

April 28, 1936.

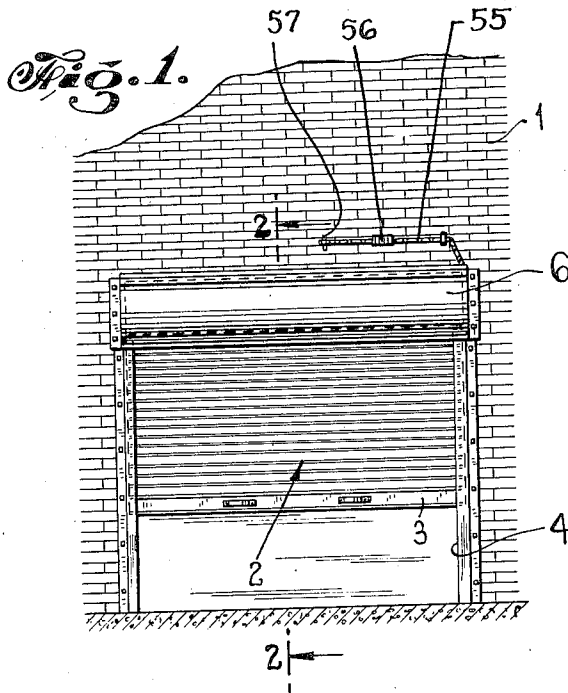
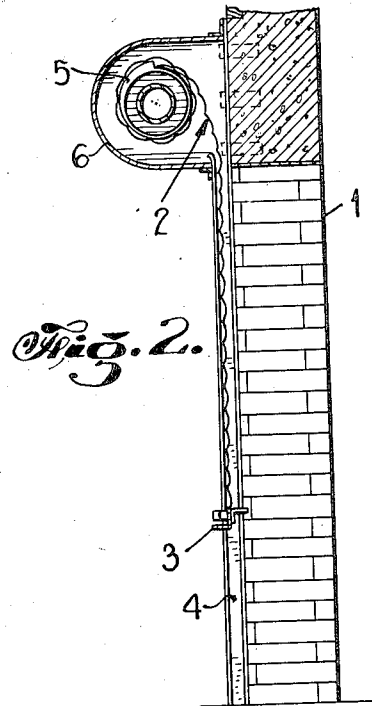
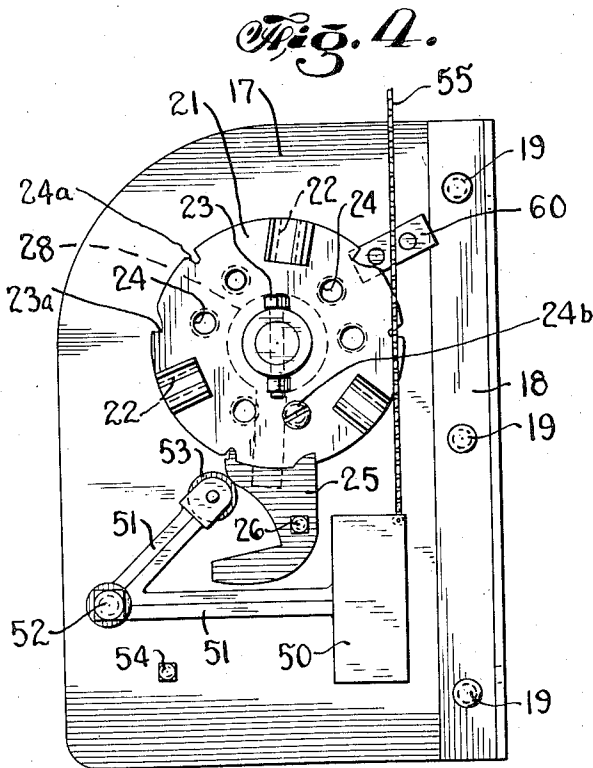
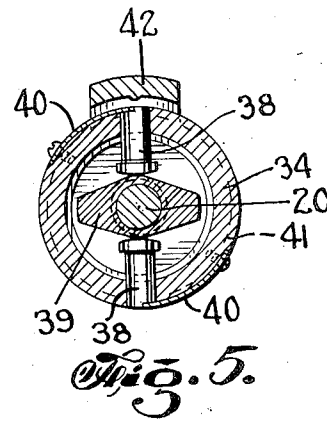
E. CAHILL

