Sept. 26, 1939. E. L. DUNN 2,173,900

OPERATING MECHANISM FOR CLOSURES FOR MOVING STAIRWAY WELLWAY OPENINGS

Filed June 25, 1938 4 Sheets-Sheet 1

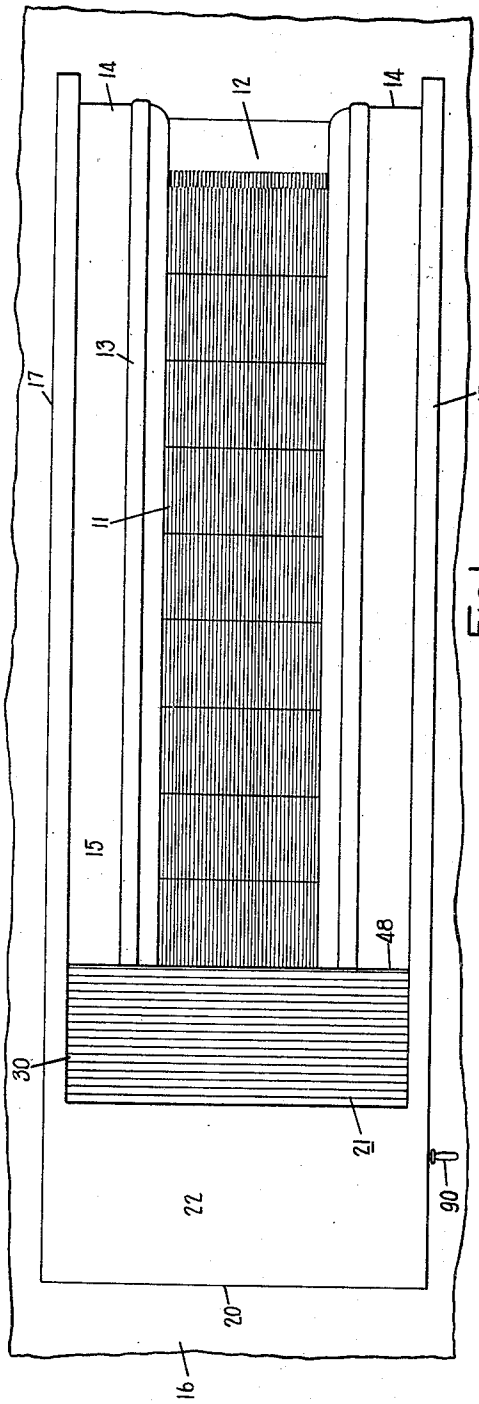


FIG. 1

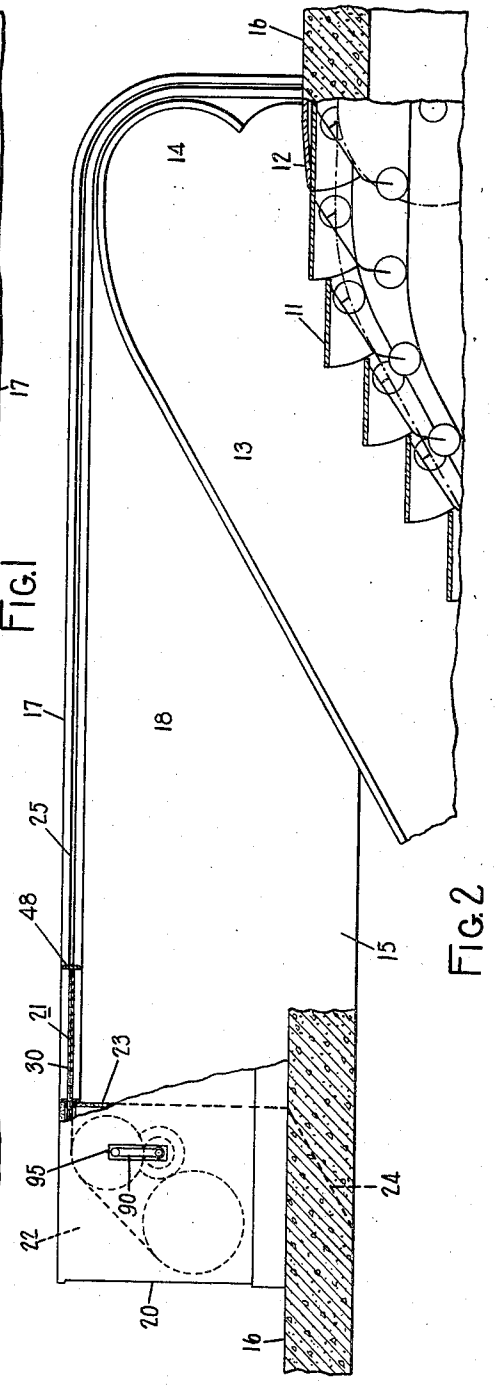


FIG. 2

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OPERATING MECHANISM FOR CLOSURES FOR MOVING STAIRWAY WELLWAY OPENINGS

