Sept. 10, 1963 P. CONGELLIERE 3,103,043

GARAGE DOOR MECHANISM

Filed March 28, 1960 2 Sheets-Sheet 1

Fig. 1

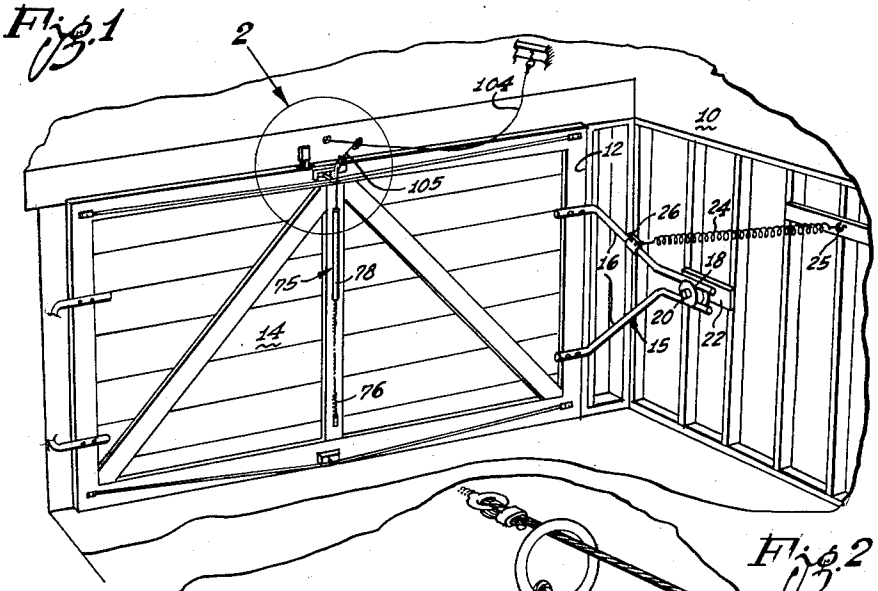


Fig. 2

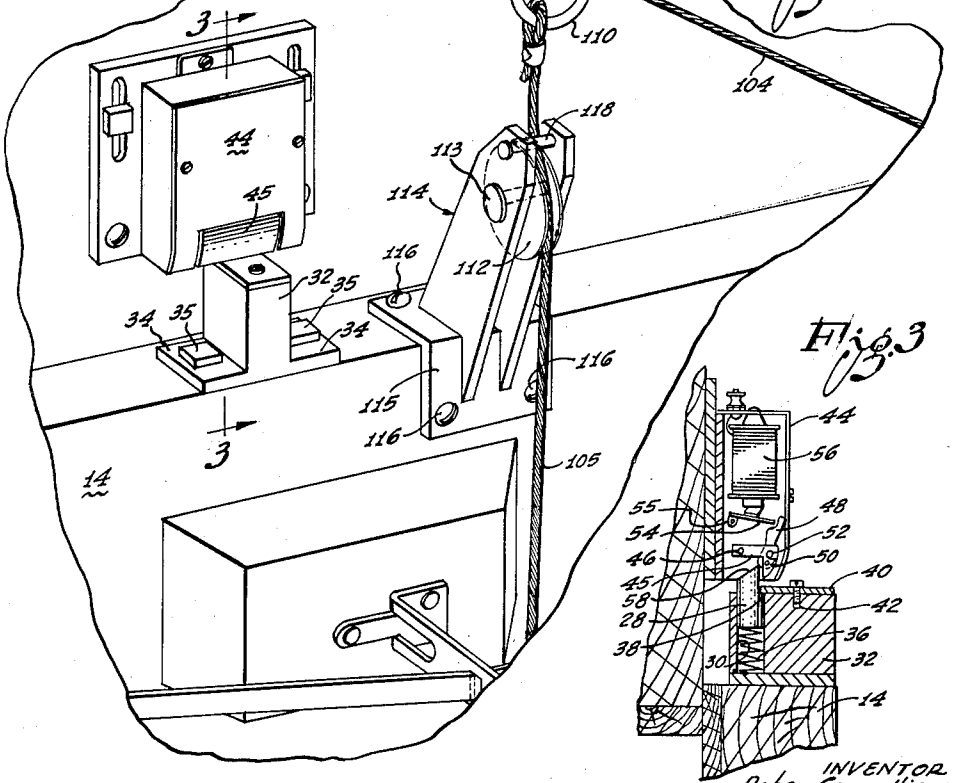


Fig. 3

INVENTOR
Peter Congelliere

By Smyth, Roston & Pavitt

Attorneys

Sept. 10, 1963 P. CONGELLIERE 3,103,043