2,038,523

FIRE DOOR

Filed Jan. 18, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

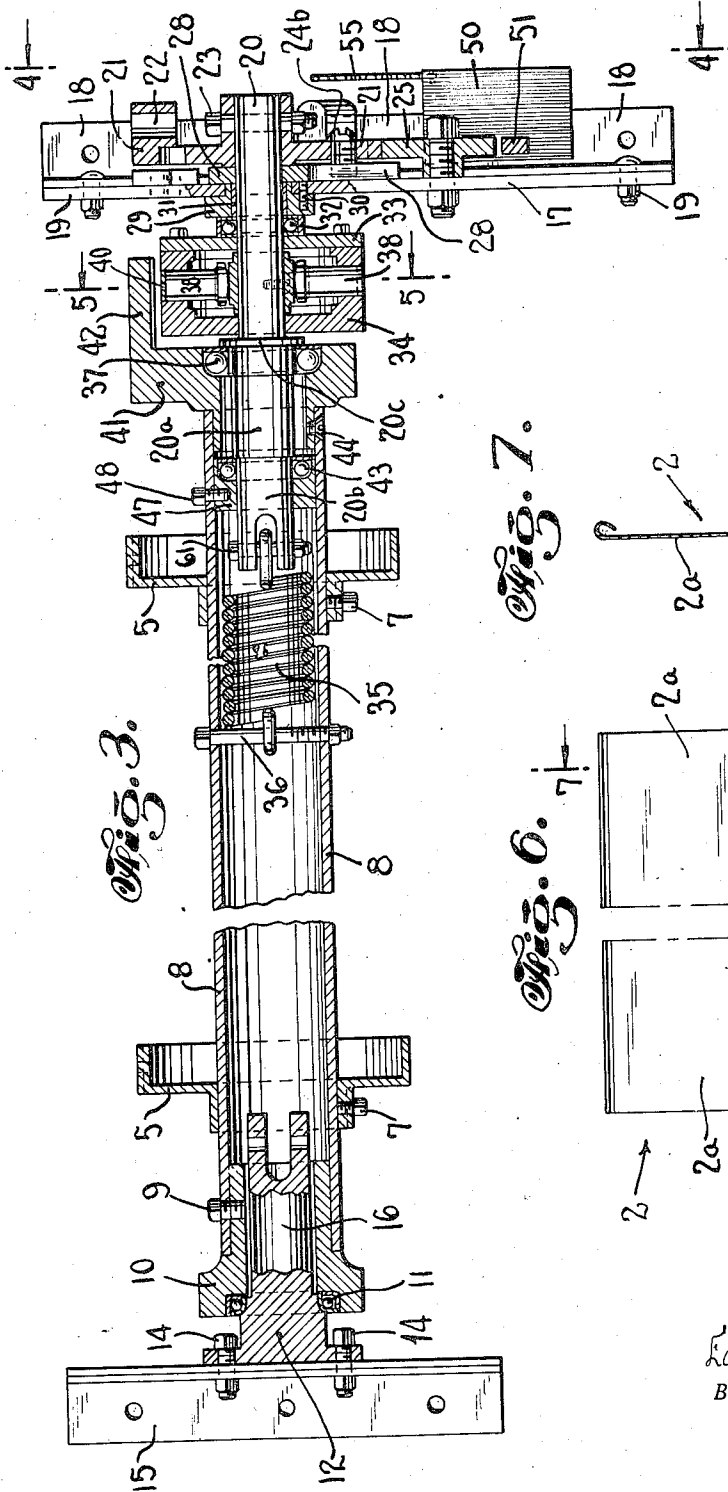
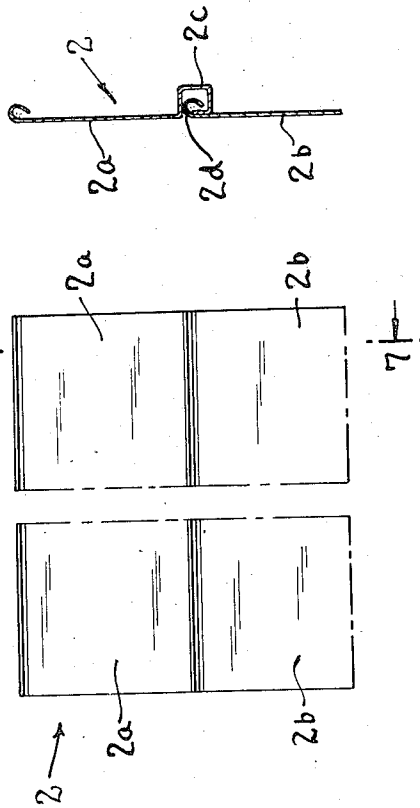


Fig. 3.

