June 4, 1929. T. OHNO 1,715,424

SHUTTER

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FIG. 1.

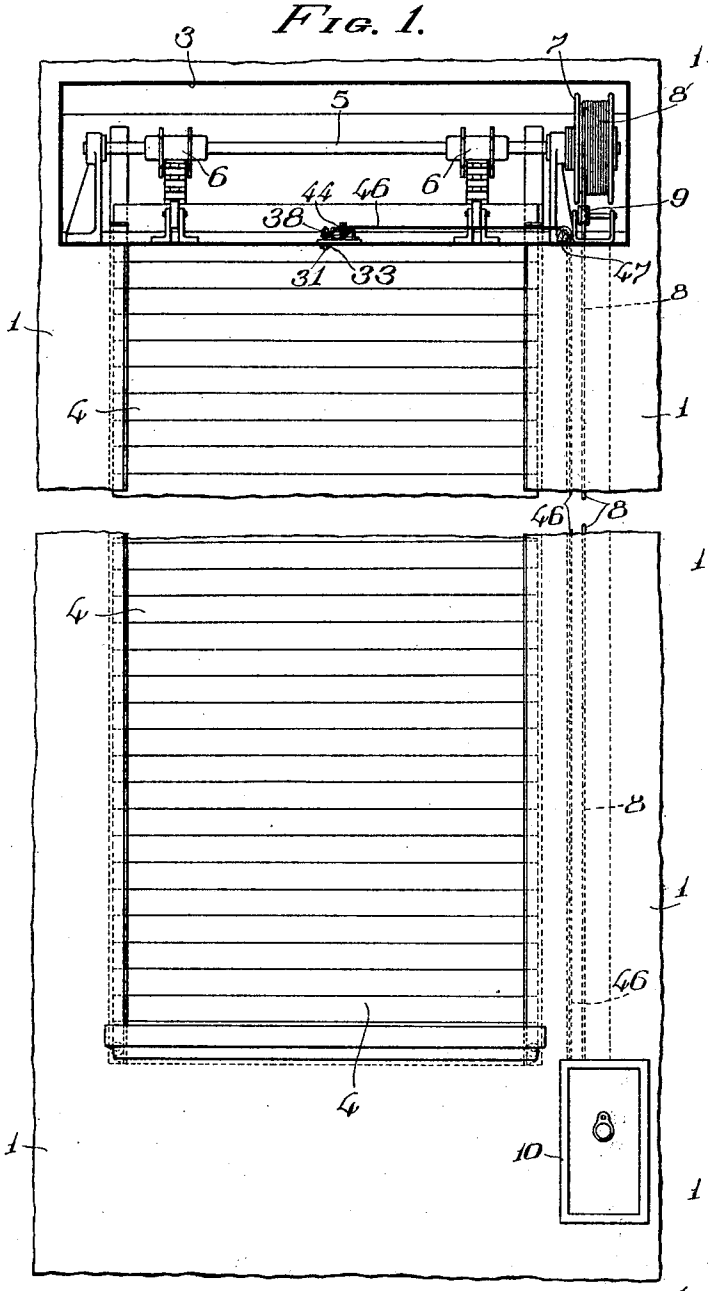
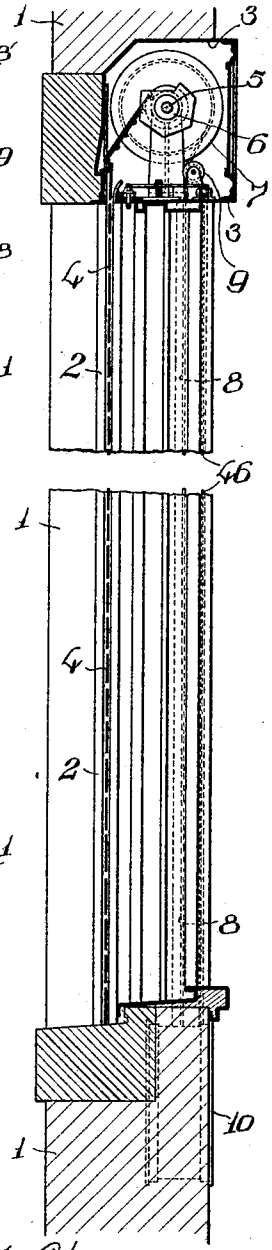


FIG. 2.