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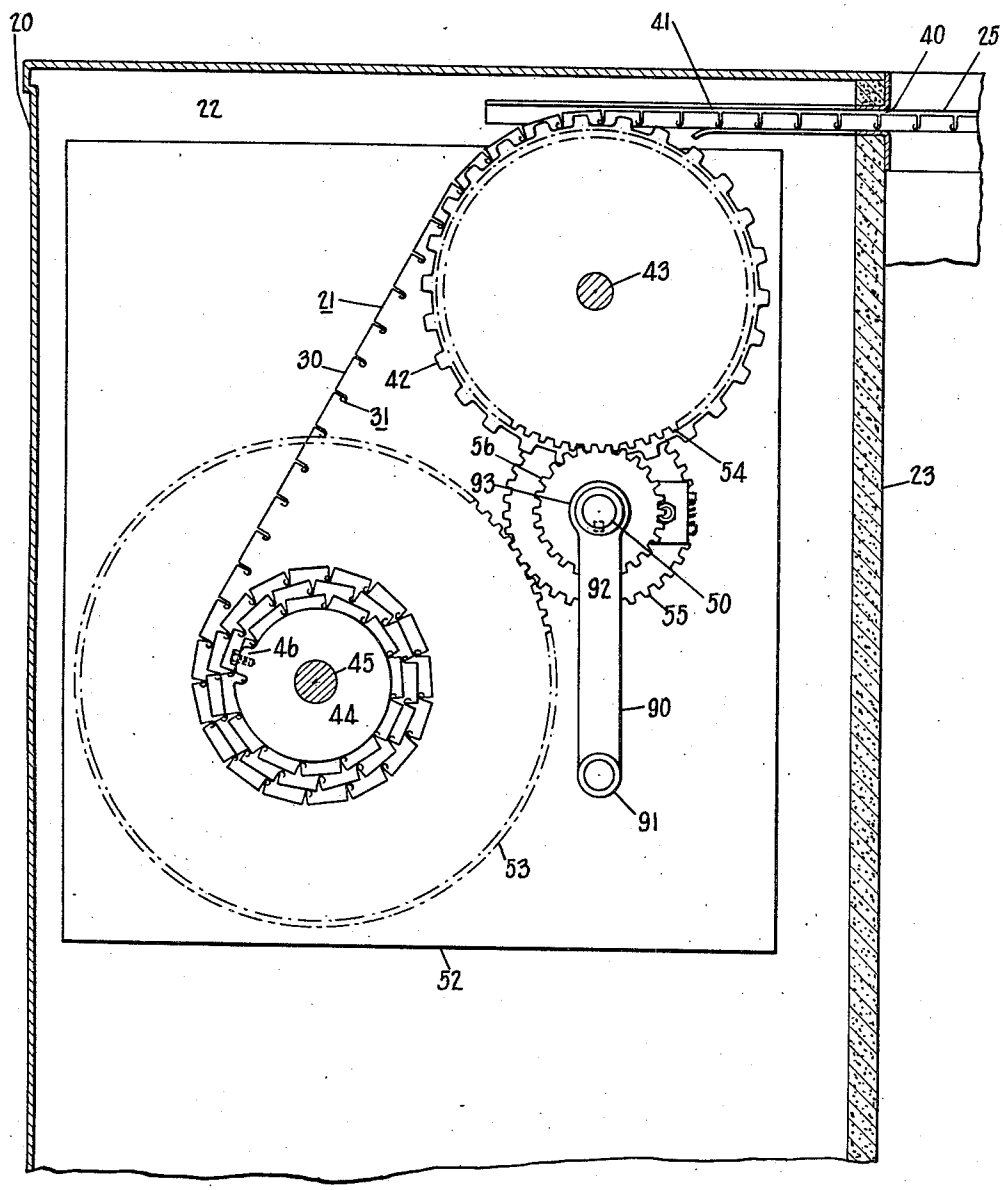


FIG. 3

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OPERATING MECHANISM FOR CLOSURES FOR MOVING STAIRWAY WELLWAY OPENINGS

