Aug. 16, 1938. F. A. PURDY 2,127,376

CLOSURE OPERATOR

Filed June 17, 1933 2 Sheets-Sheet 1

Fig. 1

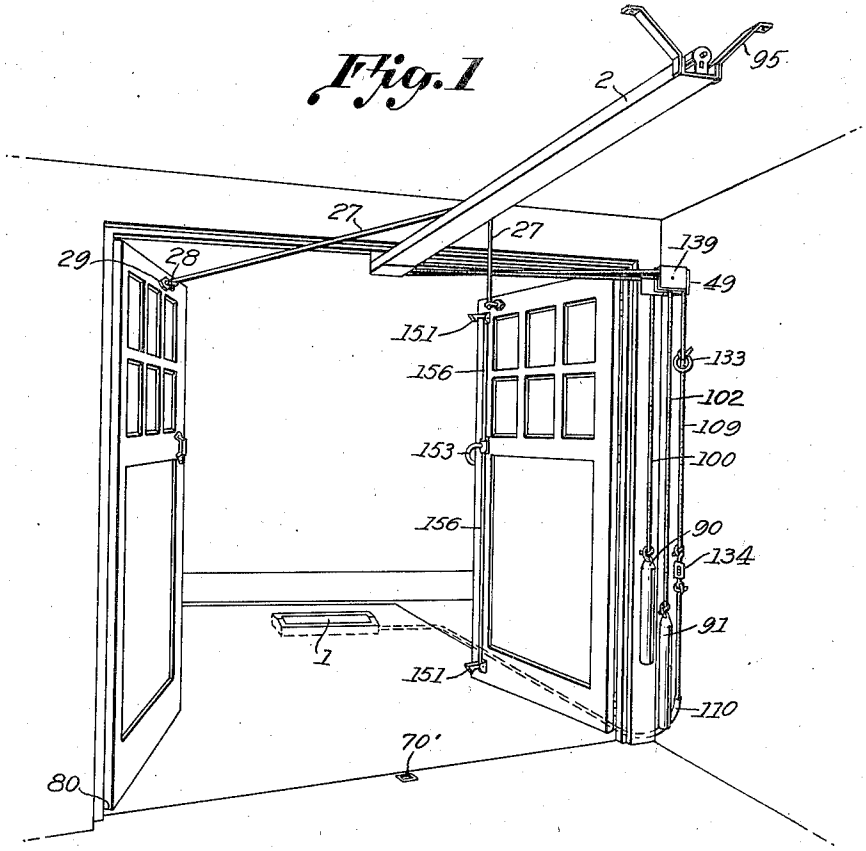
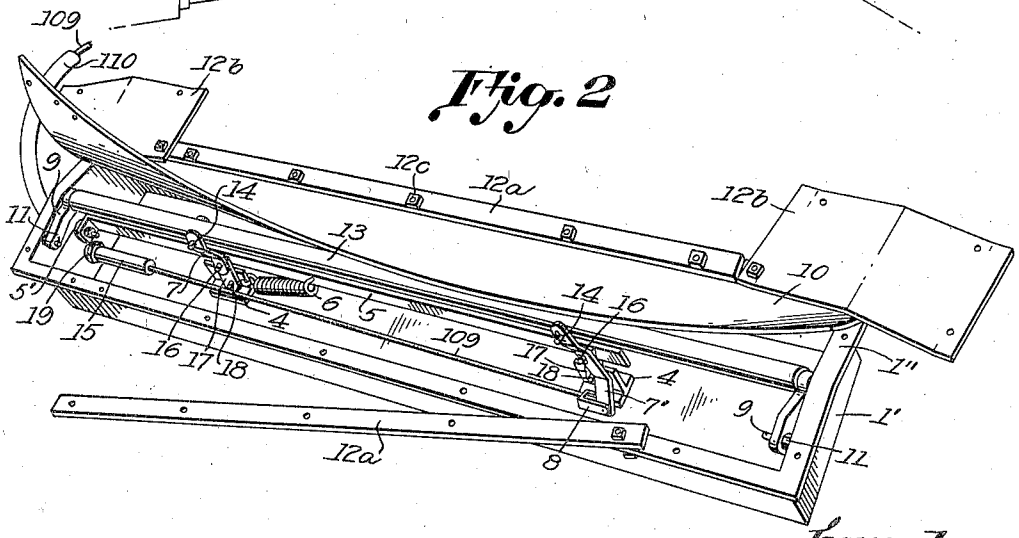