T. Ohno Inventor

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FIG. 3.

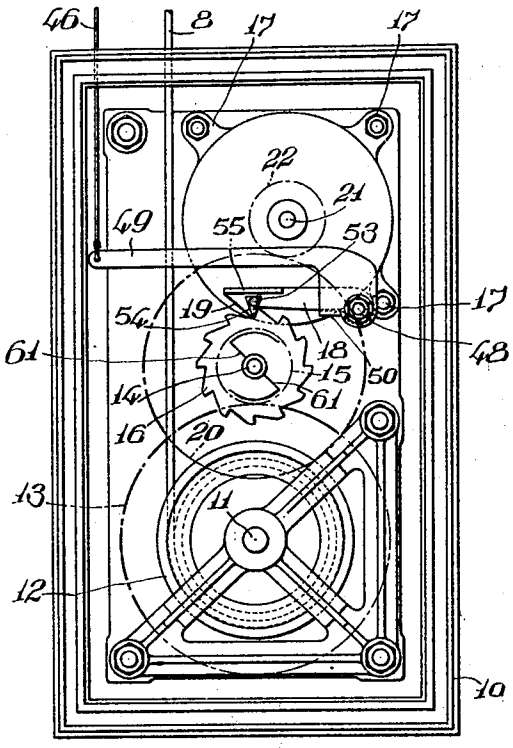


FIG. 4.

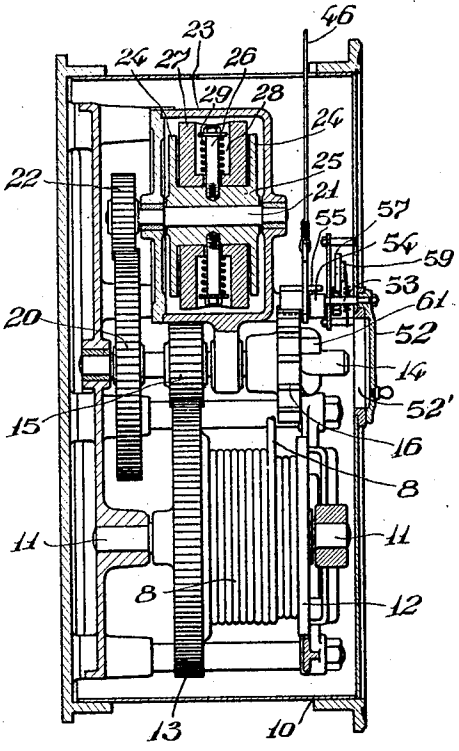


FIG. 5.

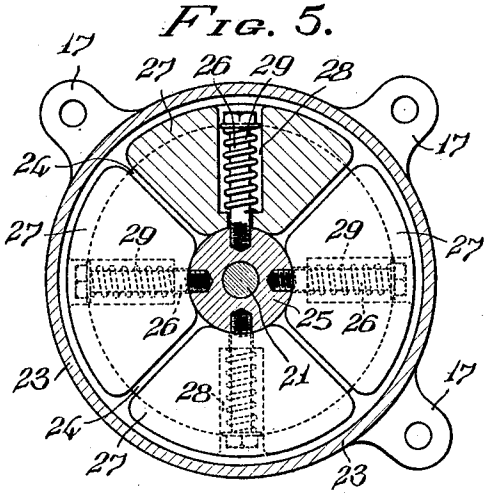
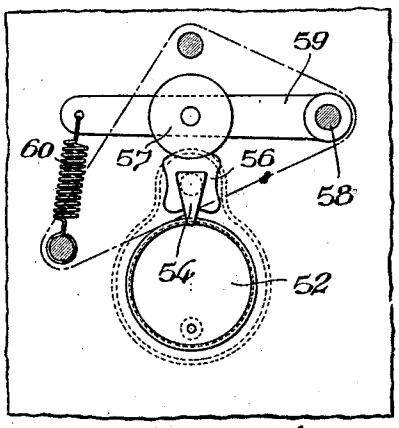


FIG. 6.