GARAGE DOOR MECHANISM

Filed March 28, 1960 2 Sheets-Sheet 2

Fig. 4

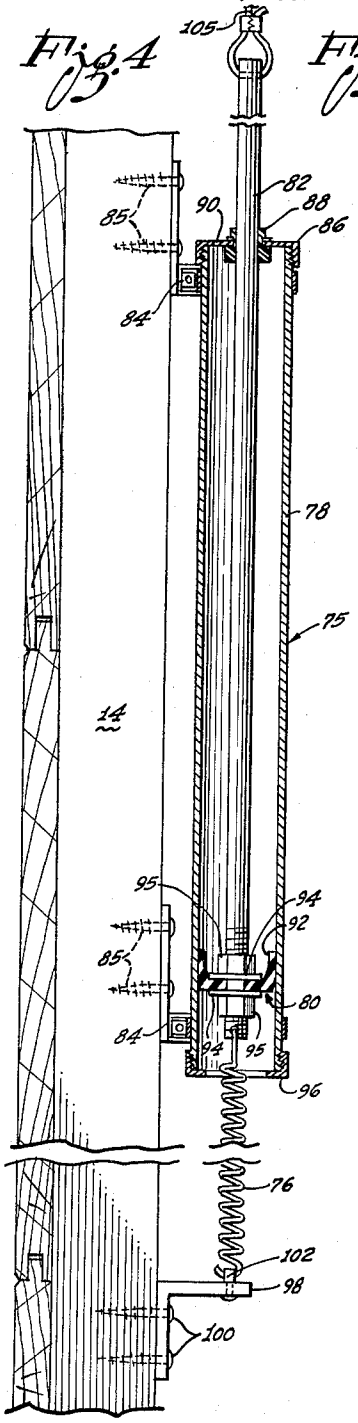


Fig. 5

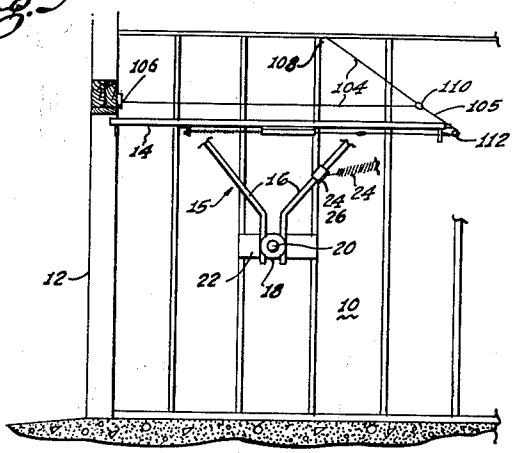
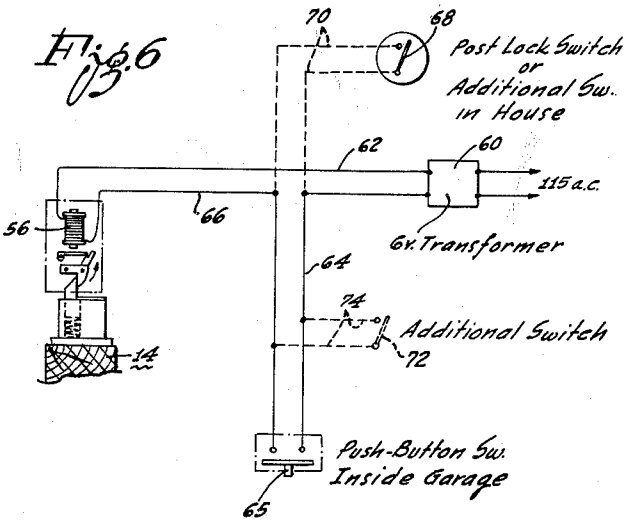


Fig. 6



INVENTOR:
Peter Congelliere

By Smyth, Roston & Pavitt
Attorneys.

