before release, may, nevertheless, be released by a slight increase in the fluid pressure in the motive means. More particularly the invention aims to provide a fluid actuated release box which will effectively hold against movement the door or other part so to be held so long as such holding is required and will surely and quickly release it when release is called for and which can be made to sell for a price that will permit its more widespread use.

Other objects, important features and advantages of the invention, to which attention has not hereinabove specifically been directed, will appear hereinafter when the following description and claims are considered in connection with the accompanying drawings, in which—

2

Figure 1 is a front elevation of a release box embodying the present invention shown in operative holding relation to a self-closing door fire dampers;

Figure 2 is a front elevation, with the cover removed, of the aforementioned release box, with the internal mechanism shown in its operative load-retaining position;

Figure 3 is a view similar to Figure 2 but showing the parts of the interior mechanism in the positions which they assume when the load has been released and before the box has been reset:

Figure 4 is a section on the line 4—4 of Figure 2 looking in the direction of the arrows,

Figure 5 is a section on the line 5—5 of Figure 2 looking in the direction of the arrows, and

Figure 6 is a detail section on the line 6—6 of Figure 2.

In the illustrative embodiment of the invention the box-like casing 2 is shown as having flanges 4 and 6 provided with screw or bolt holes through which attaching means may pass to attach the release box to a stationary part adjacent to the door or other device to be held against its tendency to move. A removable cover 8 may be held in place by screws 10 screwed into corner pieces 12 integral with the casing 2.

A fulcrum shaft 14 has its bearings in a thickened part 16 of the rear wall of the casing 2 and extends through this rear wall to the outside of the casing. Attached to that part of the shaft which lies outside the casing 2 is a load-retaining and releasing arm 18 provided with a counterweight 19 tending to rock the arm 18 back into its load-retaining or reset position after the box has been tripped to release the load. At its inner end the shaft 14 has attached thereto a trip arm 20 having a pawl-like end which cooperates with a catch 22 on a catch lever 24 independently fulcrumed at 26 on the smooth part of the shank of a headed machine screw 28 having a shoulder 30 between the fulcrum part 26 and the threaded part 32 that screws into a tapped opening into the thickened part 16 of the rear wall of the casing. Washers 34 and 36 of Bakelite or other suitable material are preferably provided in the locations shown to insure free operation of the catch lever 24.

It will be seen that the end of the pawl-like trip arm 20 is rounded back at 38 and that a rounded recess 40 is provided in the catch lever 24 behind the catch 22 to permit the trip arm 20 to swing considerably beyond its catch relation to the part 22 of the catch lever 24 when the release box is being reset, for a purpose hereinafter more fully to be set forth. A spring 42

coiled about the hub of the catch lever and connected at one end to the thickened part 16 of the rear wall of the casing and at its other end to the catch lever 24 is so tensioned as to tend to hold the catch lever up against a stop screw 44 and in its catch position. In this position it will be seen from an inspection of Figure 3 that, when the box is being reset, the trip arm 20 will engage the catch lever 24 and move it downward against the action of the spring 42 until the pawl-like end of the trip arm 20 passes the catch 22 on the catch lever and enters the curved recess 40 in the catch lever 24. The spring 42 will then cause the catch lever 24 to move back up against the stop screw 44, thus bringing the catch into its holding or catch relation to the trip arm 20, as shown in Figure 2.

To lock the catch lever 24 in its catch relation to the trip arm 20 against any tendency of a component of force which might cause the lever 24 to move downwardly into tripping relation to the trip arm 20, a locking lever 46, fulcrumed at 48 upon the smooth part of the shank of a headed machine screw 50, similar in construction to the screw 28, is so located that it may be moved into position so that its upper end 52 may be brought into position beneath the outer end 54 of the catch lever 24 to lock this lever against moving into tripping relation to the trip arm 20. A spring 56, connected at one end to the locking lever 46 and at its other end to a thickened part 58 of the rear wall of the casing 2 into which the screw 50 is screwed, is so tensioned that it urges the lock lever 46 out of locking relation to the catch lever 24.

