Sept. 2, 1958 F. A. PURDY 2,850,088

DOORS

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Fig. 1.

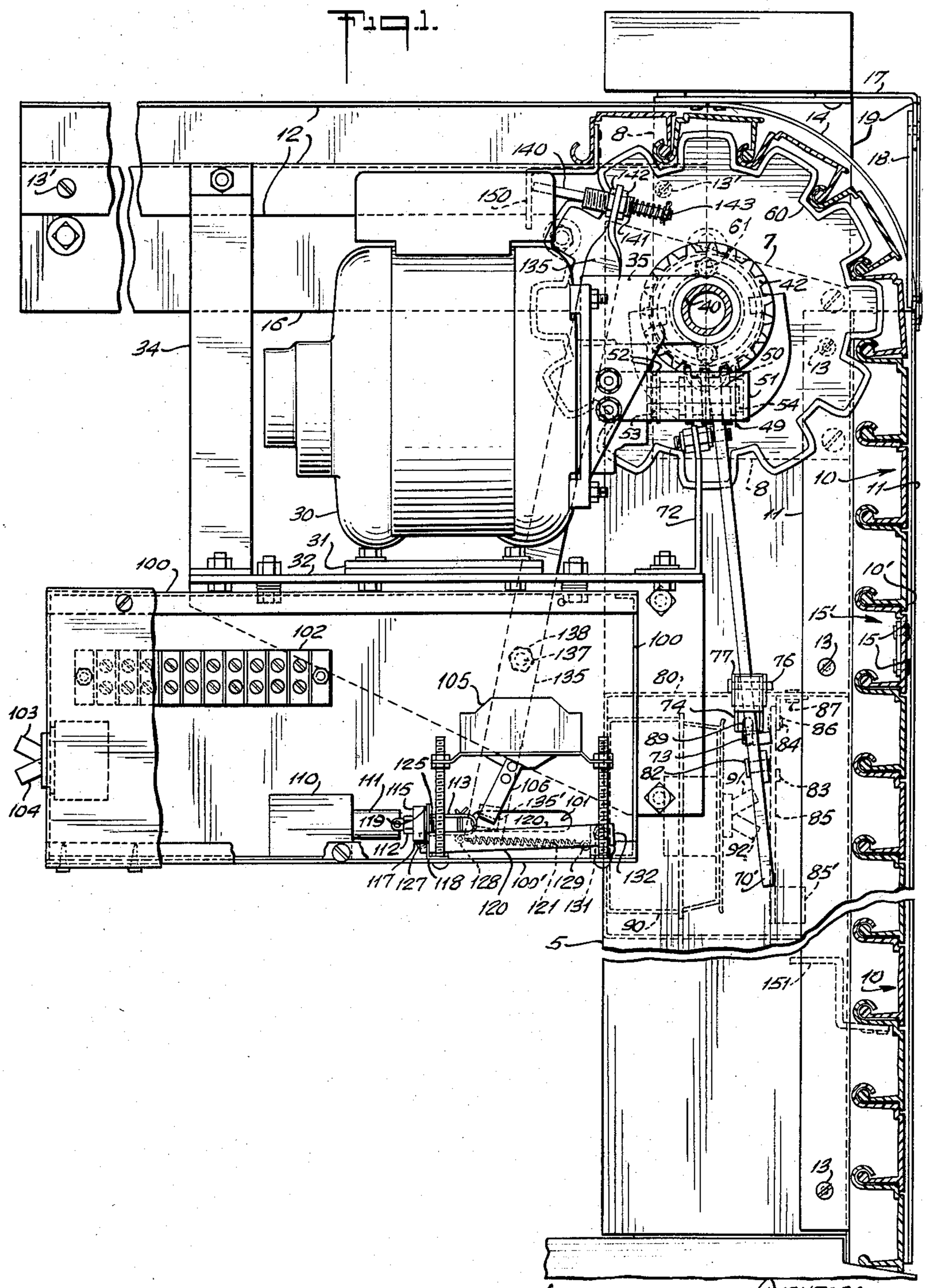

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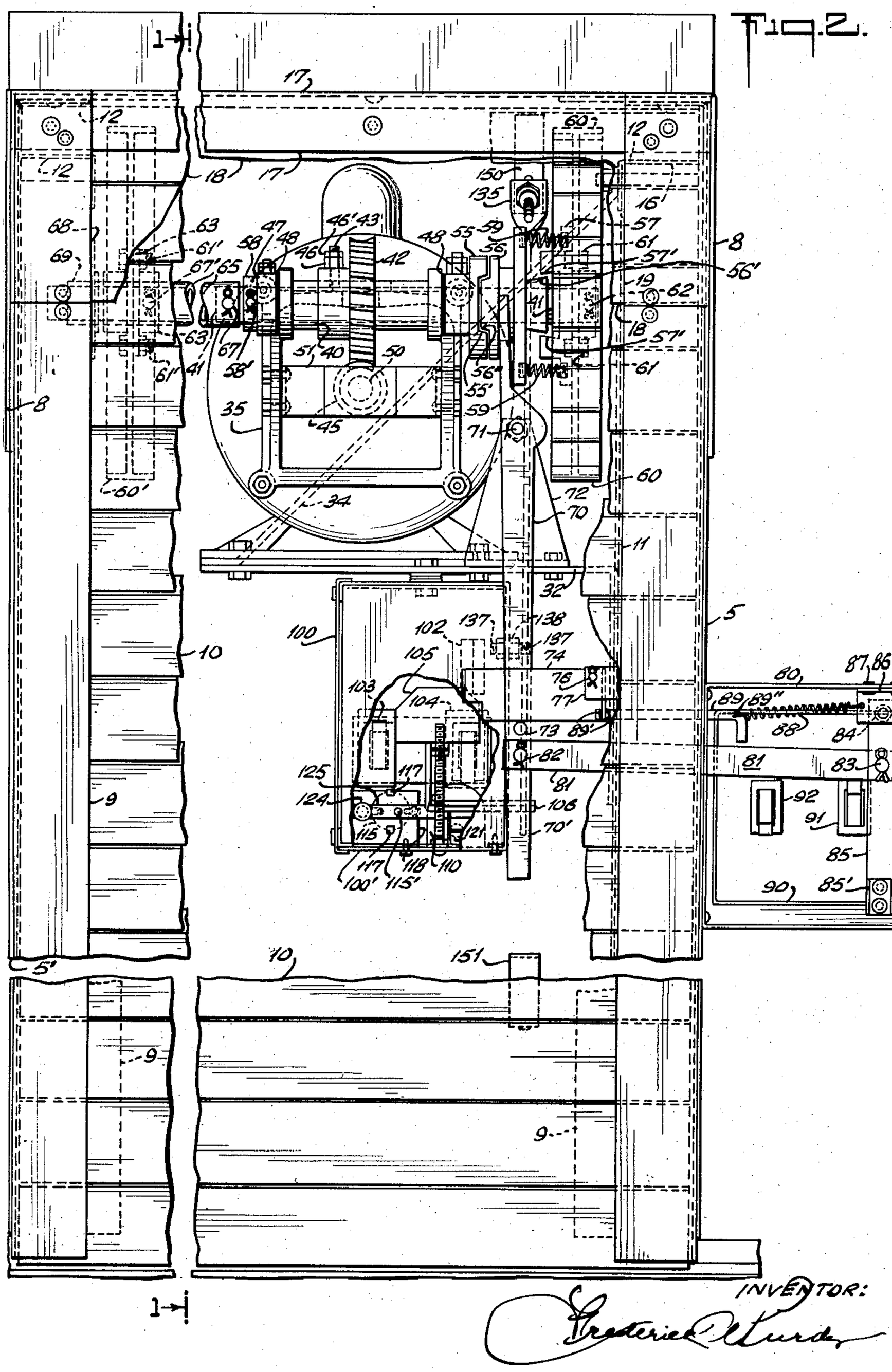
Fig. 2.



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United States Patent Office

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DOORS

Frederick A. Purdy, Scarsdale, N. Y.

Application May 10, 1952, Serial No. 287,167

7 Claims. (Cl. 160—188)

The invention relates to doors, and has particular reference to doors of garages and other building structures.

Objects of the invention are economy in manufacture and warehousing, simplicity in design, and convenience and dependability in use and saving in cost of building construction. Other objects will become apparent in the development of the description.

Drawings

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

Figure 1 is a side view of door and mechanism as seen from the line **1—1** of Figure 2.

Figure 2 is a front view as seen by a person outside a garage facing the doorway.

General observation

The door consists of a series of slats, preferably horizontal, of extruded plastic, light in weight, so that it requires no counterbalancing means for aid in opening. The slats interconnect by hinge joints shaped in the plastic. They extend from side to side of doorway and are guided by tracks which confine them in vertical series when the door is closed and in horizontal series overhead when the door is open.

The door is shown with a motor drive, and with a clutch to disengage the motor for manual operation, as in the event of failure of electric current supply. The motor drives two gears one either side of doorway. These gears mesh directly into the interiorly formed channels of the slats. Thus the slats require no machining or other treatment to suit them for the gear-drive.