Fig. 6.



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UNITED STATES PATENT OFFICE

2,038,523

FIRE DOOR

Edward Cahill, New York, N. Y.

Application January 18, 1936, Serial No. 59,683

2 Claims. (Cl. 189—57)

My invention relates to an improved automatic fire door, fire shutter and the like.

One of the objects of my invention is to improve fire shutters or fire doors which are normally held in the raised or open position, and which have means for automatically releasing the same upon a predetermined rise in temperature. When said curtains are released, they are automatically moved to the closed position.

Another object of my invention is to provide a device of this kind which is of simple and efficient construction, and which can be manufactured at low cost. Another object of my invention is to provide improved impulse means for moving the shutter to the closed position, when the device is released.

Another object of my invention is to provide improved means for regulating the tension of the spring which holds the curtain in the open or inoperative position.

Other objects of my invention will be set forth in the following description and drawings which illustrate a preferred embodiment thereof, it being understood that the above statement of the objects of my invention is intended to generally explain the same without limiting it in any manner.

Fig. 1 is a front elevation of the improved structure.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional view, partially in elevation, which illustrates the essential parts of the operating mechanism.

Fig. 4 is a sectional view on the line 4—4 of Fig. 3.

Fig. 5 is a sectional view on the line 5—5 of Fig. 3.

Fig. 6 is an elevation which shows a modified form of the curtain.

Fig. 7 is a sectional view on the line 7—7 of Fig. 6.

Referring to Fig. 1, the curtain 2 is shown as partially closing the opening in a wall 1. It is to be understood that in the normal position of said curtain, it is located wholly within the hood 6, or closing part or all of the opening.

Said curtain is provided with a bottom rail of any suitable rigid material, and said rail 3 is guided in vertical guides 4 in the usual manner.

Referring to Fig. 3, the upper end of the curtain is connected to the dummy barrels 5, in the usual manner. These dummy barrels may be made of cast-iron or the like and the distance between said dummy barrels may be less than

the width of the curtain, so that the curtain overlaps said dummy barrels.

Referring to Fig. 3, the left-hand dummy barrel 5 is connected by means of bolts 7 to a barrel or hollow shaft 8. Said hollow shaft 8 is connected by means of bolts 9 to a sleeve 10. Said sleeve 10 is mounted, by means of an end-thrust anti-friction bearing 11, upon a member 12, which is fixed by means of bolts 14 to an upright plate 17, connected to angle-iron 15.

Said member 12 is provided with a forked extension 16 which may be used in case it is desired to utilize a spring which will be auxiliary to the spring 35, which will be later described.

The right-hand dummy barrel 5 is also fixed to the hollow shaft 8 by bolts 7 so that both said dummy barrels 5 turn in unison with the shaft 8.

Referring to Fig. 3, a shaft 20 has a wheel 21 connected thereto by means of bolts 23. Said wheel 21 is provided with lateral lugs, which are provided with radial recesses or bores 22. Said recesses or bores 22 can be engaged by means of an ordinary tool, in order to turn the shaft 20 for winding up the spring 35.

As shown in Fig. 4, the wheel 21 is provided with a series of holes 24, and a stop-pin 24b can be located in any one of said holes 24.

As shown in Fig. 3 and in Fig. 4, an arm 28 has a hub which is loosely mounted upon the shaft 20, so that the arm 28 can turn relative to said shaft 20.

Said arm 28 may abut the pin 24b which has been located in one of the holes 24.

When the wheel 21 is released, as will be later described, said wheel 21, together with the shaft 20, turns in the clockwise direction, referring to Fig. 4, until said arm 28 contacts with the stop 60, which is fixed to the stationary plate 17, thus stopping the further turning movement of the wheel 21 and of the shaft 20.

A bearing member 29 is mounted upon a bushing 31, which may be made of bronze or other suitable material.

Said bearing member 29 is connected by means of bolts 30 to the vertical plate 17, which is connected by means of bolts 19 to a vertical angle-iron 18.

A plunger-housing 34 is mounted freely upon the shaft 20, so that the shaft 20 can turn relative to said housing 34.

The housing 34 is located between an enlargement 20c of the shaft 20, and an anti-friction bearing 32, so that the housing 34 is held against longitudinal shifting on the shaft 20.