Fig. 2



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CLOSURE OPERATOR

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Fig. 3

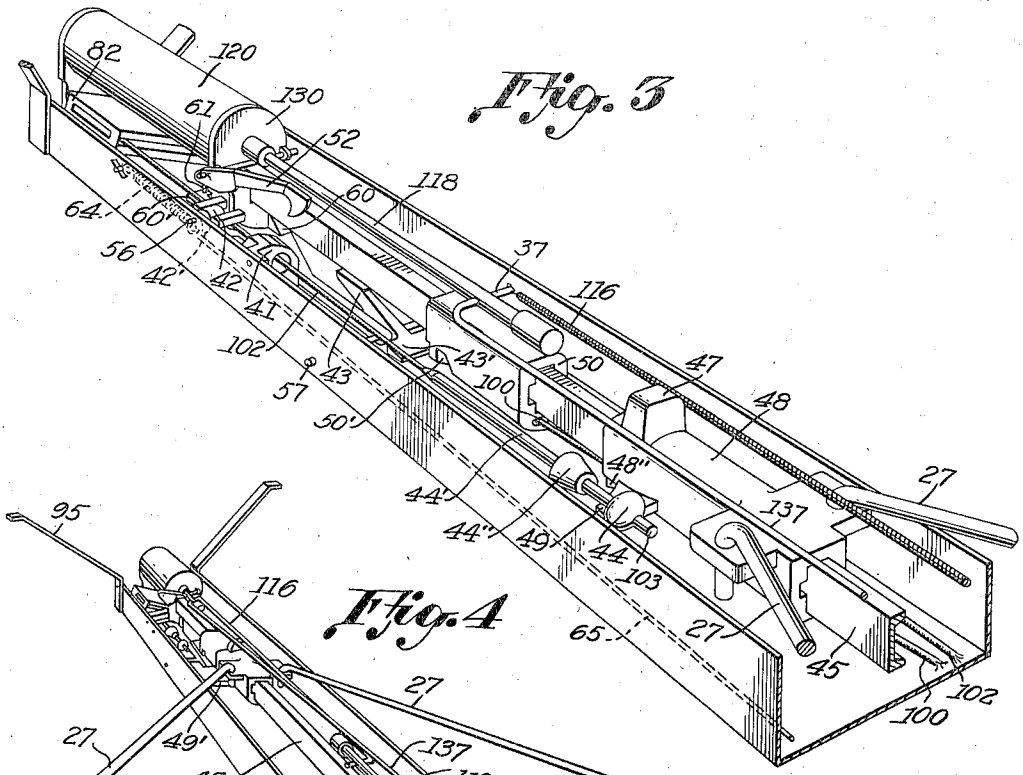

Fig. 4

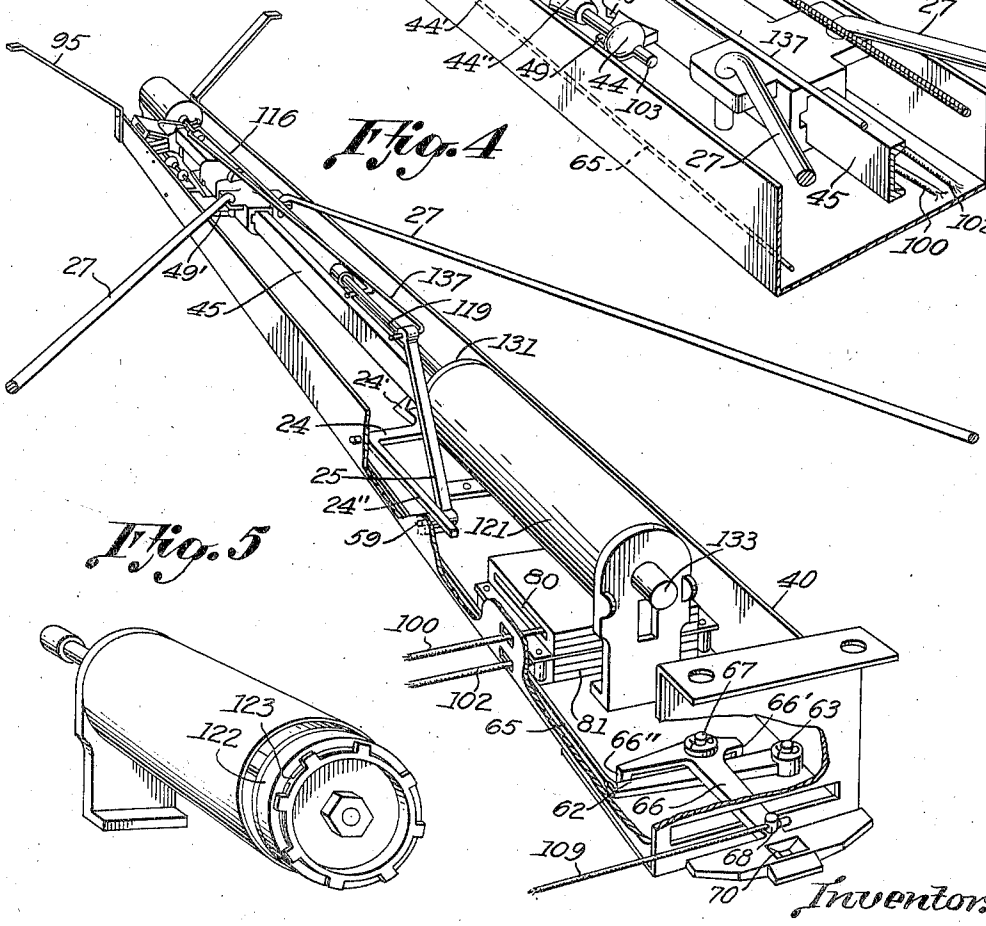

Fig. 5

Inventor:

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Patented Aug. 16, 1938 2,127,376

UNITED STATES PATENT OFFICE

2,127,376

CLOSURE OPERATOR

Frederick A. Purdy, Scarsdale, N. Y.

Application June 17, 1933, Serial No. 676,311

17 Claims. (Cl. 268—35)

This invention relates to closure-operators, and has particular reference to devices for opening, closing, and controlling the operation of doors of garages, and similar building structures.

Objects of the invention are increased dependability, ease of operation, convenience and economy. Other objects will become apparent in the development of the description.

The instant mechanism is an improvement over the device disclosed in my prior application, filed Dec. 14, 1928, Serial No. 326,084, which has resulted in Patent No. 2,062,015, issued Nov. 24, 1936.

Drawings

A preferred form of the invention is illustrated in the accompanying drawings, in which

Figure 1 is a general perspective view of a garage doorway, showing my invention as installed, including the overhead mechanism and connections to doors; the door-latches and control; the weight-bracket attached to wall supporting weights connected by cables to the overhead mechanism; and the contact-unit in the runway with a cable-connection extending through a pipe into the garage to the overhead mechanism;

Figure 2 is a perspective view of the contact-unit, showing the internal arrangement, the diaphragm top, and the water-proof design;

Figure 3 is a perspective view from above of the rear end of the overhead mechanism;

Figure 4 is a perspective view from above of the overhead mechanism; and

Figure 5 is a view of an air-cylinder piston.