T. Ohno inventor

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FIG. 7.

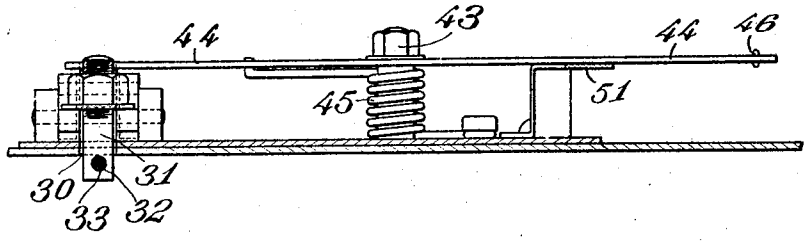


FIG. 8.

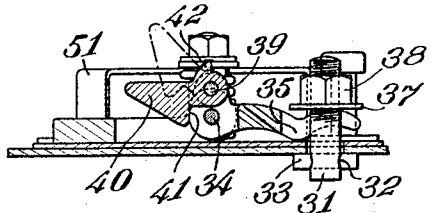


FIG. 9

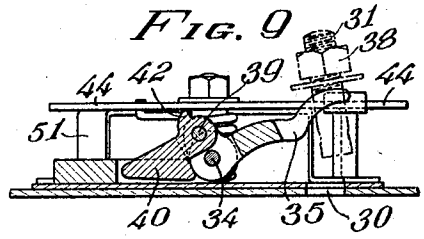


FIG. 10.

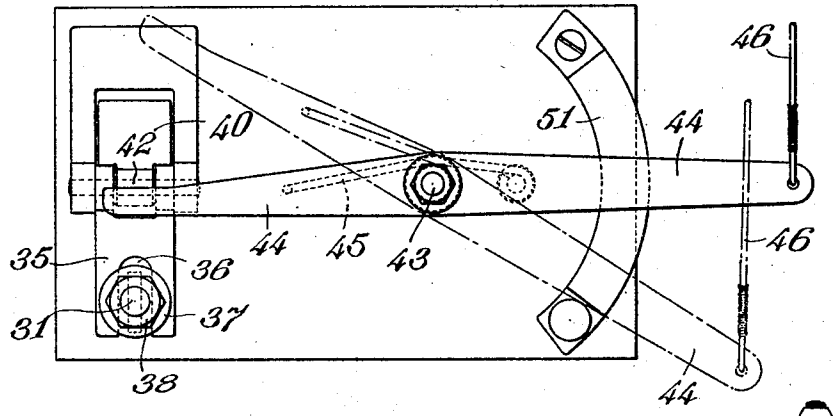


FIG. 12.

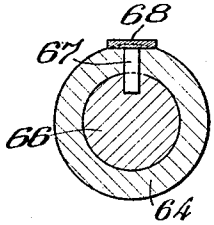
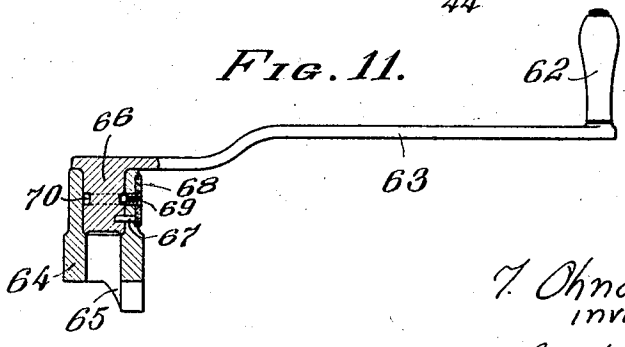


FIG. 11.



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Attys.