United States Patent Office 3,103,043 Patented Sept. 10, 1963

3,103,043

GARAGE DOOR MECHANISM

Peter Congelliere, 3341 W. 116th St., Inglewood, Calif.

Filed Mar. 28, 1960, Ser. No. 18,000
6 Claims. (Cl. 20—16)

This invention relates to a closure assembly for the doorway of a building, which assembly includes a counterbalanced door movable to an overhead open position. While various features of the invention are widely applicable to door installations in general, the invention has been initially embodied in a door assembly for a homeowner's garage. This embodiment has been selected for the present disclosure and will provide adequate guidance for other specific uses of the basic invention.

A garage door such as employed in the selected embodiment of the invention is movable upwardly and rearwardly from a forward vertical closed position to an overhead horizontal open position. For this purpose, the door is mounted by side arms or by equivalent linkages to swing about a pivot axis that is parallel with the door and is spaced substantially inward from the doorway. Counterbalancing means is required to facilitate the opening movement of such a door, since the center of gravity of the door rises a substantial distance in the opening movement. Typically, such a counterbalancing means comprises a pair of long springs on opposite sides of the garage connected to the respective mounting arms of the door.

Since the two counterbalancing springs oppose the closing movement of the door, the stressing of the springs rises to a maximum as the door approaches its fully closed position. Consequently, no special care is required to close the door in a gentle and non-damaging manner.

On the other hand, since the counterbalancing springs urge the door to open and since the mounting arms swing to favorable angles relative to the spring as the door moves towards its fully open position, it is difficult to keep the door from reaching its limit opening position without making a heavy damaging impact against the building structure. In fact, the counterbalancing springs are commonly connected to the door closer than desirable to the pivot axis of the door to minimize the jolting impact at the end of the door-closing movement. If the impact were not objectionable, much better counterbalancing action could be achieved by shifting the points of connection of the springs to points further out from the pivot axis of the door.

The primary object of the present invention is to meet this problem by providing energy-absorbing means to decelerate the closing movement of the door. The provision of the energy-absorbing means not only avoids the jolting impact at the end of the door opening movement but, also, permits the counterbalancing springs to be connected to points further out from the pivot axis of the door for improved counterbalancing action. In fact, a feature of the preferred practice of the invention is that the point of connection of the counterbalancing spring with the door is spaced so far from the pivot axis of the door that the counterbalancing springs actually bias the door towards its open position. This arrangement makes it possible to use a remotely controlled latch to hold the door at its normal closed position so that when the latch is released by remote control, the door is actuated automatically by the counterbalancing springs to move from its closed position to its open position.

One problem to be considered in the construction of such an energy-absorbing means is that, while it must oppose the force of the counterbalancing springs, it must not interfere to any serious degree with the counterbalancing function of the two springs. If the energy-absorbing means were designed to store all of the energy that it absorbs, the stored force would be subsequently released in opposition to the counterbalancing springs and could defeat the purpose of the counterbalancing springs. On the other hand, if the energy-absorbing means is designed to oppose the counterbalancing springs primarily by dissipating energy, its effectiveness should be confined to the single direction of the door opening movement lest it subsequently interfere with the closing movement of the door.

The invention solves this problem by using spring means to store only a relatively small proportion of the energy that is to be absorbed, the stored energy being sufficient only to restore the mechanism of the energy-absorbing means to its starting position when the door is closed. The invention further employs dashpot means in tandem or series with the energy-storing spring means to dissipate the major portion of the energy that must be transferred to decelerate the opening door.

In addition, the invention further meets the problem by incorporating a by-pass in the dashpot means controlled by a check valve to make the dashpot effective only in the one direction of the door opening movement. A feature of the present embodiment of the invention is the use of a piston that flexes to serve both as a by-pass and as a check valve. Thus, the piston makes it unnecessary to provide additional structure for the by-pass and check valve.

Another problem to be considered is to provide some simple, inexpensive but efficient arrangement for connecting the energy-absorbing means to the building structure in such manner that it operates only over a terminal portion of the door opening movement. This problem is complicated by the fact that the whole door is translated bodily over a relatively long curved path between its two limit positions.