Each character of reference represents the same part in all drawings in which it appears.

To indicate the similarity of functions in the widely different designs, the design in this application, and that in my application filed December 14, 1928 above referred to, characters of reference have been used herein for certain significant parts as far as practical the same as in the preceding application referred to for parts having substantially similar functions.

General outline

Superficially, the device consists of a contact-unit 1, set in concrete outside the garage in the path of the vehicle, including a depressible member 13, adapted, with transmitting parts to apply a pull on a cable 109 extending into the garage through a pipe or hose 110; two weights 90 and 91 at the garage-wall suspended by cables on sheave-wheels on bracket 49, these weights constituting energy-storing or inherently energized motive-means, one for door-opening and the other for door-closing; an overhead mechanism 2, set at right angles to the doorway, having a track longitudinally therein on which yoke and shuttle members, connected by cables to the weights, slide to move the doors, the doors being connected to the yoke by drive-arms 27; having two air-cushion dash-pots, one at each end of the track as cushioning means to yieldingly terminate the opening and closing movements of doors, the rearward air-cylinder constituting also a time-delay means to delay the start of door-closing action; having a clutching member 44 for connecting the door-closing weight to the yoke, and means for disengaging same and for other control; having latches for the yoke and shuttle; and having springs, suitable sheaves for the cables, etc.; having also extending from its front end a door latch-keeper (acting with the door-latches and control as an automatic lock) formed in a doubly displaceable crank 66 to which the cable 109 from the contact-unit is attached.

The terms "energy storing motive-means" or "inherently energized motive-means" are intended to define motive-means which by positioning are put into condition to deliver energy for motivation of the door; as by the deflection of a spring, the raising of a weight, or the positioning of the door itself to move by its own weight. A motive-means to which the motivating energy is delivered as consumed, such as an electric motor, is not regarded as energy storing motive-means or inherently energized motive-means in the sense in which used here.

Contact-unit

The box 1' is water-proof, sealed at the top by diaphragm 10, preferably of rubber, bound all around to the flanges 1'' by bolts 12c the downward heads of which are imbedded in concrete set around the box, and the threaded upward ends of which take nuts set down on binding strips 12a and binding plates 12b. The diaphragm 10 is raised on the middle longitudinal line to the same extent above the level of the side binding strips 12a as it becomes depressed below that level under the vehicle-wheel. Thus the diaphragm is not subject to stretching in operation. The binding plates 12b prevent depression and stretching of the diaphragm in the area that is close up to the binding ends.

Base-lugs 4 are fastened to the bottom of the box. Links 17 are mounted pivotally, as at 18, to respective base-lugs 4, and at 16 to connecting

bar 5 and to links 7, which links 7 are pivotally mounted at 14 to a bearing-bar 13. Bearing-bar 13 is confined to movement vertically by arms 9, pivoting in its ends, and pivotally mounted on the ends of the box 1' at 11.

A clevis 8 is attached pivotally to an extension of one of the links 7, designated 7', and to this clevis a fastening is made by cable 109, this cable 109 extending into the garage through the pipe or hose 110, where it extends upward and over a sheave 139 on wall-bracket 49 to the doubly displaceable crank 66 that extends from the front end of the overhead mechanism.

A packing-pipe 15 occupies a hole in box 1', end encloses a packing-gland through which cable 109 passes from the box to the pipe or hose 110.

The packing-pipe, with the cable through it, is filled with packing-material, and plugs, drilled to fit the cable and slid onto the cable, are driven into both ends. A nut inside the box on the threaded outer end of the packing-pipe forms a flange which confines a gasket-ring 19 against the wall of the box to make the exit-hole for the pipe-connection water-proof.

A pipe-coupling is run up tight on the thread of the packing-pipe that extends outside the box, so that, at the time of installing, the whole packing-gland turns frictionally on the box-wall with the turning of the coupling in threading it onto the pipe or hose 110.

The packing-gland keeps water out of the pipe or hose 110 in case of damage to the diaphragm 10.

Spring 6, attached between one of the base-lugs 4 and the connecting-bar 5, normally tends to bring one end of connecting-bar 5 against an end-wall of the box 2, and the length of this end of connecting bar 5 determines the angular position taken by the supporting links 7 and 17 when bearing-bar 13 is in upward position, in which angular position of links 7 and 17 the pivots 16 are off-center from a straight line between respective pivots 14 and 18, so that a sufficient load on bearing-bar 13 will depress it vertically against the resistance of the spring 6.

The farther the pivots 16 are thus off-center, the weaker is the resistance of spring 6 to the load, and the lighter is the load required to depress the bearing-bar 13.

To adjust this resistance, a bolt with washers 5' under its head is put through a hole in that part of the end of connecting-bar 5 which is formed at a right angle to its main length, so that the head of the bolt makes the contact with the inside end-wall of the box, washers added under the bolt-head, or taken away, making the adjustment of the effective length of the connecting-bar 5.

The height of the base-lugs 4, the depth of section of connecting-bar 5, and the diameter of bearing-bar 13, are so related that when the required operable depression of the bearing-bar 13 occurs, the bar 13 comes to rest on the connecting-bar 5, at the same time as the latter comes to rest on the tops of the base-lugs 4, which have a solid rest on the floor of the box, supported in turn by the concrete foundation below.

The arrangement described provides a means of translating a downward movement of bearing-bar 13 under the weight of a vehicle-wheel, into an endwise pull on cable 109, by the displacement of link 7' from a substantially vertical position to a slanting position in which its end to which clevis 8 is attached moves away from the point of entry of the cable at the packing-gland. This pull is uniform however far to one side or other of the exposed surface of the diaphragm the weight of the vehicle is applied.