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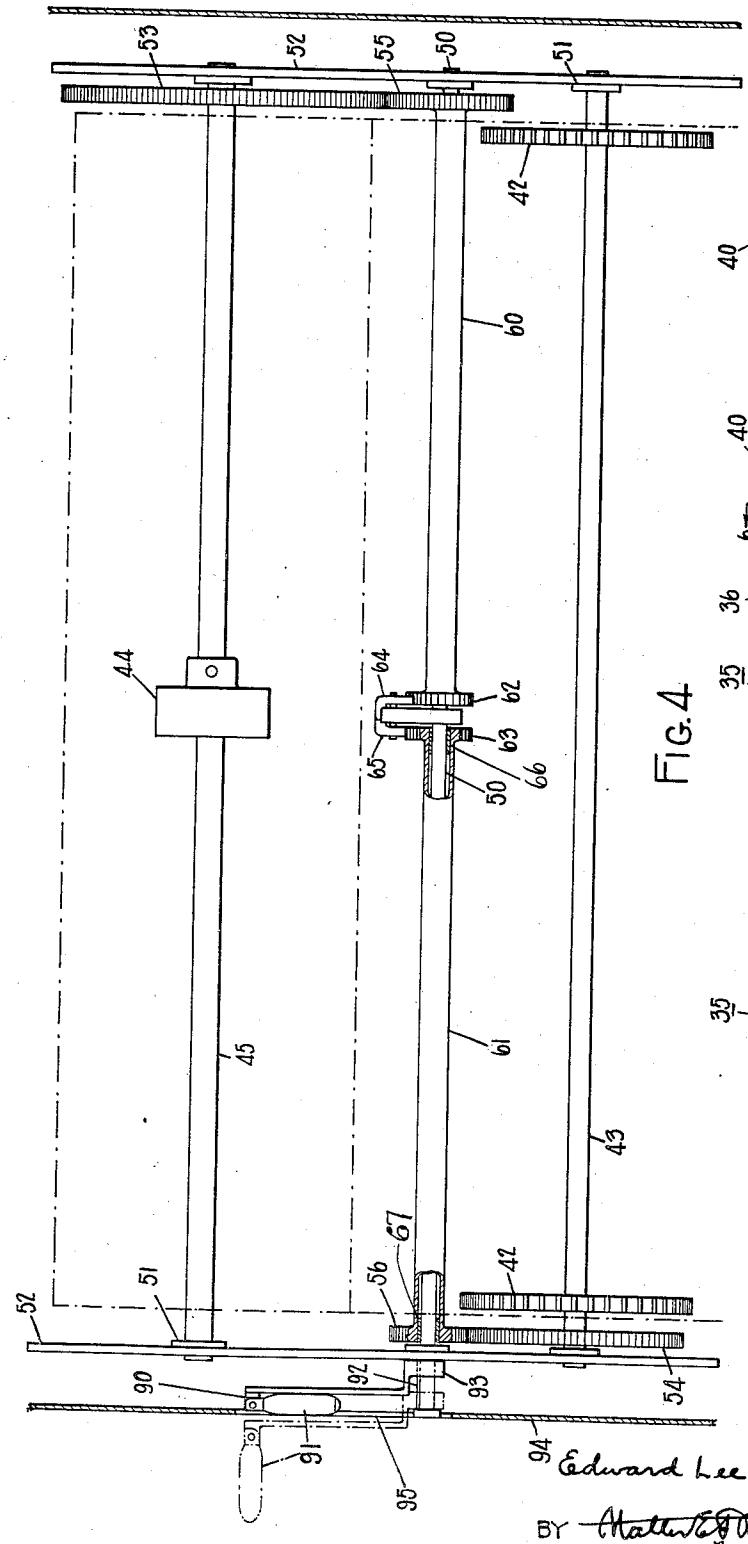


FIG. 4

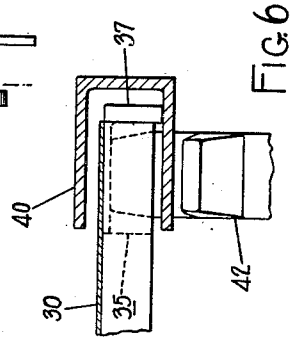


FIG. 6

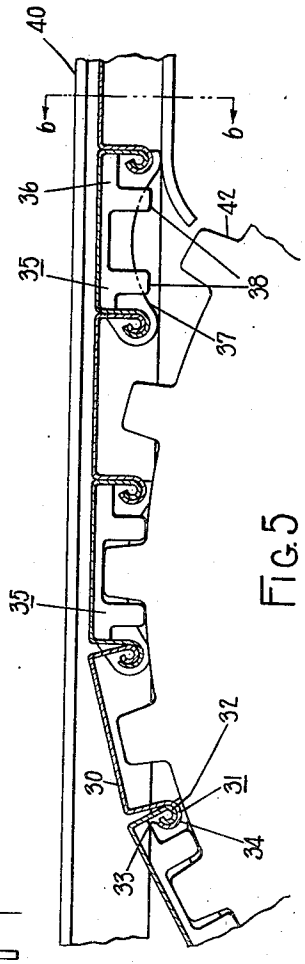


FIG. 5

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OPERATING MECHANISM FOR CLOSURES FOR MOVING STAIRWAY WELLWAY OPENINGS

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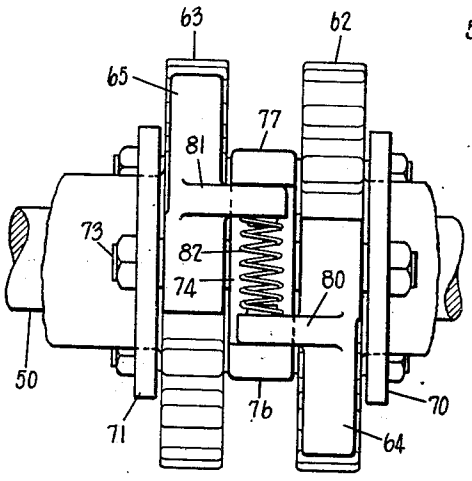