In the present embodiment of the invention, this last problem is solved by an arrangement of cables which directly connects the energy-absorbing means to the building structure but with ample provision for lost motion. Two cables are used, one cable being anchored at both ends to the building and extending overhead in the general direction of the door movement. The second cable is connected at one of its ends to an energy-absorbing means carried by the door and is connected at its other end to a ring that loosely engages the first cable. Throughout the major portion of the opening movement of the door, the ring merely slides along the first cable to provide the required lost motion for delaying the operation of the energy-absorbing means. As the door approaches its limit open position, the ring reaches a point on the first cable where the ring is effective to pull both of the cables taut for the delayed operation of the energy-absorbing means.

The features and advantages of the invention may be understood from the following detailed description, together with the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 is a perspective view from the interior of a garage showing a door arrangement embodying the present invention, the door being shown in its forward lower vertical closed position;

FIG. 2 is a greatly enlarged fragment of FIG. 1 showing how the second cable that is carried by the door is connected to a ring that slides on the first cable, this view also showing a remotely controlled latch mechanism to keep the door closed;

FIG. 3 is a fragmentary sectional view on a reduced scale of the latch mechanism, the section being taken as indicated by the line 3—3 of FIG. 2;

FIG. 4 is a sectional view of the energy-absorbing means mounted on the door;

FIG. 5 is a side elevational view of the door in its fully open position; and

FIG. 6 is a wiring diagram of a circuit for controlling the latch mechanism.

FIGS. 1 and 5 show a building structure or garage, generally designated **10**, having a doorway **12** which is normally closed by a door **14**. FIG. 1 shows the door in its forward vertical closed position, and FIG. 5 shows the door in its alternate rearward upper horizontal position. The door **14** is mounted at its opposite sides on corresponding mounting arms **15**. Each of the mounting arms **15** comprises a pair of angular bars **16** which are fixedly connected to a sleeve or bearing member **18** on a corresponding fixed pivot **20**. In the construction shown, each fixed pivot **20** is mounted on a base member **22** which is fixedly attached to the building structure. This arrangement permits the door to swing between the two limit positions shown in FIGS. 1 and 5.

Since the center of gravity of the door **14** is elevated by a distance approximating one-half the vertical dimension of the doorway, suitable means is provided to counterbalance the weight of the door. In this instance, a pair of relatively long conventional counterbalancing springs **24** is employed for this purpose. One end of each counterbalancing spring **24** is suitably connected to the building structure as indicated at **25**, and the other end is connected to a fitting **26** that is clamped onto one of the angular bars **16** of the corresponding mounting arm. In this instance, each of the fittings **26** is spaced further than usual from the corresponding fixed pivot **20** not merely to improve the counterbalancing action, but to go further and convert the counterbalancing springs into springs for exerting all the force required to open the door. Such a desirable spacing of the fitting from the door axis is permitted because the invention provides for automatic deceleration of the door at the end of its opening movement.

The door may be normally latched at its closed position by the mechanism shown in detail in FIGS. 2 and 3. As shown in FIG. 3, a latching plunger **28** is slidingly mounted in a bore **30** in a metal block **32** that is fixedly mounted on the upper edge of the door. In the construction shown, the metal block **32** has a pair of base flanges **34** for anchorage to the door by suitable screws **35**. The latch plunger **28** is urged upward by a spring **36** in the bore **30**, and normally a shoulder **38** of the plunger abuts the edge of a stop plate **40** that is mounted on the metal block **32** by suitable screws **42**.

For cooperation with the latch plunger **28**, a latch mechanism generally designated M is mounted on the building structure above the door opening, and this latch mechanism is adapted for electrical actuation under remote control. The latch mechanism is a well-known device available in commerce.

The latch mechanism M, which is enclosed in a housing **44**, includes: an angular latch dog **45** mounted on a fixed pivot **46**; a latch finger **48** that is mounted on the latch dog by a pivot **50** and is normally positioned against a stop pin **52** on the latch dog; a latch arm **54** mounted on a pivot **55**; and a solenoid **56** positioned immediately above the latch arm **54** to raise the latch arm from its normal lower latching position to an upper release position. When the solenoid **56** is de-energized with the latch arm **54** in its lower position shown in FIG. 3, the latch arm cooperates with the latch finger **48** to prevent upward movement of the latch dog **45**. Consequently, if the door is in its closed position shown in FIG. 3, the latch dog **45** engages the side of the latch plunger **28** to lock the door.