Overhead mechanism

The front end of the frame 40 of the overhead mechanism is fastened to the lintel of the doorway, and the rear end of the frame 40 is suspended from the ceiling of the garage by bracket 95 the length and angles of which are adjusted at time of installing.

A track 45 is held at its ends in respective sockets formed in air-cushion end-brackets 130 and 131. This track, preferably rectangular to control the members thereon, carries a yoke 48 and a shuttle 50, each cored out to fit the track, and arranged to slide thereon.

Two eyes in the yoke receive pivotal ends of round door-drive rods 27, one rod extending to each door, where its pivotal end engages in the hole of an eye-bolt 28 put through the door. Pivotal ends of the rods are made by turning the rod to a right angle.

The eye-bolts 28 in the doors have nuts 29 at both faces of the door, inside and outside, by which adjustment may be made to allow for warp in doors, or to bring a lap-strip of one door to slide over the other door in reaching closed position, or to bring the doors into the precisely required position when closed.

The distance at which the eye-bolt is located from the vertical edge of door determines the angle at which the door will be positioned when open.

The yoke 48 has an upwardly extending boss 47 which acts as a bumper against the end-caps of the pistons of air-cushions.

The yoke 48 has a lug 49 extending on one side, upon which the arrow-hook 44 catches as shown. The stem 44' of the arrow-hook is a tube, and through it cable 102 from the door-closing weight passes, this cable terminating at knob 103 beyond the head of the arrow-hook. The arrow-hook is at all times under the stress of the weight 91.

The back of the head 44 of the arrow-hook is turned concave, and the concavity fits a boss 49' (Fig. 4) on the lug 49, which holds the arrow-hook to the lug except when unclutched or disengaged as described under the heading "Operation."

The use of this arrow-hook for clutching will be recognized as a piece of design which in mechanics is called "daring", since there is no positive means of keeping it confined to the lug 49 other than gravity and friction applied by the bearing of the weight 91 through the cable 102.

But dependability, proven in use through the fact that gravity does not fail, warrants the use of this extremely simple invention for a clutch.

This arrow-hook has a tendency to revolve, a little at a time, so that it does not always come to rest (in the fulcrum-block 41 later described) with precisely the same point directly upward as when it left the fulcrum-block in being pulled away with the yoke. This may be due to twisting in the cable 102 in the freeing of stresses within the cable, or to a roll on the lug 49 if the engagement of the head of the arrow-hook 44 does not always occur directly on the center-line of the boss 49'.

The arrow-hook therefore is circular in the design of its parts so that in any and all revolved positions it is effective in the same way.

The cable 100 from the other weight, for door-

opening, is made fast to the shuttle-body below the track.

A cross-ridge 50' extends downwardly from the shuttle body for engagement by the shuttle-latch 60, pivoted on cross-rod 57 and held normally upward by the spring 61 attached between the extension 60' of the shuttle-latch and the adjacent air-cushion bracket 130.

A protective latch 43 also pivots on cross-rod 57 and has a counterweighting tail 43' as a gravity means to hold the latching end normally upward to engage with the body of the shuttle in case the shuttle-latch 60 should have an inadequate hold and let go.

When the shuttle is held by the shuttle-latch 60, the latching end of latch 43 is clear of the body of the shuttle, so that the latch 43 is normally free of stress other than the weight of its tail.

The end of the yoke-body that comes into contact with the shuttle extends downward at 48'' to line up with the under face of the shuttle body. so that, when the shuttle is in contact with the yoke, the shuttle and yoke are mutually preventive of latching, the shuttle preventing the latch 24 (described in next paragraph) from engaging the yoke, and thus permitting of hand-operation in the re-setting work later described, and the yoke preventing the engagement of the protective latch 43 and thus avoiding interference with the automatic opening operation later described.

Yoke-latch 24 pivots by the journals of its cross-body in the flanges of the channel-frame 40, and its latch end 24', which engages the yoke when the latter is drawn fully forward, and which thus holds the doors in open position, is held normally upward by the counterweight of the tail 24'' extending from the cross-body.

Cam-lever 25 pivots at 59 and is driven by push-rod 137, (preferably of aluminum since part of its weight is added to the weight of piston-rod 118, later described as counterbalanced by the weight of the piston within the cylinder), this push-rod 137 being pivotally engaged in the upper end of the cam-lever 25.

The cam portion of cam-lever 25 is positioned below the tail 24'' of yoke-latch, and the forward movement of the lever brings the cam to raise the tail 24'' and thus downwardly disengage the latch-end 24' of yoke-latch 24 from the lower extension 48'' of yoke 48.

This arrangement provides within the mechanism a power capable of releasing the latch-end 24' that holds doors open, and this latch, being under friction due to the bearing of the closing weight, and a highly accentuated friction when the door is subject to wind pressure, offers a high resistance to actuation. The spring 116 must be relatively weak, for it must contribute as little as possible to the resistances opposing the closing-weight in order that the mass of the closing weight and the effort required to re-set it may not be unduly increased.

Accordingly the upper position of the cam-lever 25 travels through a relatively long distance corresponding to the distance by which the push-rod 137 is moved by the relatively weak spring, and the cam-portion of the cam-lever 25 has a relatively short travel, and this drives the tail 24'' of the yoke latch 24 a longer distance upward than the latch-end 24' travels downward to release the yoke, in proportion as these ends 24' and 24'' of the yoke-latch extend from the yoke-latch pivot.

Thus there is obtained a relatively strong drive to actuate the release of the yoke-latch 24 taken from a relatively weak spring.