As shown in Fig. 5, the shaft 20 has a cam 39 connected thereto and said cam is located within the housing 34. Said housing 34 is provided with radially-movable plungers 38. These plungers 38 are held yieldingly in their inner position, by means of springs 40. Each said spring 40 has one end thereof connected to the housing 34, and the other end of said spring 40 is located on a shoulder or in a notch of the plunger 38.

When the plungers 38 are moved outwardly, one of said plungers will strike against the arm 42 of the sleeve 41. As shown in Fig. 3, said sleeve 41 has a projecting end which fits within the hollow shaft 8, and bolts or screws 44 connect the sleeve 41 to the hollow shaft 8.

Anti-friction bearings 37 are located between the shaft portion 20c, and the sleeve 41.

An additional anti-friction bearing is provided, between the hollow shaft 8 and the inner shaft 20. The anti-friction members 43 of said bearing are located between the adjacent end-face of the enlarged shaft portion 20a, and a member 47, which is fixed to the shaft 8 by means of screws 48.

The shaft 20 is provided with a reduced end-portion 20b, which passes through the member 47, which thus serves as a bearing support for said reduced shaft portion 20b.

The shaft portion 20b is forked, and it is provided with a transverse pin 61, to one end of which the helical spring 35 is connected. The other end of said helical spring 35 is connected to a transverse pin 36, which is fixed to the hollow shaft 8.

If a spring which is auxiliary to the spring 35 is desired, said spring may be connected at one end to the member 16, and the other end may be connected to a pin, which may be spaced from the pin 36 which is shown in Fig. 3, and which is connected to barrel 8.

Any desired number of dummy barrels 5 may be utilized for supporting the curtain.

Referring to Figs. 6 and 7, this shows an improved method of articulating the elements of the flexible curtain. Figs. 6 and 7 show curtain members 2a and 2b which may be rolled or stamped out of any suitable metal. The member 2a is provided with a bead 2c, which has a general rectangular shape.

The curtain member 2b is provided with a hook end 2d, which is located turnably within the bead 2c.

As shown in Fig. 1, a chain 55 is connected at 57 to the wall 1 or some other fixed part. Said chain 55 includes a fusible link 56.

The said chain 55 is connected to a vertically movable weight 50.

As shown in Fig. 4, said weight 50 is integral with a bell-crank lever having two arms 51, said lever being pivotally mounted at 52 to the plate 17.

A pawl 25 is pivotally connected at 26 to the plate 17 and said pawl has teeth which are adapted to engage a pair of notches or teeth 23a and 24a, which are formed in the periphery of the wheel 21. The notches 23a and 24a have different shapes, and the teeth of pawl 25 have shapes corresponding to the respective shapes of said notches.

In the position of the parts which is shown in Fig. 4, the pawl 25 locks the wheel 21.

The operation of the device is as follows:—

The helical spring 35 is wound up by turning inner or spring-shaft 20 by means of wheel 21 until the force of spring 35 is sufficient to hold the fire-resisting curtain in its upper or open position.

Referring to Fig. 4, the wheel 21 is turned in

the counterclockwise direction in order to wind up spring 35. While wheel 21 is being turned, the weight 50 may be below the position which is shown in Fig. 4, so that anti-friction roller 53 of lever 51 engages the bottom arm of pawl 25, so that pawl 25 is released from wheel 21. Lever 51 may then abut stop 54, which is fixed to plate 17. The spring 35 is ordinarily wound up when the curtain is in the closed position, until the force of the spring can raise the curtain to the open or partially open position. The spring thus counterbalances the weight of the curtain.

The chain 55 may then be moved upwardly and held in the position shown in Figs. 1 and 4, by means of the fusible link or other automatic release, so that roller 53 is in the position shown in Fig. 4.

The reaction of spring 35 tends to turn wheel 21 in the clockwise direction, referring to Fig. 4. However, pawl 25 then holds wheel 21 against clockwise turning, referring to Fig. 4.

When the fusible link 56 melts, weight 50 is released until the lower arm of the bell-crank lever strikes stop 54. Referring to Fig. 4, this clockwise turning of the bell-crank lever causes roller 53 to strike against the bottom lateral arm of pawl 25, thus turning pawl 25 in the counterclockwise direction, until it releases wheel 21, and pawl 25 is held by roller 53 in said release position. The weight 50 is made sufficiently heavy to shift pawl 25 to the inoperative position. Wheel 21 can now turn clockwise until pin 24 abuts arm 28 and arm 28 strikes stop 60. The unwinding of spring 35 lessens its force so that the curtain can descend.