A control-box, containing a power switch and a reversing switch for the motor, controlled by the door when it reaches either fully open or fully closed position, and containing a solenoid to throw the power on, also manual control switches, follow a part of the design shown in my application for closure-operators to be filed May 31, 1952, Serial No. 290,859, now Patent No. 2,758,836 issued August 14, 1956.

The door

Each slat, **10**, Figure 1, is in the form of a channel of which the web is exposed outside the garage and the flanges point inward, one flange having at its edge (called rod-edge) a round rod integral, and the other flange having its edge curved into a socket-course (called socket-edge) to embrace the rod-edge of the next adjoining slat. The slats are put together, into a series that comprises the door, by the rod-edge of one being slipped endwise into the socket-edge of another. The socket-edge is so shaped that the rod-edge cannot escape from it except by being drawn out endwise. Connected slats are free to turn hinge-wise in moving from vertical to horizontal or the reverse. The close fits by rod-edges into socket-edges hold the series of slats so that it is non-extensible, and the close contacts between adjoining flanges resist compression within the series making practicable a pressure

applied by hand or power to put the door into open position, and affording a resistance to partial opening of a door locked by the immobility of the worm wheel, later observed, against the worm.

A water-drip fin **10'** is integral with each slat..

For manual lifting, hand-holes **15**, Fig. 1, are provided through the plastic, covered by flaps of rubber or other material **15'** which retract to close the holes when the fingers are removed.

The slats that make up the door are free-sliding endwise in their rod-and-socket joints. There is some clearance between the ends of these slats and the respective guide-tracks that confine them. In manual operation of the door a means is needed to prevent the slats from taking a slant out of level, and out of square with the guides, if a lift at one hand-hole were stronger than at the other, which could set up friction within the guide-channels and impede door-movement from vertical to horizontal. The means of holding the slats from thus slipping out of parallel with lintel is the cross-shaft **65** and its gears **60** and **60'**.

Vertical guide-tracks **11** are fastened by screws **13**, Figure 1, one track on each jamb **5** and **5'** of doorway, and these provide guide-channels at the exterior surface of the doorway wall, so that the door affords full end-room within the garage.

This is of particular value. Earlier overhead door designs put the door on the interior surface of the doorway wall, constricting garage length so that reconstruction is required for today's longer cars. The present door can be applied to standing construction to lengthen garage space by the thickness of wall plus thickness of door and thickness of frame, adding about a foot to the garage length, and without using a door that kicks outward at a car standing near it. In new construction it affords a saving in cubic footage in that utilizable garage length may embrace space through to the outside, rather than the inside, of the doorway wall. A similar saving is afforded in cubic footage overhead in new construction. The door lies at the level of the lintel. Most overhead doors require headroom of about a foot above the lintel-level from vertical to horizontal.

Saving of cubic footage is in three directions: height of ceiling, length up to door, and width wall-to-wall. Increases in widths of cars year to year, and scraping of door-jambs by cars, tend to make obsolete a door of eight-foot width, and to bring the nine-foot door into more general use, practically corresponding to width wall-to-wall at many garages. In order that greater width and cubic footage in new garage construction may be held to a minimum, the door-drive motor and mechanism must be brought within the confines of door-width. The motor and its drive mechanism cannot be put outside the end of a drive-shaft across the doorway, it must be put within the door-width limits—the drive-shaft must go through the drive-mechanism. This requirement is met in the motor-drive shortly to be observed.

A further value in having doorway breadth brought to the limit of the garage side walls is the passage-area afforded to persons where the car extends into the space between door-jambs.

The horizontal guide-tracks **12** are fastened by screws **13'** to horizontal stringers **16** suitably supported from wall or ceiling on each side of the garage. Vertical and horizontal guide tracks are formed the same, this form appearing in the end views of the horizontal tracks **12** in the upper corners of Figure 2. The slats seal against weather by having their ends fitting closely up to the webs of the channel in the vertical tracks. The vertical and horizontal tracks are joined by a curved connector **14** to which they are riveted. An angle-piece **17** across the doorway from side to side is fastened under the lintel or header of the door-frame and forms a canopy above

the door and tracks. This may extend downward to the level at which the door-slats turn inward of the garage to go overhead. Preferably, where access by vehicles to the rated doorway height is needed, a flap **18** of rubber riveted to the angle-piece **17** extends down to this level. End-pieces **19**, one either side of doorway, riveted to **11** and **17**, complete the closure against weather.