To maintain the locking lever 46 in its locking relation to the catch lever 24 until the release box is to be tripped a latch is provided comprising a latch lever 60 fulcrumed at 62 on the smooth part of a headed machine screw 64, similar in construction to the screw 28, the latch lever 60 having a tooth 66 at its end adapted to hook over a similar tooth 68 on an arm 70 integral with the locking lever 46. A spring 72, attached at one end to the latch lever 60 and at its other end to the thickened part 16 of the rear wall of the casing 2, urges the latch lever 60 downward so that when the locking lever 46 is brought into locking relation to the catch lever 24 the latch lever 60 will move downward to cause its tooth 66 to come into latched relation to the tooth 68 on the arm 70. It will be seen that in this position the mechanism of the release box is positively locked against release of any load held upon the arm 18 but may be released by a comparatively small force.

As hereinabove suggested, the release box of the present invention is intended primarily for operation by the sudden expansion of a fluid in a fire prevention system of the rate-of-rise type where the expansion is caused by a rapid rise in temperature, it being understood, of course, that mechanical means under the control of a central station may also be provided for causing a sudden increase in pressure on the fluid sufficient to operate the system at will. As herein shown the means for unlatching the latching lever 60 to cause the tripping of the release box comprise bellows 74, of the extensively used "sylphon" type, connected by an inlet tube 76 with the fluid containing tubular system making up the rate-of-rise fire prevention or other controlling system of the expansible fluid type, the end wall 78 of the bellows 74 moving somewhat like an ordinary fluid operated piston when the fluid pressure in the bellows 74 causes the expansion of the bellows.

In order that gradual expansion of the fluid in the system may not cause the operation of the release box tripping mechanism a slow leak is provided of such capacity that gradual expansion of the fluid in the system due to the gradual changes of temperature ordinarily occurring in a room will be compensated for by the gradual escape of the expanding fluid through this leak. As herein shown, see Figure 6, the leak is provided in a nipple 80 screwed into the piston-like end 78 of the bellows 74, this nipple having an enlarged recess 82 below its vent 84 of sufficient inside diameter, say ¼", to receive a porous plug 85 of suitable material, such as balsa wood, which will allow the gradual escape of the expanding fluid and at the same time keep dust out of the leak opening.

Mounted in a recess on the under side of latch lever 60 and projecting below said lever is a cushion 86 of soft rubber arranged above the vent 84 and normally separated from the rounded end of the nipple 80 by a small gap, say about .002". When the bellows 74 expands with a sudden rise in fluid pressure and the end of nipple 80 engages the soft rubber cushion 86 the leak through vent 84 will be sealed and the whole force of the expanding fluid will then act upon the bellows, and particularly upon the end 78 thereof to raise the latch lever 60 into its unlatching position. As above stated, when the parts are in the position shown in Figure 2 there will be a small gap, which may be as small as .002", between the end of the nipple 80 and the rubber cushion 86, thus allowing for the escape of gradually expanding fluid. As soon, however, as the fluid begins to expand rapidly as when a fire occurs, the leak capacity of the balsa wood plug 85 will not be sufficient to permit the escape of this fluid, the piston 78 will move upwardly and by so doing seal the vent 84 and thus the pressure of the expanding fluid will cause the unlatching movement of latch 60 and the tripping of the release box.

It will be seen that as soon as the tooth 66 of the latch 60 moves out of engagement with the tooth 68 on the arm 70 of the locking lever 46 the spring 56 will tend to move the locking lever out of locking relation to the end 54 of the catch lever 24 and the pressure of the load on the arm 18 will cause the trip arm 20 to rock the catch lever 24 about its fulcrum in the counter-clockwise direction sufficiently to release the trip arm 20 and thus release the load.