If the solenoid **56** is energized, while the door is closed, the consequent swinging of the latch arm **54** to its upper release position frees the latch dog **45** and the latch dog will yield to pressure exerted laterally by the latch plunger **28**. Thus, if opening force is applied to the closed door by the counterbalancing springs while the solenoid is energized, the latch dog **45** will yield to the pressure of the plunger **28** and swing to its release position to permit the door to open.

The door may be closed and latched without energization of the solenoid since the latch plunger **28** has an inclined cam face **58** on its upper end. When the door in its closing movement approaches the latch mechanism M while the solenoid is de-energized, the lower edge of the latch mechanism housing **44** cams the latch plunger **28** downward against the opposition of the spring **36**. The locking latch dog **45** keeps the plunger **28** retracted until the plunger travels to the fully closed position of the door, whereupon the spring **36** shifts the plunger upward to its normal latching position shown in FIG. 3.

FIG. 6 shows how a control circuit may be provided for the solenoid **56**. A transformer **60** energized by house current has one of its leads **62** connected to one side of the solenoid **56**, and has its other lead **64** connected to one side of a push-button switch **65** inside the garage. The second side of the solenoid **56** is connected by a a wire **66** to the second side of the switch **65**. A second outdoor switch **68**, provided with a suitable key-operated lock (not shown), may be connected in parallel with the switch **65** as indicated by the dotted lines **70** and, if desired, a third switch **72** inside an adjacent dwelling may also be connected in parallel with the switch **65** as indicated by the dotted lines **74**.

The energy-absorbing means of the present embodiment of the invention comprises a dashpot means, generally designated **75**, and an energy storing means in the form of a coiled spring **76**. The dashpot means **75** comprises a dashpot cylinder **78** that is fixedly mounted on the door, and a piston assembly which includes a piston, generally designated **80**, and an upwardly extending piston rod **82**.

The dashpot cylinder **78** is mounted on the inner face of the door **14** by a pair of brackets **84** which are secured to the door by suitable screws **85**. The upper end of the dashpot cylinder **78** is closed by a screw-threaded cap **86** which is centrally apertured to mount a suitable sealing means **88** that slidingly embraces the piston rod **82**. The cylinder cap **86** is further provided with a suitably dimensioned dashpot orifice **90**.

The piston **80** comprises a centrally apertured cup-shaped member **92** of resilient rubber-like material which is clamped onto the piston rod by a pair of washers **94**, backed up by corresponding nuts **95**. The lower end of the dashpot cylinder **78** is provided with a screw-thread stop collar **96** which blocks complete withdrawal of the piston **80** from the lower end of the cylinder.

The upper end of the energy-storing spring **76** is connected to the lower end of the piston rod **82**, and the lower end of the spring is connected to the door by means of a bracket **98**. The bracket **98** is a simple angular member that is mounted on the door by suitable screws **100**, the bracket being equipped with a suitable fitting **102** for hook engagement by the spring **76**.

Delayed actuation of the piston rod **82** is accomplished by a first cable **104** in cooperation with a second cable **105**. The first cable **104** extends in the general direction of the arcuate movement of the upper end of the door **14**. In the construction shown, one end of the cable **104** is connected by an eye screw **106** to the building structure immediately above the doorway **12**, and the other end is connected by an eye screw **108** to the garage ceiling. When the door is closed, the first cable **104** hangs in a somewhat slack manner as indicated in FIG. 1.

The second cable **105** is connected at its upper end to a ring **110** that is slidingly mounted on the first cable **104**. The lower end of the second cable **105** is connected to the upper end of the piston rod **82** in the manner indicated in FIG. 4.