FIG. 9

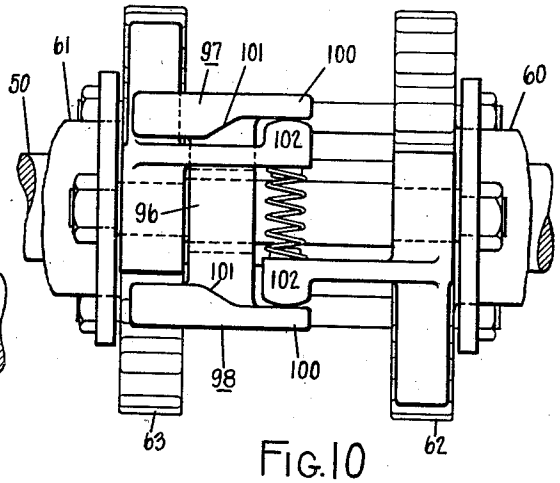


FIG. 10

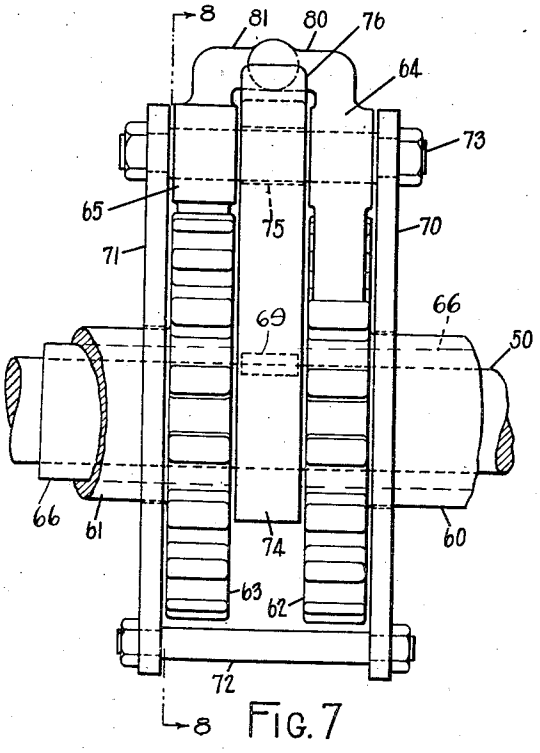


FIG. 7

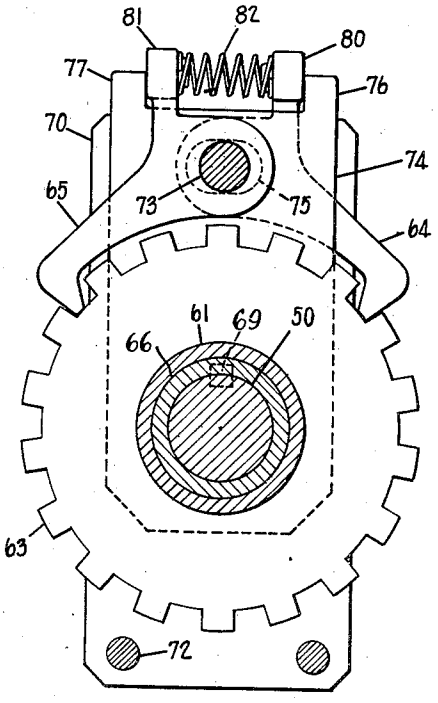


FIG. 8

Edward Lee Dunn INVENTOR

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Patented Sept. 26, 1939

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UNITED STATES PATENT OFFICE

2,173,900

OPERATING MECHANISM FOR CLOSURES FOR MOVING STAIRWAY WELLWAY OPENINGS

Edward Lee Dunn, Livingston, N. J., assignor to Otis Elevator Company, New York, N. Y., a corporation of New Jersey

Application June 25, 1938, Serial No. 215,785

7 Claims. (Cl. 189—57)

The invention relates to moving stairways and especially to closing off the stair wells in case of fire.

In the majority of buildings in which moving stairways are provided, the stairways extend through openings in the ceilings. In case of a fire on a lower floor, these openings, usually termed wellways, act as flues, creating a draft to aid combustion. Also, in stores where goods are on display, the wellways permit the passage of smoke from lower to upper floors to damage goods on the upper floors.

The general practice for present day moving stairway installations is to provide a railing around the exposed portion of the wellway, usually about the height of the stairway balustrade. This involves a minimum of obstruction of the view of one portion of the floor from another, which is especially desirable for stores. Also, such construction more readily admits of design conformable with present day architectural standards. The invention will be described as applied to such construction.

It is the object of the invention to provide closures for moving stairway wellways, especially those of the above construction, which may be quickly and readily operated.

In carrying out the invention as applied to such moving stairways, solid walls are provided from the floor to the top of the railing. A flexible curtain or shutter is provided for completely closing the wellway opening, guides being provided for guiding the shutter from a compartment at the end of the wellway along the top of the railing and around a curve at the stairway newel to the floor. Normally the shutter is wound on a drum located in this compartment.