To facilitate the tripping of the box, particularly if for any reason the spring 56 should fail, the meeting faces 52 and 54 on the lock lever 46 and catch lever 24, respectively, are so inclined to the direction of the force exerted upon lock lever 46 by catch lever 24 as to provide a component of force tending to move the lock lever 46 in its releasing direction. It has been found in practice that if the inclination of the end face 52 to the straight line through the fulcrum 48 be at an angle of $7° \pm 1°$, the desired releasing action will be obtained under practically all conditions.

When the load has dropped off the trip arm 18 the box may be again reset, in the event that the fluid in the bellows 74 is not still pressing the bellows end 78 and the parts carried thereby upward out of their normal position of rest. As soon as the fluid pressure has returned to normal in the bellows 74 the release box may be reset. To permit such resetting without opening the box, a pin 87 is provided on the trip arm 20

adapted to engage a shoulder 88 on a link 90 provided in its ends with slots 92 and 94. The slot 94 receives the shank of a small screw 96 screwed into the end of a stud screw 98 and serves to guide and limit the longitudinal movement of the link 90. The slot 92 receives the shank of a screw 98 in the lock lever 46. The link 90 thus serves, in the first place, to limit the movement of the lock lever 46 away from its operative position. When the fulcrum shaft 14 is rocked to an angle sufficient to cause the pin 87 to engage the shoulder 88 on the link 90 and move this link to the right in Figure 3, the left hand end of the slot 92, engaging the shank of the screw 98 in the lock lever 46, will cause said lever to rock about its fulcrum 48 toward locking relation to the catch lever 24.

As the trip arm 20 rocks in a counterclockwise direction about the axis of the fulcrum shaft 14 it will be seen that it first engages the catch lever 24 in the region of the catch 22 and presses this down sufficiently to snap the pawl-like end of the trip arm 20 past the catch, after which the spring 42 will move the catch lever 24 back against the stop 44. Further movement of the trip arm 20 in the counterclockwise direction will bring the pin 87 into engagement with the shoulder 88 on the link 90 and effect the movement of the lock lever 46 into locking relation to the catch lever 24.

It will also be seen that this movement of the lock lever 46 under the pull of the link 90 will move the tooth 68 on the arm 70 of the lock lever 46 into such relation to the tooth 66 on the latch lever 60 that the spring 72 acting on the latch lever 60 may snap the tooth 66 into latching relation to the tooth 68, assuming that the fluid in the bellows 74 has returned to its normal pressure. When the teeth 66 and 68 of the latch mechanism are thus engaged the release box is ready to receive the load to be released on its arm 18, which load may be almost any movable element that is to be held against movement, such for example as the arm 100 on a vertically sliding window or door 102, slidable in guides 104 and 106 under the action of gravity, the release box thus operating to hold it in open condition until the box is tripped as hereinabove set forth.

As hereinabove pointed out, the vent opening 84 in the nipple 80 and the leak capacity of the balsa wood plug 85 in the recess 82 in the nipple 80 are such as to insure an ample venting of the air in the system under ordinary conditions, that is, venting of increases in pressure in the system due to gradual increases in temperature and restoration of atmospheric pressure when the temperature again lowers. When, however, as above pointed out there is a sudden increase of pressure in the system, due to a sudden rise of temperature, the vent 84 is closed almost immediately since this increase in pressure causes an expansion of the bellows 74 and the movement of the end 78 toward latch lever 60. The gap provided between the cushion 86 and the nipple end, usually not over .002", is so short that, as above stated, the closure of the vent 84 takes place almost immediately by engagement of the end of the vent opening 84 with the rubber cushion 86.