Preferably, suitable guide means is provided on the

upper end of the door **14** to guide and route the second cable **105** from the ring **110** to the upper end of the piston rod **82**. As best shown in FIG. 2, such a means may comprise a circumferentially grooved sheave **112** mounted by means of a pivot pin **113** between the two arms of a bracket **114**. In the construction shown, the bracket **114** has an angular base **115** that is secured to the door by suitable screws **116**. A cross pin **118** mounted between the two arms of the bracket **114** is positioned sufficiently close to the periphery of the sheave **112** to serve as means to confine the cable **105** in engagement with the sheave **112** at all times.

The manner in which the invention operates for its purpose may be readily understood from the foregoing description. At the normally closed position of the door, shown in FIGS. 1 through 4, the two counterbalancing springs **24** on the opposite sides of the door are stressed in tension to their maximum length. The piston **80** is retracted to the lower end of the dashpot cylinder **78** as shown in FIG. 4, and the associated energy-storing spring **76** is relaxed. The first cable **104** is slack and the ring **110** that is connected to the second cable **105** is near the forward end of the cable **104**. The door is locked in its closed position by engagement of the latch plunger **28** with the latch dog **45** as shown in FIG. 3.

To open the door, the solenoid **56** is energized by any one of the three switches **65**, **68** or **72**, whereupon the counterbalancing springs swing the door upward towards its open position. As the two mounting arms **15** on the two sides of the door swing upward, they pass through a range of angles relative to the counterbalancing springs **24** that increase the length of the mounting arms applied by the springs and thus facilitate the upward movement of the door. With the counterbalancing springs **24** connected to the mounting arms at points more distant than usual from the pivot axis of the door, the counterbalancing springs are highly effective to accelerate the door for rapid opening operation. During the initial and major portion of the opening movement of the door, the cable **105** merely drags the ring **110** along the slack cable **104**.

As the door approaches its fully open position, the ring **110** reaches a position on the cable **104** to cause the two cables to be pulled taut in the manner shown in FIG. 5. Consequently, the final opening movement of the door causes the cable **105** to pull the piston rod **82** upward against the resistance of the spring **76** and against the resistance of displacement flow of the air out of the dashpot cylinder **78** through the dashpot orifice **90**. The compression of the air in the dashpot cylinder by the piston absorbs energy which is dissipated by displacement flow through the orifice **90** with a desirable retarding or cushioning effect for rapidly decelerating the door. The storage of energy in the spring **76** by the elastic elongation of the spring has a further deceleration effect. Consequently, the door opens with only a gentle impact against the building structure.

After the door is fully open, a residual quantity of air is trapped under pressure in the upper end of the dashpot cylinder **75** but the energy that is stored in this manner is dissipated immediately by escape of the air through the dashpot orifice **90**. Thereafter only the energy absorbed by the spring **76** is stored in the fully open position of the door.

When the door is subsequently closed by manual force, the initial closing movement of the door is boosted by the tension of the spring **76**. The primary purpose of storing energy in the spring **76**, however, is to retract the piston **80** as permitted by the two cables **104** and **105** as the door returns to its closed position. The downward retraction of the piston **80** tends to create a vacuum in the cylinder **78** above the piston and, of course, such a vacuum retards the retraction of the piston by the spring **76**. Rapid return of the piston **80** is desirable for prompt restoration of the dashpot to its starting state in

the event that the door is opened immediately after it is closed.

While the preferred practice of the invention has been described in which the counterbalancing springs are connected to the door at a relatively great distance from the door axis to provide all of the force required for opening the door, it is to be understood that the points of connection may be closer to the door axis so that the counterbalancing springs function in the conventional manner. In such an arrangement, the door is not opening automatically by the counterbalancing springs in response to unlatching of the door. Improved counterbalancing action is achieved, however, by shifting the points of connection of the counterbalancing springs further than usual away from the axis of the door movement.

A feature of the invention is that the rubber-like cup shaped member **92** of the piston readily yields to the pressure differential created by a vacuum in the cylinder **78**. The cylindrical skirt of the piston yields by flexing radially inward from the surrounding wall of the cylinder to open up a by-pass passage for the flow of atmospheric air into the cylinder. It is apparent that in this manner the cup shaped member **92** not only serves as means for by-passing the dashpot orifice **90** for the admission of air into the cylinder **78** but, also, serves in effect as a check valve to prevent reverse flow, i.e., outward flow of air past the piston.