Patented June 4, 1929. 1,715,424

UNITED STATES PATENT OFFICE.

TADASHI OHNO, OF HONGOKU, TOKYO, JAPAN.

SHUTTER.

Application filed September 29, 1926. Serial No. 138,536.

My invention relates to improvements in a shutter of the type in which slats are successively fastened together to form a flexible door or curtain which is rolled on a shaft when opened, comprising a centrifugal governor geared to the curtain, means for automatically releasing the curtain by the fusion of a fusible metal in an emergency, and means for manually releasing the curtain.

The principal object of the invention is to regulate the downward closing movement of the curtain by the provision of a centrifugal governor so that any danger may be avoided and so that the curtain and the controlling mechanism may be rendered safe and durable. Another object of the invention is to automatically close the curtain in the event of fire by means of a fusible pin forming a part of the automatic releasing device. Another object of the invention is to provide a controlling device adapted to be operated independently either automatically or manually. Further objects of the invention will appear in the course of the present specification.

The accompanying drawing shows an embodiment of the present invention, in which:—

Fig. 1 is an elevational view of the improved shutter as seen from inside.

Fig. 2 is a vertical transverse sectional view of the arrangement shown in Fig. 1.

Fig. 3 is an enlarged side elevational view of the housing with the front wall removed.

Fig. 4 is a sectional side elevation of Fig. 3.

Fig. 5 is a sectional elevation of the centrifugal governor on an enlarged scale.

Fig. 6 is a fragmentary side elevational view looking outwardly from the inside of the housing, showing the access opening and its covers.

Figs. 7 to 10 are detailed views of the automatic releasing device.

Figs. 11 and 12 are detailed views of the handle with safety pin.

Same reference characters designate the same part throughout the views of the drawing.

Referring firstly to Figs. 1 and 2, (1) represents a frame of the window or opening to which the shutter is attached. (2) (2) are channels or grooves arranged at both sides of the frame (1). (3) is a shutter box arranged at the upper side of the frame (1). (4) is a flexible door or curtain composed of a plurality of narrow steel slats successively fastened together and arranged in the channels (2) (2). (5) is a main shaft arranged in the shutter box (3) for supporting the curtain. (6) (6) are barrels fixed on the shaft (5) and to which one end of the curtain is connected so that it may be rolled substantially concentrically thereon or unrolled therefrom depending on the direction of rotation of the shaft (5). (7) is a rope drum fixed at the end of the shaft (5). (8) is a rope wound on the drum. (9) is a guide pulley for the rope (8). (10) is a housing arranged at the lower part of the frame (1).

In order to control the operation of the curtain controlling mechanism is arranged within the housing (10) and is adapted to be operated automatically or manually. As shown in Figs. 3 and 4, a shaft (11), provided with a drum (12), upon which the other end of aforesaid rope (8) is wound, is arranged at the lower part of the housing (10). Said shaft (11) is provided with a gear (13) which meshes with a gear (15) fixed on the shaft (14). A ratchet wheel (16) is fixed on the shaft (14) and is engaged by a pawl (19) pivoted as at (17), whereby the curtain is prevented from being unrolled by its own weight.

The shaft (14) is further provided with a gear (20) which meshes with a gear (22) fixed on a shaft (21) arranged at the upper part of the housing (10) so that the rotating speed of the shaft (21) is considerably increased through said gear trains. The shaft (21) is passed through a circular casing (23), as shown in Figs. 3 and 4, and a collar (25) provided at both ends with disks (24) is fixed on the shaft (21) within the casing (23). The collar (25) is also provided with radial arms (26) respectively provided with a mass (27) of a sector shape slidably mounted on it. Each mass (27) is provided at its bore (28) with a spiral spring (29) surrounding the adjacent arm (27). Each spring is adjusted to overcome the weight of the adjacent mass (27) so that when the shaft (21) is at rest the masses (27) are yieldingly held against the collar but when the shaft (21) rotates at or above a predetermined speed the masses (27) move outwardly under the action of centrifugal force and frictionally engage the inner periphery of the casing (23).