The principal feature of the invention is the provision of shutter operating mechanism having manually operable rotatable means which is operable upon rotative movement in one direction to extend the shutter to close the wellway opening and upon rotative movement in the opposite direction to retract the shutter into its storage space.

Other features and advantages of the invention will become apparent from the following description and appended claims.

In the drawings:

Figure 1 is a simplified plan view of the wellway of a moving stairway embodying the invention, the shutter being shown partially extended;

Figure 2 is a side view of the same, parts being broken away;

Figure 3 is a side view of the shutter operating mechanism, illustrating the shutter partially wound on the drum;

Figure 4 is a plan view, somewhat schematic, of the shutter operating mechanism;

Figure 5 is a detail of a portion of a driving cog wheel with the shutter meshing therewith;

Figure 6 is a section taken along the line 6—6 of Figure 5;

Figure 7 is a side view of the pawl and ratchet drive;

Figure 8 is an end view of the same, taken along the line 8—8 of Figure 7;

Figure 9 is a plan view of the same; and

Figure 10 is a plan view of another arrangement of pawl and ratchet drive.

Referring first to Figures 1 and 2, a simplified single stairway installation has been illustrated with no additional stairway to the side of or above it. The stairway comprises an endless series of steps 11 having tread cleats thereon for meshing with a comb 12 at the end of the stairway. Balustrading 13 is provided on each side of the stairway, this balustrading terminating in newels 14 at the end of the stairway. The stairway extends upwardly at an angle through an opening 15 in the floor 16. A railing 17 is provided outside the balustrading on each side of the wellway opening. Solid walls 18 extend from the floor to the top of the railings. Each railing terminates at the end of the stairway and is curved to conform to the curvature of the stairway newel. At the other end the side walls join with an end wall 20 to enclose the wellway.

A flexible shutter 21 is provided for closing the wellway. When not in use, this shutter is kept in a compartment 22 at the inner end of the wellway. This compartment is illustrated as formed between the end wall 20 and another end wall 23 forward of end wall 20 and extending upwardly from a soffit 24. A channel-shaped guide 25 is provided on the side of each railing, this guide extending from compartment 22 along the top of the railing and around the curve at the end of the stairway to the floor.

The shutter is made up of a plurality of hinged slats in the form of channel members 30 extending crosswise of the wellway. The hinges 31 are illustrated as formed by bending the adjacent flanges into partial cylinders, one to fit within the other as illustrated in Figure 5. This forms a seal against the passage of fire and smoke when the shutter is in extended position. The diameter of the inner cylinder 32 is greater than the distance between the edge 33 of the outer cylinder 34 and the wall of its flange, thereby secur-

ing the inner cylinder within the outer cylinder to form a lock type hinge. Alternate ones of the slats are provided at each end with end plates 35 to hold the slats in place sidewise. Each of these end plates is formed with a base member 36 riveted to the end of the slat and an end member 37 extending from the base member across the ends of the hinges.

A slot 40 is provided across the front of end wall 23 in alignment with the guides 25 to receive the shutter within compartment 22. Also, guide members 41 extend rearwardly from the slot 40 as illustrated in Figure 3 on each side of the compartment for guiding the shutter onto cog wheels 42. These cog wheels are provided one on each side of the compartment and are secured in driven relation to a cross shaft 43. Spaced lugs 38 are formed on the base members of the end plates 35 in position to mesh with the teeth of the cog wheels.

From the cog wheels, the shutter extends downwardly at an angle onto a drum 44 mounted in driven relation on cross shaft 45. The drum is illustrated as having a spiral surface, the difference between the maximum and minimum radii being equal to the thickness of the shutter. The end of the shutter is secured to a lug 46 formed on the drum at the point of minimum radius, the lug extending into the trough of the shutter. The radius increases in a clockwise direction around the drum, enabling the shutter to be wound upon the drum in a spiral of increasing diameter by counterclockwise rotative movement of the drum as viewed in Figure 3. The drum as illustrated in Figure 4 may be relatively short, as a three-point suspension is had by the drum and the two cog wheels to maintain the shutter in proper position.

To extend the shutter outwardly from its storage compartment over the wellway opening, shaft 43 is rotated clockwise as viewed in Figure 3, the teeth of the cog wheels 42 meshing with the lugs of the end plates for the slats to pull the shutter off the spiral drum 44 and push it through guides 41 out through slot 40 into the guides 25. To retract the shutter into its compartment, shaft 45 is rotated counterclockwise to wind the shutter back onto the drum, an end plate 48 being provided on the end of the shutter to engage end wall 23 to bring the shutter to a stop in retracted position and to close slot 40. The cross shafts 43 and 45 are driven by an operating shaft 50 also extending crosswise of the compartment. These shafts are supported in bearings 51 in end plates 52, one on each side of the compartment. A gear 53 is secured to shaft 45 at one end thereof and another gear 54 is secured to shaft 43 at the opposite end thereof. Gears 53 and 54 are driven from shaft 50 through the intermediary of smaller gears 55 and 56 respectively.