The rearward end of push-rod 137 is turned to form a short length 37 at a right angle, and upon this the piston-rod latch 52 may engage, this short length 37 being introduced through a hole in the piston-rod 118, and its position held by cotter-pins either side of the piston-rod.

This short length 37 extends further beyond the piston-rod 118 for the mounting of the spring 116 noted below, interconnecting between the air-cushion piston-rods.

The point at which the short right-angle end 37 of the push-rod 137 goes through the piston-rod 118 is such as to give clearance of about an inch beyond the point at which latch 52 engages it, so that the engagement occurs even if doors do not reach fully closed position within the inch or so of tolerance.

The air-cushion dash-pot pistons are of conventional design, each having a leather 122 sealing compression and pressed against the interior of the cylinder by expansion spring 123 within the leather.

This pressure by the expansion spring serves the purpose of insuring compression in all temperatures that affect the pliability of the leather, and at all stages of wear, and in the case of the rearward air-cushion 120 serves the purpose of slowing down the movement of piston lengthwise of the cylinder against the pull of spring 116.

The leather is kept "live" by a charge of neat's-foot oil contained in the cylinder.

The piston-rods are tubular, capped air-tight at the pistons, and of a light material, preferably aluminum, and with preferably an iron cap on each to take the bumping by the boss 47.

The design thus is made to provide that at the fully drawn out position of the piston-rod the outward extreme of the rod is counterbalanced by the weight of the piston within the cylinder and does not sag downward to bind and prevent a full outward pull by a spring of a strength that is desired at a minimum to allow of the lightest possible motive-weights 90 and 91 which must operate against it, as well as against friction, etc.

Such a spring is that designated 116; which interconnects between the two piston-rods 118 and 119, being fastened to each by a cotter-pin in small rods put through the piston-rods at right-angles, one of these being the extension 37 of push-rod 137, already noted.

Each air-cushion dash-pot 120 and 121 has in its bracket at the end farther from that traversed by its piston-rod a hole 133 of predetermined size to allow escape of air under compression at a rate which permits of terminating the respective movements of doors at opening and at closing at a desired rate of speed.

A fulcrum-block 41 is fastened to the channel-frame 40, and it has a bell-shaped or conical interior hole through it terminating at its rear side in a hole large enough to admit the stem 44' of arrow-hook 44. The rearward position of the arrow-hook is limited by the bearing of its knob 44'' against the fulcrum-block at the larger end of the conical hole.

Rearward of the fulcrum-block, a dual cam or trigger 42 pivots at 56 in the flange of the channel-frame 40. The two fingers of this trigger are normally held in substantially horizontal relation by spring 64 attached between a crank-extension 42' of the trigger 42 and the flange of the channel-frame 40.

In a hole in the extension **42'** of trigger **42**, the pivotal end (bent at a right angle) of a round pull-rod **65** is introduced, so that a forward pull by the pull-rod **65** brings the forward finger of the trigger **42** upward to lift the piston-latch **52**, and brings the rearward finger downward to depress the stem **44'** of the arrow-hook.

The stem **44'** on being depressed assumes a downward slanting position behind the fulcrum-block, in which position it depresses the extension **60'** of shuttle-latch **60**, this extension **60'** being somewhat rearward of the trigger **42**. The trigger **42** at its rearward finger is not brought far enough downward to depress the shuttle-latch **60**, so that the shuttle-latch is depressed only when the stem **44'** is present through the fulcrum-block. A tolerance of extra length is provided in the stem **44'** so that if doors do not reach a fully closed position to bring the knob **44''** into contact with the fulcrum-block, the depression of the shuttle-latch will still be obtained.

The forward end of pull-rod **65** is formed into an eye engaging transmission-arm **62**, which is pivoted at **63**.

A doubly displaceable crank **66** pivots at **67**, and has two extensions with lugs **66'** and **66''** unequally distant from its pivot, both normally in contact with transmission-arm **62**, that lug **66'** which is nearest the pivot **63** being the shorter distance from the pivot **67**, and that lug **66''** which is farther from the pivot **63** being the farther from the pivot **67**, the arrangement being such that a uniform displacement sidewise of the doubly displaceable crank **66**, whether to the left or right (according to which side of garage cable **109** comes from) will apply a uniform movement to the transmission-arm **62**, the pull-rod **65**, and the trigger **42**.

To a pin **68** pivotal in the end of the doubly displaceable crank **66** that extends through a slot in the front end bracket of the frame **40**, the cable **109** from the contact-unit in runway is attached, and, in installing, this cable **109** may be brought from the left wall or the right, whichever is found the more suitable according to conditions, whether or not the weights are placed at the same wall.

Cable **109**, in the length extending at the wall upward from the pipe or hose **110** to the sheave **139**, has a hand-ring **133** tied to it, to afford the same effect in operation by a hand-pull as would be obtained by a wheel-depression at contact-unit.

There is also a turn-buckle **134** set in the cable **109**, to afford convenient means of taking up the cable to the length necessary to secure the desired effectiveness in pull from the contact-unit.

In the extreme frontal end of the doubly displaceable crank **66** is formed a keeper-recess **70** with slanting sides left and right of the interior. In the sill there is a keeper-notch **70'**. These keeper-recess and notch cavities **70** and **70'** are engageable by the latches **151** pivotally attached to the door and arranged to hold the door locked when so engaged. The latches **151**, by gravity, normally take positions to engage the keeper-recess and keeper-notch **70** and **70'** respectively, when door is brought to closed position. Rods **156** connect between latches **151** and a lifter **153**, which is the indoors element of a door-lock of conventional type requiring a key for release from outside.