However, it is desirable to give the curtain a positive downward movement.

The turning of shaft 20 and of its cam 39 moves plungers 38 outwardly. One of the plungers 38 strikes against arm 42 of sleeve 41, and since said member 41 is fixed to barrel 8, the barrel 8 is given a positive turning impulse by the plunger 38 so as to lower the curtain.

As the curtain falls, the unwinding of spring 35 is checked when stop 60 becomes operative, so that the further descent of the curtain winds up spring 35 so as to cushion the fall of the curtain. The curtain may descend until it closes the opening. However, if a person is standing under the curtain when it is released, the fall of the curtain is sufficiently gradual so as to prevent injury. When the curtain is in the closed position, the spring 35 may substantially or partially counterbalance the weight of the curtain, so that the curtain can be raised easily, after the emergency has passed. The curtain may then be pushed up directly or the spring 35 may be wound up in order to raise the curtain.

The curtain may be rewound upon the dummy barrels by turning wheel 21 in the counterclockwise direction (referring to Fig. 4) and then pulling up on chain 55 and replacing the fusible link 56. The spring may be wound up additionally after the curtain has been raised.

The impulse device for starting the unwinding of the curtain is a positive device, which does not depend upon centrifugal force, and it may be effective before shaft 20 has turned a full revolution. The stop pin 24 should be located so as to permit sufficient turning of shaft 20, so as to cause one of the plungers 38 to strike against arm 42 and to turn member 41 and barrel 8.

When the curtain is in the open or partially open position, the plungers 38 are located so that their outer ends are in the position shown in

Fig. 5, with springs 40 abutting the outer surface of housing 34. Said springs may then be under stress, so as to hold plungers 38 inwardly. The weight and inertia of housing 34 are sufficient to retard said housing against turning when shaft 20 is turned, so that cam 39 can force plungers 38 outwardly.

When the curtain is in the open position or in the partially open position, the weight of the depending portion of the curtain tends to turn the barrel 8 clockwise. Since the spring 35 tends to turn said barrel 8 counterclockwise, and since the shaft 20 is held against movement by means of the wheel 21 and the pawl 25 and the member 51, the curtain remains in the position to which it has been adjusted. Since certain allowance must be made for friction, which tends to retard the fall of the curtain, and which also tends to retard the raising of the curtain, the force of the spring 35 may be a little less or a little greater than the downward force which is exerted by the depending portion of the curtain.

When the temperature arises above the predetermined limit, so as to melt the fuse 56 or to release other automatic means, the wheel 21 is released. The wheel now turns in the clockwise direction (referring to Fig. 4) and the pin 24b turns the arm 28, until said arm 28 strikes against the member 60.

The unwinding of the spring 35 thus weakens its force, so that the curtain is free to descend. Of course, as the curtain is unrolled, the weight of the depending portion thereof increases, so that the unwinding action of the depending portion of the curtain is cumulative.

However it often happens that the curtain does not descend, due to excessive friction or the like. If the movement of the curtain is started, by overcoming static friction and the like, the curtain will then continue to descend with accelerated speed. If the curtain falls too rapidly, this is objectionable, as the curtain may injure a person who is standing beneath the same, when the wheel 21 is released. However, since the unwinding of the spring 35 is regulated by means of the adjustable member 24b, the spring 35 can be controlled so that it offers sufficient opposition to the descending movement of the curtain, so as to cushion this descending movement, and cause the same to be sufficiently gradual.

Referring to Fig. 5, when the shaft 20 and its cam 39 are turned, the housing 34 remains substantially stationary, since it has sufficient weight and inertia, and said housing 34 is mounted on anti-friction devices. Likewise, the interior of said housing may be filled with a suitable lubricant, if desired, such as a grease.

Since the cam 39 is turned relative to the housing 34, the tapered portions of said cam are pressed against the inner ends of plunger 38, which are suitably rounded, as shown in Fig. 5. If desired, the inner ends of said plunger 38 could be provided with anti-friction rollers of the familiar type.

The cam 39 therefore forces the plungers 38 outwardly, against the force of springs 40. The force of said springs 40 now tends to turn the housing 34 in the same direction as the shaft 20 and the cam 39. The arm 42 does not occupy a predetermined position relative to the plungers 38, when the wheel 21 is released, as the curtain may be fully raised or partially raised at that time.