Owing to the spiral arrangement of the shutter on drum 44, the speed of rotation of shaft 45 relative to shaft 43 varies in accordance with the amount of the shutter which is wound on drum 44. To prevent the locking of the gears due to this difference in speed of shafts 45 and 43, the mechanism is arranged so that gear 55 is not driven upon counterclockwise movement of shaft 50 as viewed in Figure 3 to drive gear 54 through gear 56 and so that gear 56 is not driven upon clockwise rotative movement of shaft 50 to drive gear 53 through gear 55. This is effected by securing gear 55 to an elongated sleeve 60 on shaft 50 extending inwardly from the gear and by securing gear 56 to another elongated sleeve 61 on shaft 50 extending inwardly from the gear, as illustrated in Figure 4. On the inner end of sleeve 60 is provided a ratchet wheel 62. Similarly, on the inner end of sleeve 61 is provided a ratchet wheel 63. These wheels are driven from shaft 50 through the intermediary of pawls 64 and 65. The inner and outer ends of the sleeves are provided with bearings 66 and 67 respectively on which the sleeves may turn with respect to shaft 50.

Referring to Figures 7, 8 and 9, to the sides of the ratchet wheels are arranged plates 70 and 71, these plates being rotatably mounted on sleeves 60 and 61 respectively. At the bottoms of the plates and beneath the ratchet wheels are provided a pair of spacing rods 72, these rods being provided with shoulders for spacing the plates and with threaded ends beyond the shoulders which extend through apertures in the plates and on which are provided nuts for securing the plates together. A similar spacing rod 73 extends between the upper ends of the plates above the ratchet wheels, nuts being provided on the ends of this rod for securing the top ends of the plates together. Rod 73 also serves as a pivotal support for the pawls 64 and 65. These pawls are arranged on rod 73 between the plates 70 and 71 and an operating arm 74 secured by key 69 to shaft 50 between the ratchet wheels. This arm is provided with an elongated slot 75 through which rod 73 extends and on opposite sides of its upper end is provided with lugs 76 and 77 for engaging arms 80 and 81 formed on the upper ends of pawls 64 and 65 respectively and extending inwardly therefrom in a position to be engaged by the lugs. A compression spring 82 is arranged between the ends of arms 80 and 81, biasing the pawls for opposite movement about rod 73.

With this arrangement, upon counterclockwise movement of shaft 50 as viewed in Figure 8, operating arm 74 is moved to the left with respect to rod 73. Assuming the parts in the positions illustrated in Figure 8 with the pawls in tooth slots of their respective ratchet wheels, during the movement of arm 74, lug 76 engaging arm 80 of pawl 64 swings the pawl about the rod against the force of spring 82 to lift it off its ratchet wheel into position to clear the ratchet teeth. When the arm reaches a position where rod 73 is engaged by the right hand end of slot 75, the plates 70 and 71 and pawls are swung as a unit counterclockwise. Pawl 65 being in a tooth slot in ratchet wheel 63 causes counterclockwise movement of this ratchet wheel. If this pawl had not been in a tooth slot at the time, counterclockwise movement of the unit would result in the pawl 65 reaching a position to move into a tooth slot. Counterclockwise rotative movement of ratchet wheel 63 results in counterclockwise movement of gear 56 in Figure 3, gear 56 in turn rotating gear 54 clockwise. This effects rotative movement of the cog wheels in a direction to pull the shutter off the drum, extending it outwardly over the wellway. Pawl 64, being held off ratchet wheel 62 during this operation, cannot be engaged by the wheel during its movement by the drum through gears 53 and 55.

Upon clockwise movement of shaft 50 as viewed in Figure 8, a similar operation takes place except that ratchet wheel 62 is rotated by its pawl to wind the shutter back on the drum. Assuming the parts in the positions illustrated, initial movement of shaft 50 effects clockwise rotative movement of arm 74, moving this arm to the right with respect to rod 73. During this movement

lug 77 acts through arm 81 to lift pawl 65 off ratchet wheel 63 and upon the engagement of the left hand end of slot 75 with rod 73, clockwise movement of the unit as a whole takes place, pawl 64 acting to effect clockwise rotation of ratchet wheel 62. This causes clockwise rotative movement of gear 55 to rotate gear 53 counterclockwise, winding the shutter back onto the drum. This effects rotative movement of the cog wheels but pawl 65, being held off ratchet wheel 63, cannot be engaged by this wheel during its movement by the cog wheels through gears 54 and 56.