Cable **102**, from door-closing weight **91**, passes over a sheave in a housing on weight-bracket **49**, enters the channel-frame **40** through a slot in flange, and passes around a sheave wheel in housing **81**, thence rearward to the sheave in housing **82**, thence forward to its fastening in the knob **103** at the arrow-hook **44**.

Cable **100** from door-opening weight **90**, passes over a sheave in a housing on weight-bracket **49**, enters the channel-frame **40** through a slot in flange, and passes around a sheave-wheel in housing **80**, thence rearward to its fastening in the shuttle already noted.

These cables may enter the channel-frame from either side, according to the wall of garage selected for placement of the weights.

A beveled bottom **80** is put on doors to prevent snow from being raked in at closing after being swept outward by the doors in opening.

Operation

The door-operator is designed to operate in the main from depression of mechanism within the contact-unit to close the doors when the user drives away from the garage, and to open the doors when he drives back.

It is designed to be re-set by the manual operation of the doors when the user, having alighted from the vehicle, closes the doors, and when, in going to get the vehicle out of the garage, he opens the doors.

The automatic service is had when the user is in the vehicle under movement outside the garage, and the manual operations occur when the user is on his feet to conveniently perform them.

Assuming that the position of the mechanism is that taken immediately after a door-opening movement under action of weight **90** has been had, the user having driven into the garage, the user alights from the vehicle and pulls one of the doors closed by hand. The other door follows, through interconnection of drive-arms **27** at yoke **48**.

In this hand-operation the yoke **48** is driven rearward on the track **45**, and it drives shuttle **50** also rearward, so that the weight **90**, connected to the shuttle by the cable **100** is brought into upward position. The shuttle becomes engaged by the shuttle-latch **60** when the doors are brought to fully closed position, thus holding the weight **90** with energy stored by its position.

At the same time as the shuttle-latch engages the shuttle, the yoke reaches a position in which it is engaged by the arrow-hook **44**, the head of the arrow-hook being forced upward by the lug **49** on yoke **48** as it approaches, and the arrow-hook snapping back to horizontal and bringing its concavity to engage on the boss **49'** of lug **49**—the horizontal position being automatically taken by the arrow-hook because the stress of weight **90** is applied horizontally at the arrow-hook by the cable **102**.

Thus the door-closing weight **91** becomes engaged on the yoke **48** through cable **102** and arrow-hook **44** at the termination of the hand-operation of closing the doors, and the weight **91** thus applies its bearing to hold the doors closed, continually, until the time when the arrow-hook is detached from the yoke at the moment of initiating an automatic opening later described.

The latches **151** engage with the keepers **70** and **70'** when doors are thus pulled closed, and the doors are thus locked, although of course the doors may be additionally locked by bolts or otherwise if desired. It is sufficient that one of the doors only be locked as that bearing the latches **151**, and this is preferably the door that laps over the other on the outside. The locking

of one door holds the other also, through the interconnection of drive-arms and yoke **48**.

In the hand-operation of re-opening the doors, after disengaging the lock by key or otherwise in the conventional manner, one door is moved by hand to fully open position, the other following through interconnection of drive-arms **27** and yoke **48**. This pulls the arrow-hook **44** forward with the yoke, and raises the weight **91** by cable **102**, thus storing energy by the position of the weight. At this fully open position of doors the latch **24** engages the yoke, and holds the doors in open position against the normal closing tendency of the weight **91**.

At the beginning of the forward movement of yoke **48**, in hand opening of doors, the protective latch **43** was cleared by the yoke, leaving its engaging end to move upward under gravity of its tail **43'** to prevent any precipitate drop of the weight **90**, in case of an inadequate hold by the shuttle-latch **60**.

Upon the vehicle being driven out of the garage, its first wheel on one side depresses mechanism in contact-unit in runway effecting a pull on cable **109**, and displacement of members **66**, **62**, and **65** to bring the trigger **42** into substantially vertical position in which the lower cam finger has no effect in the absence of arrow-hook stem **44'**, while the upper finger is effective in lifting piston-rod latch **52**. The piston-rod thus released moves slowly forward out of the cylinder at a speed determined by the pull of spring **116** against friction of the leather **122** in the cylinder, set up by the expansion spring **123**. The push-rod **137**, moved forward by the piston-rod **118**, drives cam-lever **25** to raise the tail **24''** of the yoke-latch, and to disengage the latch-end **24'** from the yoke, releasing the doors to close under the bearing of closing-weight **91** applied through cable **102**, arrow-hook **44**, yoke **48**, and drive-arms **27**.

The period of time taken for the movement of piston-rod **118** out of the cylinder **120** affords time for the vehicle in backing out through the doorway to get fully clear of door-range before the doors start to close. This is of value where the contact-unit must be set within a car's length of doors, as in the case of a curved approach, or an installation in a sidewalk.

This period of time is determined by the expansion strength of spring **123** inside the leather **122**, against the strength of spring **116** which moves the piston.

The second wheel on the same side of vehicle upon passing over the contact-unit depresses the mechanism therein, resulting in a movement of parts up to the raising of the piston-latch **52**, the same as when the first wheel passed over the contact-unit. But this movement of parts is without effect, since the parts designed to be set into action by such movement have already been set into action.

Thus the device operates whether one or both wheels of the car are so driven as to engage it, and there is time for the second wheel to pass ineffectively over the contact-unit, not only in the period of drawing out of the air-cylinder piston, but in the time taken for doors to reach a substantially closed position, which time is extended by the checking effect of the air-compression when the boss **47** of yoke **48** comes into contact with the piston-rod **118**, and retards the closing movement of doors to the speed allowed by the escape of air through the hole of predetermined size in the rearward bracket of air-cushion **120**.

Upon the doors reaching fully closed position under pull of the weight **91**, the latches **151** engage keepers **70** and **70'**, and the doors become automatically locked.