If the plungers 38, or one of them, strike against a lateral face of the arm 42, said arm 42

is given an impulse, which tends to turn the same in the clockwise direction. This blow is sufficient to overcome static friction and the like, so that the curtain begins to descend at accelerated speed, save to the extent that the fall of the curtain is cushioned by the spring 35, after the turning of the shaft 20 has been stopped by the members 24b and 28 and 60.

After the turning of the shaft 20 has been thus stopped, the springs 40 force the plungers 38 inwardly, so that when the movement of the housing 34 is stopped, said plungers occupy the position relative to the cam 39, which is shown in Fig. 5. The tapered surfaces of the cam 39 permit said shaft 20 and the cam 39 to turn 15 through a predetermined arc, before the cam 39 operates to move the plungers 38 outwardly. This arc may be small.

In some cases, as the plungers 38 are forced outwardly by the turning of the shaft 20 relative to the housing 34, one of said plungers may contact with the inner face of the arm 42, instead of contacting with the lateral face of said arm 42. Said lateral face would be the left-hand face which is shown in Fig. 5.

If there is substantial friction between the inner face of the arm 42 and the outer ends of the plungers 38, the frictional force which is exerted by the respective plungers 38 will turn the arm 42 in the same direction as the shaft 20.

If there is little or no friction between the outer ends of the plungers 38 and the inner face of the arm 42, the plungers 38 will be held against further outward movement by the inner face of the arm 42, so that the housing 34 will turn in unison with the shaft 20. When the shaft 20 is locked against further turning movement by the members 24b and 28 and 60, the housing 34 will continue its turning movement, and one of the plungers 38 will strike against the left-hand face of the arm 42.

The dimensions of the parts can be designed and proportioned so that the release of the shaft 20, and the turning thereof until the members 24b, and 28 and 60 become effective, will result in striking the arm 42 a blow which will move said arm 42 and the barrel 8, in the direction which causes the curtain to descend.

The member 8 may be designated as a shutter support, since the members 5 are affixed thereto.

The member 41 may be designated as a portion of the shutter support, since the member 41 is connected to the member 8.

It will be noted that the plungers 38 are positively actuated by the turning of the shaft 20 so as to force said members 38 outwardly, so that the operation of the device is not dependent upon centrifugal force and the plunger 38 may be light. Said plungers may be sufficiently heavy to use the effect of centrifugal force.

Since the plungers 38 fit closely in the housing 34, and since the housing 34 and its removable end plate 33 fit closely but non-frictionally on the shaft 20, the entrance of dirt and the like into the housing 34 is prevented.

The members 38 may be designated as impulse members because they positively turn the shutter support so as to unwind the shutter therefrom.

I do not wish to be limited to the use of two plungers 38 since I may use one plunger or any desired number of plungers.

I have shown a preferred embodiment of my invention, but it is clear that numerous changes

and omissions can be made without departing from its spirit.

I claim:

1. In combination, a flexible fire shutter and
5 a turnable support on which said shutter can
be wound, a turnable shaft, a spring connected
to said shaft and to said support, said spring
being connected to said turnable support so that
10 said spring can resist the turning of said sup-
port in the direction in which the shutter is un-
wound from said support, holding means for
holding the shaft against turning, an automatic
release device which operates upon an increase
15 in temperature for rendering said holding means
inoperative, impulse means normally held in in-
operative position, said shaft having means for
actuating said impulse means to the operative po-
sition of said impulse means when the shaft is
20 turned, said impulse means being mounted and
adapted to contact with a portion of the shutter
support when said impulse means are moved to
the operative position, so as to impart a positive
movement to said shutter support and to cause

the shutter to be unwound from said shutter sup-
port.

2. In combination, a flexible fire shutter and
a turnable support on which said shutter can be
wound, a turnable shaft, a spring connected to
said shaft and to said support so that said spring
can resist the turning of said support in the
direction in which the shutter is unwound from
said support, means controlled by a rise in tem-
perature and adapted to hold the shaft against
10 turning until the temperature is above a prede-
termined limit, a floating housing mounted upon
the shaft, movable plunger means mounted in
said housing, spring means adapted to hold said
plunger means in inoperative position, said shaft
15 having a cam which is adapted to force the
plunger means outwardly and to turn said hous-
ing when the shaft is turned relative to the hous-
ing, said support having a portion with which
the plunger means are adapted to contact when
20 said plunger means are forced outwardly.

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