The energy-absorbing means may be quickly and easily installed without requiring special skill or special tools. It is a simple matter to mount the dashpot cylinder **78** on the door by means of the two brackets **84**, and it is equally simple to mount the bracket **98** on the door for anchorage of the lower end of the energy-storing spring **76**. It is an exceedingly simple matter to complete the installation by anchoring the two ends of the cable **104** to the garage structure. After the installation is completed, the point of connection of the two counterbalancing springs **24** to the two mounting arms **15** may be shifted outward from the usual locations to improve the counterbalancing action, as heretofore explained.

My description in specific detail of the selected embodiment of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims.

I claim:

1. A closure assembly for a doorway of a building structure, comprising: a door for said doorway mounted on the building structure to move between a closed position and an open position; spring means connecting said door and the structure of the building to urge the door from its closed position to its open position; energy-absorbing means mounted on said door; a first cable-like member anchored at its opposite ends to spaced points on the building structure; and a second cable-like member connected at one of its ends to the energy-absorbing means and slidingly connected at its other end to the first cable-like member, whereby said one end of said second cable-like member moves along said first cable-like member during an initial major portion of the door opening movement and both of the cable-like members are pulled taut as the door approaches its limit open position with consequent operation of said energy-absorbing means to decelerate the door.

2. A combination as set forth in claim 1 in which said energy-absorbing means includes means to store energy to boost the initial closing movement of the door opening.

3. A closure assembly for a doorway of a buliding structure, comprising: a door for said doorway mounted on the building structure to move between a closed position and an open position; a latch to releasably hold the door in its closed position; spring means connecting said door and the structure of the building to urge the door towards its open position in opposition to said latch whereby releasing the latch results in automatic opening

of the door; energy-absorbing means mounted on said door; a first cable-like member anchored at its opposite ends to spaced points on the building structure; and a second cable-like member connected at one of its ends to the energy-absorbing means and slidingly connected at its other end to the first cable-like member, whereby said one end of said second cable-like member moves along said first cable-like member during an initial major portion of the door opening movement and both of the cable-like members are pulled taut as the door approaches its limit open position with consequent operation of said energy-absorbing means to decelerate the door.

4. A closure assembly for a doorway of a building structure, comprising: a door for said doorway mounted on the building structure to move between a closed position and an open position; first spring means connecting said door and the structure of the building to urge the door from its closed position to its open position; a dashpot comprising a first dashpot member fixedly mounted in upright position on the inner face of the door and a cooperating second dashpot member in sliding engagement with the first member, one of said two members being a cylinder and the other of said two members being a piston; second spring means connecting said second dashpot member with the door to urge the second member to a position for starting the dashpot operation; a first elongated flexible member extending in the general direction of travel of the upper end of the door, said flexible member being anchored at its opposite ends to the building structure; and a second elongated flexible member having one end movably connected to said first flexible member to shift along the first flexible member and having its other end connected to said second dashpot member for operation thereof and for stressing of said second spring means as the door approaches its limit open position.

5. A combination as set forth in claim 4 which includes guide means on the upper end of the door to route said second flexible member to said second dashpot member.

6. A door-closing assembly for a doorway of a building structure, comprising: a door for said doorway mounted on the building structure to move between a forward vertical closed position and a rearward overhead open position; a dashpot cylinder fixedly mounted in upright position on the inner face of said door; a piston assembly including a piston slidably mounted in said cylinder and a piston rod extending upward from the cylinder for movement towards the upper end of the door; spring means connecting the lower end of said piston assembly to the door to store energy to retract the piston assembly when the door is in its closed position; a first cable-like member connected in its opposite ends to the building structure and extending in the general direction of the path of movement of the upper end of the door; means movably mounted on said first cable-like member; a second cable-like member having one of its ends connected to said movably mounted means and having its other end connected to said piston rod, said first and second cable means being dimensioned to be pulled taut for actuation of said piston rod as the door approaches its limit open position.

References Cited in the file of this patent

UNITED STATES PATENTS

831,051	Flynn	Sept. 18, 1906
2,195,875	Pixley	Apr. 2, 1940
2,323,807	Ferris et al.	July 6, 1943