At closed position of doors the stem **44'** of arrow-hook is brought through the hole of the fulcrum-block **41** to a position in which its rear end is below the trigger **42**.

A pull by cable **109** from the contact-unit or from hand-ring **133** will now be effective to bring the rearward finger of trigger **42** to depress the stem **44'** of arrow-hook while the forward finger of trigger **42** effects a gesture of the latch **52**, ineffective to release push-rod extension **37** and piston-rod **118**, since the section **37** is normally about an inch rearward of engagement by the latch **52** when doors are in fully closed position.

Even if this piston were released, as would occur if the vehicle were driven so slowly that the opening action of doors was under way before the second wheel of car passed over the contact-unit, it would have no essential effect, since the doors upon opening will be prevented from latching in that position due to the presence of shuttle **50** in contact with the yoke **48**, so that any forward movement of piston **119** and push-rod **137** would have no essential (unlatching) value, and would be reversed upon hand-closing of doors in re-setting.

The pull of cable **109**, occurring from depression of contact-unit upon the return of the vehicle to enter the garage, displaces doubly displaceable crank **66** sidewise, raising the upper latch **151** on a slanted side of the interior of keeper-recess **70**, which raises also the lower latch **151** from the keeper-notch **70'**, thus unlocking the doors, while a wing to one side of the keeper-recess **70** holds the latches thus unlocked throughout the movement of the doubly displaceable crank **66** to the point of initiating the door-opening action.

The displacement of crank **66**, moves transmission arm **62** and pull rod **65** to bring the rear finger of trigger **42** downward to depress the rear end of stem **44'** of arrow-hook, which in turn depresses the extension **60'** of shuttle-latch, releasing the shuttle; and in the same movement of arrow-hook its head is levered upward through the fulcrum-block clear of its engagement with the yoke.

Shuttle **50**, under pull of the door-opening weight **90** through cable **100** pushes yoke **48** forward to open the doors, and towards the termination of the opening movement, bumper **47** meets piston **119** of air-cushion **121** to check the speed of the action at termination.

The operation described, completed with the doors in open position after an automatic opening action, brings the mechanism back to the position assumed at the commencement of this outline of operation.

Broadly applicable to door-types

It is apparent that my invention may be applied to doors of types other than that illustrated, such as a single swing door, a door sliding horizontally, or a door having a part moving vertically, since the design is fundamentally one that functions with a sliding member connected to a door.

I claim:

1. In combination, a door and means for operating the door comprising a slide, a sliding member on the slide to operate the door in one direction, another sliding member on the slide to op-

erate the door in the other direction, means for setting and holding the sliding members in operative positions, and motive means connected to the sliding members to open and close the door respectively, and means for actuating the holding means to release the sliding members to operate.

2. In combination, a door and means for operating the door comprising a door closing motive means and a door opening motive means, a slide, a sliding member on the slide connected to the door and to the motive means for closing the door, another sliding member on the slide connected to the door opening motive means, means for setting and holding the sliding members and the respective motive means in operative position, and means for actuating the holding means to release first the sliding member connected to the door closing motive means, and afterward the sliding member connected to the door opening motive means to bear against the first named sliding member to open the door.

3. In combination, a door and means for operating the door comprising two door motive means one to move the door in a given direction and the other to move the door in the opposite direction, a slide, a sliding member on the slide connected to the door and to the first named motive means, another sliding member on the slide connected to the other motive means, means for setting and holding the sliding members and the respective motive means in operative positions, and means for actuating the holding means to release first the first named sliding member and its connected motive means to drive the door in one direction, and afterward the other sliding member and its connected motive means to bear against the first named sliding member and drive the door in the opposite direction.

4. A door driving mechanism comprising a member connected to a door, a clutching means engageable with the said member and connected to a door-closing motive means, a traveler connected to a door-opening motive means and arranged to come into contact with the said member to drive the door open, and holding means for the traveler, and a trigger to release the said holding means and to disengage the said clutching means.

5. A door, a motive means to close the door, another motive means to open the door, a clutch, a member connected to the door bearing one element of the clutch, a member connected to the door-closing motive means bearing the other element of the clutch, means for engaging the clutch to bring the door-closing motive means to bear on the door, and means for disengaging the clutch to remove the bearing of the door-closing motive means when the door-opening motive means is brought into action.

6. A door-operator, comprising a door, a door closing motive means, a door-opening motive means, a track, two members slidable on the track, one of said members connected to the door and being engageable with a clutching means connected to the door-closing motive means, the other of said members having the door-opening motive means fastened to it, latching means for the said members, means for unlatching the said members to set into action the motive means required for appropriate operation of the door.

7. In a door-operator a traveler connected to a door and engageable by a door-closing motive means, another traveler connected to a door-opening motive means, means for associating the travelers into contact with each other, a latch for each traveler to prevent it and its engaged motive means from operating the door, and means for preventing the engagement of either latch when the travelers are in contact.

8. In a door-operator, in combination, a door, an energy storing motive means, a movable element connected to the energy storing motive means, a traveler connected to the door and arranged to contact the movable element, a latch for the said movable element to hold the motive means in energy-stored position, and a protective latch for the same movable element adapted to engage the latter and to hold the motive means in energy-stored position, in case of failure of the first mentioned latch, the traveler connected to the door being arranged to prevent the engagement of the protective latch when said traveler is in contact with the movable element.

9. In a door-operator an energy-storing motive means connected to a door holding means for the motive means, and releasing means for the holding means, said releasing means comprising a relatively weak spring, and a transmitter in contact with the holding means, the spring being connected to the transmitter and arranged to apply a relatively long drive upon the latter, the transmitter being arranged to transmit to the holding means a relatively strong drive through a relatively short movement.