On one end of shaft 50 is provided an operating crank 90, the crank being illustrated as arranged on the left hand end of the shaft as viewed in Figure 4. This crank is provided with a handle 91 for manually rotating shaft 50 to effect the extension and retraction of the shutter. A key 92 is provided in the end of the shaft and a slot is provided in the hub 93 into which the key extends to form a driving connection. To enable the crank to be stored in back of the wainscot panel 94 of the railing where it is not noticeable, the slot in the hub 93 is made large enough to permit the hub to slide on the shaft, the amount of this movement being sufficient to permit the crank to be stored behind the panel. Also, the handle 91 is pivotally secured to the end of the crank so as to enable it to be swung down along the crank arm. A slot 95 is provided in the face of the panel 94 through which the crank may be pulled when it is desired to operate the shutter, the crank being shown in operating position with the handle extended in dot-dash lines in Figure 4. Thus, to operate the shutter, the crank is pulled outwardly through this slot, the handle extended and the crank rotated in a direction to pull the shutter off the drum and extend it outwardly over the wellway into position to close the stairway opening. To retract the shutter, the crank is simply turned in the opposite direction and the shutter is pulled back onto the drum.

If it is desired to arrange the mechanism so that the shutter may also be operated by pulling directly on the shutter, this may be done for example by lifting both pawls from their ratchet wheels when the handle is stored in back of the wainscot panel 94. One arrangement for effecting this operation is illustrated in Figure 10. In this arrangement the operating crank 90 is secured to the end of driving shaft 50, the crank being extended from or returned within its slot 95 by sliding the whole shaft 50 endwise. Operating arm 96 is fixed to shaft 50 so as to move endwise of the shaft as well as rotate therewith. Cross extensions 97 and 98 are provided on the upper end of the arm. The ends 100 of these cross members serve to lift one or the other pawl, depending upon the direction of rotative movement. The cross members are cammed at 101 so as to squeeze the arms 102 of the pawls together upon inward movement of shaft 50 to store the operating crank. This lifts both pawls off their ratchet wheels 62 and 63. The ratchet wheels are spaced farther apart to permit this endwise movement of operating arm 96 and the arms 102 of the pawls are elongated accordingly. Thus, when the crank arm is stored behind the panel, both pawls are lifted off their ratchet wheels so that if the shutter is operated by pulling on it from the front, the ratchet wheels, in their movement by the drum and cog wheels, do not engage the pawls, rendering the shutter free to be pulled all the way out.

If desired, mechanism may be provided for exerting a drag on shaft 45 to prevent slack developing in the shutter during its extension over the wellway opening in the event that the friction of the parts is insufficient to prevent this.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which the shutter is wound on a drum and in which rotatable means is provided which is operable upon rotative movement in a certain direction for pulling said shutter from said drum and extending it over the wellway opening, comprising; a manually operable driving shaft; a ratchet wheel; an operating pawl therefor; another ratchet wheel; an operating pawl for the second named ratchet wheel; means operable by said driving shaft upon rotative movement thereof in one direction to operate the first named ratchet wheel by its pawl and upon rotative movement thereof in the opposite direction to operate the second named ratchet wheel by its pawl; means operable by the first named ratchet wheel for operating said rotatable means to pull said shutter off said drum and extend it over said wellway opening; means operable by the second named ratchet wheel for rotating said drum to wind said shutter thereon; and means operable by said driving shaft to release the operating pawl for the ratchet wheel for the direction opposite to the direction of rotation of said shaft.

2. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which the shutter is wound on a drum and in which means is provided which is adapted upon operation to pull said shutter off said drum and extend it over said wellway opening, comprising; a manually operable driving shaft; a pair of ratchet wheels mounted on said driving shaft and adapted for rotative movement with respect thereto; a pair of pawls, one for each ratchet wheel, for effecting opposite rotative movement thereof; means operable by rotative movement of said driving shaft in one direction to release the pawl from one of said ratchet wheels and to effect rotative movement of the other ratchet wheel by its pawl in said direction, and operable by rotative movement of said driving shaft in the other direction to release the pawl from said other ratchet wheel and to effect rotative movement of said one ratchet wheel by its pawl in said other direction, means operable by rotative movement of one of said ratchet wheels for causing operation of said first named means to pull said shutter off said drum and extend it over said wellway opening; and means operable by rotative movement of the other of said ratchet wheels for rotating said drum to wind said shutter thereon.

3. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which the shutter is secured to and spirally wound on a drum, comprising; a pair of cog wheels meshing with opposite sides of said shutter

and over which said shutter extends from said drum; a manually operable driving shaft; a pair of sleeves mounted on said driving shaft and adapted for rotative movement with respect thereto; a ratchet wheel secured to the inner end of each sleeve; a pair of pawls, one for each ratchet wheel, for effecting opposite rotative movement thereof, each of said pawls being biased for movement into cooperative position with the ratchet wheel for which it is provided; means for pivotally supporting said pawls; means, operable by rotative movement of said driving shaft in one direction to release the pawl from one of said ratchet wheels and to effect rotative movement of the other ratchet wheel by its pawl to rotate the sleeve to which such ratchet wheel is secured in said one direction, and operable by rotative movement of said driving shaft in the other direction to release the pawl from said other ratchet wheel and to effect rotative movement of said one ratchet wheel by its pawl to rotate the sleeve to which such ratchet wheel is secured in said other direction; means operable by said rotative movement of one of said sleeves in one direction for rotating said cog wheels to pull said shutter off said drum and extend it over said wellway opening; and means operable by said rotative movement of the other of said sleeves in the opposite direction for rotating said drum to wind said shutter thereon.

4. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which a rotatable support is provided for said shutter upon which the shutter is wound and in which rotatable means is provided which is operable upon rotative movement in a certain direction for pulling said shutter from said rotatable support and extending it over the wellway opening, comprising; a manually operable driving shaft; a pair of ratchet wheels mounted on said driving shaft in spaced relation and adapted for rotative movement with respect thereto; a pair of operating pawls, one for each ratchet wheel for effecting opposite rotative movement thereof; a pivotal support for each pawl rotatably mounted with respect to the ratchet wheel for which the pawl is provided; a crank arm secured to said driving shaft between said pawls having means operable upon rotative movement of said driving shaft in one direction for releasing the pawl from one of said ratchet wheels and upon rotative movement of said driving shaft in the opposite direction for releasing the pawl from the other ratchet wheel and also having a lost motion connection with said pawls for causing upon rotative movement of said driving shaft in said one direction rotative movement of said other ratchet wheel by its pawl in said one direction after the pawl for said one ratchet wheel is released and for causing upon rotative movement of said driving shaft in said other direction rotative movement of said one ratchet wheel by its pawl in said other direction after the pawl for said other ratchet wheel is released; means operable by rotative movement of said one ratchet wheel in said other direction for rotating said rotatable means to pull said shutter off said rotatable support and extend it over said wellway opening; and means operable by rotative movement of said other ratchet wheel in said one direction for rotating said rotatable support to wind said shutter thereon.

5. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which the shutter is wound on a drum and in which rotatable means is provided which is operable upon rotative movement in a certain direction for pulling said shutter from said drum and extending it over the wellway opening, comprising; a manually operable driving shaft; a pair of ratchet wheels mounted on said driving shaft in spaced relation and adapted for rotative movement with respect thereto; a pair of plates rotatably mounted with respect to said driving shaft, one on each side of said ratchet wheels; a pin extending between said plates; a pair of pawls pivotally mounted on said pin, one for each ratchet wheel, for effecting opposite rotative movement thereof, each of said pawls having a releasing arm; a spring between said arms biasing said pawls into positions for cooperating with said ratchet wheels; a crank arm secured to said driving shaft between said ratchet wheels, said crank arm having a slot through which said pin extends and a pair of oppositely disposed lugs, one for each pawl arm, said crank arm upon rotative movement of said driving shaft in one direction acting through one of its lugs to release the pawl from one of said ratchet wheels and through said pin and the pawl for the other ratchet wheel upon the end of said slot engaging said pin to effect rotative movement of said other ratchet wheel in said one direction and upon rotative movement of said driving shaft in the opposite direction acting through the other of its lugs to release the pawl from said other ratchet wheel and through said pin and the pawl for said one ratchet wheel upon the end of said slot engaging said pin to effect rotative movement of said one ratchet wheel in said opposite direction; means operable by rotative movement of said one ratchet wheel in said opposite direction for rotating said rotatable means to pull said shutter off said drum and extend it over said wellway opening; and means operable by rotative movement of said other ratchet wheel in said one direction for rotating said drum to wind said shutter thereon.

6. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which a rotatable support is provided for said shutter upon which said shutter is wound and in which rotatable means is provided which is operable upon rotative movement in a certain direction for pulling said shutter from said rotatable support and extending it over the wellway opening, comprising; driving means for said rotatable support; driving means for said rotatable means; a manually operable member having an extended and a retracted position; means operable by said manually operable member, when in extended position and upon rotative movement thereof in one direction, for operating said driving means for said rotatable means to pull said shutter off said rotatable support and extend it over said wellway opening; means operable by said manually operable member, when in extended position and upon rotative movement thereof in the other direction, for operating said driving means for said rotatable support to wind said shutter on said drum; and means operable by said manually operable member when in retracted position for preventing cooperation of said driving means for said rotatable means and its operating means and of said driving means for said rotatable support and its operating means, whereby said shutter may be extended over the wellway opening by pulling on its manually.

7. Operating mechanism for a flexible shutter for the wellway opening of a moving stairway in which the shutter is wound on a drum and in

which rotatable means is provided which is operable upon rotative movement in a certain direction for pulling said shutter from said drum and extending it over the wellway opening, comprising; a driving shaft; a manual member for operating said shaft, said shaft being shiftable endwise to retract said operating member; a ratchet wheel; an operating pawl therefor; another ratchet wheel; an operating pawl for the second named ratchet wheel; means operable by said driving shaft upon rotative movement thereof in one direction to operate the first named ratchet wheel by its pawl and upon rotative movement thereof in the opposite direction to operate the second named ratchet wheel by its pawl; means operable by the first named ratchet wheel for operating said rotatable means to pull said shutter off said drum and extend it over said wellway opening; means operable by the second named ratchet wheel for rotating said drum to wind said shutter thereon; and means operable by said endwise movement of said driving shaft to retract said operating member for lifting said operating pawls off their ratchet wheels to permit said shutter to be extended over said wellway opening by pulling directly on said shutter.

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