When the pawl (19) is disengaged from the ratchet wheel (16), the shaft (14) is released and the curtain (4) starts unrolling owing to gravity and the weight of the outer hanging

slat or slats, causing the shaft (5) to be rotated and the rope (8) to be wound on the drum (7) and unwound from the drum (12) in the housing (10). As the curtain (4) descends in the channels or grooves (2), the weight of the unrolled part increases and correspondingly increases the speed of closing action or movement. The curtain being made of steel slats the weight is considerable. Therefore, if the curtain is left to be freely unrolled, the speed may become sufficient to endanger those passing under it, or irreparably damage the curtain or the mechanisms when the lowermost slat strikes the sill. The centrifugal governor according to the present invention is provided to regulate such undesirable speed of the descending curtain. When the drum (12) is rotated by the unrolling of the curtain the shaft (11) rotates in the housing (10) and the speed is augmented by the gear trains (13) (15) (20) (22) so that the shaft (21) is quickly rotated and by the centrifugal force induced the masses (27) move radially against the springs (29) and slidably and frictionally engage the inner periphery of the casing to consequently retard the rotation of the shaft (21). The radial pressure of the masses (27) on the casing (23) and the friction caused thereby increases due to the centrifugal force caused by the rotation of the shaft (21). Therefore the unrolling of the curtain may be regulated not to exceed a predetermined speed by properly designing the governor as well as gear ratio etc.

Heretofore it has been proposed to retard the closing movement of the curtain by other means, but the present invention includes the application of a centrifugal governor whereby the regulation may be accomplished more effectively. The hanging end of the curtain when closed is comparatively slight in comparison with the entire length of the curtain and the descending speed of the curtain at the initial closing movement is apt to be rather slow. According to the present invention the moving masses of the centrifugal governor are provided with the springs which force the former toward the centre of the casing so that they will not come in contact with the casing before the curtain reaches a predetermined speed so that the curtain is never retarded at the beginning of its closing movement.

The device for automatically closing the curtain in an emergency is operated by a fusible pin arranged at the lower side of the shutter box (3), or any other convenient place. An example of said fusible pin is shown in Figs. 7 to 10. An aperture (30) is formed at the bottom of the shutter box (3) and a plug (31) is freely passed therein. The lower part of said plug which projects below the shutter box (3) is apertured at (32) and a pin (33), made of a fusible metal, is passed through it to prevent the plug being pulled upwardly and released. Within the box (3) the plug (31) passes through the slot (36) formed at one end of a lever (35) fulcrumed at (34), and is provided at its other end with a washer (37) and a nut (38). At the other end of said lever (35) there is arranged an arm (40) fulcrumed at (39) and having at the lower side a jaw (41) which abuts at the end of the lever (35) to prevent the arm (40) from turning downwardly. A lever (44) is fulcrumed on a vertical spindle (43) provided with a spiral spring (45) which acts on said lever during its horizontal swinging movement on the guide (51). One end of the lever (44) is set to bear against the projection (42) formed on the upper side of the arm (40) while the other end has attached thereto one end of a cord (46) which passes over a guide pulley (47) (see Fig. 1) and has its other end connected to an arm (49) pivoted at (48) in the housing (10). This arm (49) has a projecting portion (50) which extends beneath the pivoted pawl (19) when the latter is in engagement with the ratchet wheel (16), as shown in Figs. 3 and 4.

In the stated device the plug (31) being held by the fusible pin (33) the lever (35) and the arm (40) keep the position as shown in Fig. 8, and the lever (44) is held by the projection (42). Now in an emergency when the fusible pin (33) melts the plug (31) is freed as shown in broken lines in Fig. 9. The lever (44) presses the projection (42) under the action of the spring (45), so that when the plug (31) is freed the lever (35) and the arm (40) move as shown in Fig. 9, whereby the cord (46) is lifted and the arm (49) (see Fig. 3) moves upwardly causing the projecting portion (50) to disengage the pawl (19) from the ratchet wheel (16). The shaft (14) is now released and the curtain is unrolled. After the curtain has been again opened and the fusible pin (33) replaced as shown in Fig. 8, the lever (44) is reset. The projection (42) is pulled by the lever (44) and the arm (40) moves as shown in broken lines Fig. 8, and the lever (44) is again supported at the projection (42) as shown in the same figure.