10. In a door-operator, a door, a mechanism for moving the door, a means for motivation of the door connected to the mechanism, actuating means for the inception of motivation of door-movement, and a control means combining in one element a time-device and a cushioning device arranged to postpone for a period of time the actuation for inception of door movement, and to cushion the termination of the movement so incepted.

11. A door, a door driving mechanism and motive means therefor, and a clutch between the motive means and the door comprising a latching element connected to the motive means and a member connected to the door upon which the latching element engages, the latching element comprising a stem with a circular latch head fixed on it having a dish-like area of which a central area is occupied by the stem, the dish-like area being adapted to contact and engage upon the door-connected member, this engagement being made by a sector comprising a part of the dish-like area, and by any sector thereof without determination of the sector at which the engagement may occur and without resort to control means to hold the latching element to bring the said contact into any given sector of the dish-like area.

12. A door, a door driving mechanism and motive means therefor, and a clutch for engaging the motive means to the door comprising a stem with a clutch head thereon to engage a member connected to the door, a fulcrum member with a hole for the stem, a boss on the stem to contact the fulcrum member and limit the position of the clutch head, and a flexible member attached to the stem and connecting to the motive means arranged to so apply the bearing of the motive means upon the stem as to control the latter when in the fulcrum member to hold a position in which it will engage the clutch head onto the member connected to the door when the latter is brought within effective clutching range of the clutch head.

13. In combination, a door, and means for operating the door comprising motive means for closing and opening the door, two engaging

means, connecting means connecting the motive means to the respective engaging means, a traveler on a slide and connected to the door adapted to be engaged by the engaging means respectively, and means for bringing each engaging means separately into engagement with the traveler, one engaging means being on the same slide as the traveler, and the other engaging means being positioned to engage the traveler when the latter is brought into appropriate range, this last named engaging means being held in position for such engagement by the stress of the motive means applied through the connecting means by which it is connected to the motive means.

14. In combination, a door and means for operating the door comprising motive means for closing and opening the door, two engaging means connected to the motive means, a traveler connected to the door adapted to be engaged by the engaging means respectively, and means for engaging each engaging means separately upon the traveler, one engaging means to drive the traveler in a given direction to close the door, and the other engaging means to drive the traveler in the opposite direction to open the door and a single vehicle-contact control means for the two engaging means, two cushioning means, one to yieldingly terminate the closing movement of the door, and the other to yieldingly terminate the opening movement of the door, and an interconnection between the two cushioning means arranged to set one of the cushioning means for cushioning door movement in one direction upon the other cushioning means acting to cushion movement of door in the other direction.

15. A door-operator comprising a door, a door-opening weight, and a door-closing weight, a sliding member on a track connected to the door, a clutch of two elements one on the said sliding member and the other connected to the door-closing weight, a shuttle on the track connected to the door-opening weight, means to re-set the opening weight in upper position by manual closing of the door, and latching means for the shuttle to hold the opening weight when so re-set, means to re-set the closing weight in upper position by manual opening of the door, and latching means for the sliding member to hold the closing weight when so re-set, and to hold the door open, latch releasing means for the last named latching means combined with a dash-pot having a latched piston-rod, means for moving the piston-rod outwardly to actuate the said latch releasing means, a bumper on the sliding member to engage the piston-rod and cushion the closing of the door, another dash-pot with piston arranged to engage the same bumper to cushion the opening of the door, and a releasing trigger to selectively unlatch the latched piston-rod when door is open, and to unclutch the clutch and unlatch the shuttle when door is closed.

16. A door-operator comprising a door, a door-operating mechanism, motive means to close and open the door, and a box with a pliant cover containing a wheel-contact device located in the pathway of approach to the door, said wheel contact device comprising a depressible member under the pliant cover supported from the base of the box by a series of linkages each pivoting on the base and on the depressible member, and pivotally jointed midway between the base and the depressible member, the midway joint pivots engaging in a connecting bar by which the corresponding parts of the several linkages of the series are held in uniformly parallel relation respectively and the depressible member is held parallel with the base of the box and with the connecting bar, an extension on the connecting bar in contact with one end of the box, a spring on the connecting bar adapted to keep the said extension normally in contact with the end of the box and to recover the connecting bar and its extension into such contact after depression of the contact member, the said extension being of such length that the midway pivots of the respective linkages are normally held away from a straight line between the respective pivots at the base below and at the depressible member above, adjustment means on the said extension to vary the degree by which the said midway pivots are held away from such a straight line relation with the respective pivots at the base and at the depressible member, and to bring the said linkages normally into almost vertical positions of support of the depressible member, from which almost vertical positions of the links a depression of the depressible member moves the links to progressively more acute angular relations with the connecting bar, driving the connecting bar and its extension against resistance by the spring away from the end of the box, the said spring being so designed that its increase in resistance under deflection as the depression of the depressible member progresses is more than offset by progressively stronger angles of attack against it assumed by the linkages so that resistance to depression at the depressible member falls off after the initial resistance has been overcome, a cable attached to one of the linkages and extending to the said door-operating mechanism arranged to communicate movement from the linkage, resulting from the depressive operation of the depressible member, to the said door-operating mechanism to control the latter.

17. A door, an operator therefor, and a control means for the operator located in the path of a vehicle, said control means including a vehicle contact-member supported by linkages that assume varying angular relations to a spring connection throughout the operable movement of the contact-member, the angular relation when the contact-member is at a position corresponding to the beginning of operable movement affording a maximum of resistance by the spring, the spring resistance falling off after said maximum has been overcome, a cover of pliant material for the control-means arranged to form a yieldingly transmitting cover therefor and a gasket seal around its edges, the pliant cover being so mounted as to prevent stretching in its yielding movement.

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