From the foregoing description of the arrangement of the levers making up the holding and release mechanism of the box it will be seen that, at the point where the initial release movement takes place, only a very small force is required either to hold the release box in its locked condition or to effect the unlatching thereof for releasing the load. For example, it will be seen that the catch lever 24 is a lever of the second class and that the moment arm of the catch is of a length very much less than the moment arm to the point 54 where the catch lever 24 engages the locking lever 46, thus giving considerable power multiplication so that the power required to hold the catch 22 in retaining relation to the trip arm 20 is comparatively small. It will further be seen that the movement of the locking lever 46, which in operative position extends at substantially right angles to the catch lever 24, necessary to carry it into and out of its locking relation to the catch lever 24 is comparatively small. When in locking relation to the catch lever 24, the locking lever 46 is held by the latch members 66 and 68 which have to move only a very small distance into their unlatched relation to each other. In this connection it is to be noted that the engaging faces of the latch members 66 and 68 are preferably substantially tangential to the arc through which the latch face 66 swings with the lever 60, or even slightly inclined to this tangent toward the arc, so that there is no substantial friction incidental to the releasing movement of the latch.

From the foregoing description it will be seen that the release box of the present invention, by its arrangement of levers, provides positive retention of the load to be released while at the same time permitting its release with the application of a comparatively small increase in pressure and the movement of the release latch through a comparatively small arc of movement, the latch being a lever of the third class and thus requiring a small movement of the power-applying means to produce a considerably greater movement of the latch proper.

What we claim as new is:

1. A release box, operable upon a rapid increase in the pressure of a fluid in a rate-of-rise system for fire control or the like, comprising, in combination with a box-like casing, a fulcrum shaft extending through a wall of said casing and having a load retaining and releasing arm fixed upon the outer end thereof and having a trip arm fixed upon the inner end thereof, an independently fulcrumed catch lever having a catch thereon arranged to engage said trip arm to hold said load retaining and releasing arm in its load retaining position, a third independently fulcrumed lever normally spring urged out of but movable into such relation to said catch lever as to lock the latter in catch position, a latch for latching said last-mentioned lever in its operative locking relation to said catch lever and fluid operated motive means for engaging and tripping said latch upon a rapid increase in pressure of the operating fluid, the means for confining said operating fluid in operative relation to said motive means being provided with a slow leak to prevent operation of said motive means by gradual changes in fluid pressure, the engaging faces of said second and third levers lying at such an angle to the radius of swing of the third lever that a component of the force transmitted from the load to be released through said second lever to the third lever at least counterbalances the friction between said engaging faces, thereby facilitating the release of said second lever by the third.

2. A release box, operable upon a rapid increase in the pressure of a fluid in a rate-of-rise system

for fire control or the like, comprising, in combination with a box-like casing, a fulcrum shaft extending through a wall of said casing and having a load retaining and releasing arm fixed upon the outer end thereof and having a trip arm fixed upon the inner end thereof, an independently fulcrumed catch lever having a catch thereon arranged to engage said trip arm to hold said load retaining and releasing arm in its load retaining position, a third independently fulcrumed lever normally spring urged out of but movable into such relation to said catch lever as to lock the latter in catch position, a latch for latching said last-mentioned lever in its operative locking relation to said catch lever and fluid operated motive means for engaging and tripping said latch upon a rapid increase in pressure of the operating fluid, the means for confining said operating fluid in operative relation to said motive means being provided with a slow leak to prevent operation of said motive means by gradual changes in fluid pressure, and a counterweight arm attached to the fulcrum shaft upon the outer end thereof which so overbalances the load retaining and releasing arm as to tend to restore it to its load retaining position after the load is released.

3. A release box according to claim 2 in which a link is connected to the locking lever and means are provided on the trip arm to cooperate with said link to restore said lever to its locking relation to the catch lever when said fulcrum shaft is rocked slightly more than is necessary to restore the load retaining and releasing arm to its load retaining position.

4. A release box according to claim 1 in which the latch comprises interlocking elements one of which is carried by the locking lever and the other of which is carried by a latch lever, said latch lever being mounted to swing through a latching arc substantially perpendicular to the arc through which the locking lever swings into and out of its locking position, the engaging faces of the two latch members being substantially tangential to the arc through which the latch lever swings.

5. A release box according to claim 1 in which the arc through which the locking lever swings into and out of its locking position is substantially normal to the arc through which the catch lever swings into and out of its catching position.

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