The device for manually releasing the ratchet wheel (16) comprises, as shown in Figs. 3 and 4, a circular opening (52′) provided in the front wall of the housing (10). The opening (52′) is provided with a cover (52) carried by a pivot pin (53) which is extended inside the housing (10) and provided with a cam (54) corresponding to a projecting edge (55) formed at the side of the arm (18). The pivot (53) is further provided with a cam (56) engaging a roller (57) arranged on an arm (59) which latter is pivoted at (58) and provided at the other end with a spiral spring (60) to keep the cover (52) in position.

When the cover (52) is swung upwardly

the pivot (53) rotates and the cam (54) presses the projecting edge (55) of the arm (18) so that the pawl (19) is released from the ratchet wheel (16). Therefore if the cover (52) is opened while the curtain is raised or rolled up the latter begins its closing movement and after the curtain has been unrolled it can be again rolled up manually by turning the shaft (14) with a handle through the opening (52'). After the curtain has been rolled up the cover (52) is turned downward and the pawl (19) engages on the ratchet wheel (16) to keep the curtain from being unrolled. Thus the automatic device and the manual device can be operated for releasing the curtain without affecting each other, according to the present invention.

A preferred form of handle for manually rolling the curtain is shown in Figs. 11 and 12. The handle lever (63) is provided at one end with a crank handle (62) and at the other end with a clutch (64) having jaws (65) which are adapted to be engaged with a clutch (61) formed at the adjacent end of the shaft (14) whereby the latter may be rotated only in one direction. In the shutter of the type described the curtain may occasionally be obstructed at the channel or the rope may be irregularly wound on the drum so that the rolling of the curtain is hindered. In order to avoid injury to the curtain caused, for instance, by turning the handle beyond a predetermined extent, the clutch (64) is fitted on a pivot (66) formed at the end of the handle lever (63) and is fixed thereto by a copper pin (67). The clutch (64) is turned within the shearing strength of said pin (67) and any damage which may occur by turning the handle by force, is avoided by the breakage of said pin. The pin (67) is provided with a base (68) which is fixed at the side of the clutch (64) by a screw (69). The inner end of the screw (69) is fitted in a groove (70) formed around the pivot (66) and in case the pin (67) is broken the clutch (64) is prevented from becoming disconnected from the pivot (66).

Having thus fully described the invention, what is claimed and desired to be secured by Letters Patent is:—

1. A shutter of the character described, including in combination a gravity operated flexible curtain, a winding drum therefor, a centrifugal governor, gearing between the governor and the drum, latching means in operable relation with the gearing means and the drum for releasably holding the curtain in a raised position, an automatic releasing device operably connected with the latching means for releasing the winding drum to permit lowering of the curtain and including a spring pressed lever, a flexible element between the lever and the latching means, cooperative catch members associated with the spring pressed lever, and locking means including a fusible pin normally holding the catch members in the path of the spring pressed lever.

2. A shutter as claimed in claim 1, wherein the centrifugal governor includes a casing, a rotable boss, masses connected to the boss and adapted for radial movement with respect to the boss during the rotation thereof, and spring means for yieldingly holding the masses against the boss at the initial rotation thereof but permitting of the masses to frictionally engage the casing to prevent the lowering of the curtain beyond the predetermined speed.

3. A shutter as claimed in claim 1, wherein manually operable means is also provided for releasing the drum, said means including a pivoted arm, a cam on the arm in operative relation to the latching means for releasing said latching means, and a handle lever for rotating the gearing between the governor and the drum, substantially as and for the purposes set forth.

In testimony whereof I have affixed my signature.

TADASHI OHNO.