Each jamb is sawn off at the line **7**, Fig. 1, to admit the door, sliding from outside to inside. In most construction, where the doorway is built before jambs are put into place, and in standing construction, it is sufficient to anchor jambs and header securely to doorway to compensate for the disjointing of jambs from header. But, where needed, a steel angle-plate **8** may be used as shown to substitute for the direct jointure of jambs and header.

To prevent rubbing by vehicles directly against vertical tracks and possible bending of the tracks, scuff-boards **9** are put on either side of doorway extending a few feet upward from the sill.

Where the door is to be used without motor drive, a curved inner connector can be used opposite the connector **14**, Fig. 1, in place of gear **60** to guide and support the door as it turns from vertical to horizontal.

Motor drive

Electric motor **30** on rubber mat **31** rests on shelf **32** which is fastened to door-jamb **5** and supported from stringer **16** by hanger **34**. On an adapter-bracket **35** bolted to one end of motor a tubular gear-shaft **40** is carried, within which turns a clutch-shaft **41**, Fig. 2. A worm wheel **42** is fastened to the gear shaft by a stud **43** threaded through the hub of the worm wheel and the wall of the gear-shaft and suitably held as by nut **46** and lock-nut **46'**. Similarly a clutch element **55** is fastened to the gear-shaft on one outer side of the bracket **35** and a thrust collar **47** is fastened to the gear-shaft on the other outer side of the bracket **35**.

Pending the machining of the bracket **35** in precision practice, adjustment of the worm-wheel to mesh precisely with worm **45** is effected by insertion or removal of shims **48**, Fig. 2. Worm **45** is pinned to the rotor shaft **50** of the motor **30**. Standard electric motors have a slight end-play in rotor and shaft, and are not normally made to stand appreciable end-thrust outward or inward of the motor frame. A thrust-bearing cage **51** is bolted to bracket **35** to confine the shaft and worm. Between the hub of worm and the motor-frame two washers **52** (Fig. 1) embrace an oilite thrust-bearing **53** on the rotor shaft **50**, and on the same shaft between the bearing cage **51** and outer end of worm **45** is another oilite thrust-bearing **54**. Shims **49** at either of the thrust bearings permit of holding the rotor-shaft so that the normal end-play is divided between inward and outward extremes while endwise thrust, inward or outward, occurring in applying the drive by worm upon worm-wheel, is resisted by the oilite thrust-bearings.

This arrangement permits a low cost adaptation of a gear-reduction drive on an ordinary motor which usually sells for a fraction of the cost of a gear-head motor or of a motor and gear-set with flexible coupling. No separate bearings are needed for the worm to hold it in alignment with the worm-wheel. This design makes possible the door-drive shown, having door drive gear-wheels, one at one side of the motor and the other at the other side of the motor, and the motor must set between the door-tracks, instead of outside one of the tracks.

Clutch-shaft **41** turns free within gear-shaft **40** and carries at its end rightward in Figure 2 two elements **56** and **57** of a three element clutch, of which the other element **55** has been bolted on gear-shaft **40**. Element **57** is bolted by bolts **61** to the door-gear **60** and is pinned at its hub by pin **62** to the clutch-shaft.

Clutch-shaft **41** is confined against creeping leftward of Figure 2 by the springs **59** and against creeping rightward of Figure 2 by a collar **58** pinned by pin **58'** to the shaft. Beside collar **58**, shaft **41** is pinned by pin **67** to a tubular cross-shaft **65** which extends across doorway from side to side and is preferably of aluminum to avoid sagging. Cross shaft **65** at the side of doorway leftward of Figure 2 is pinned by pin **67'** to the hub **63** of door-gear **60'** which hub is bolted by bolts **61'** to the web of the door-gear. At this side of doorway the cross shaft and door-gear are supported by a plate **68** fastened to jamb **5'** and carrying a flanged oilite bearing **69**.

Clutch

Clutch element **56** has a jaw **56'** at all times engaged within the jaws **57'** of element **57**, and it has an opposite jaw **56''** which engages between the jaws **55'** of elements **55**. Engagement is effected by compression springs **59**, held in pockets in elements **56** and **57**, pressing element **56** against element **55**. Disengagement is effected by clutch-fork **70** two lugs of which ride in a groove of element **56**, this fork being threaded for a pivoted mounting on threads of a stud **71** locked by nuts in a hole of bracket **72** which bracket is bolted to motor shelf **32**. Movement of clutch-handle **70'** leftward of Figure 2 presses element **56** rightward against springs **59** out of engagement with element **55**.

This disengaged position is held by latch **74**, which drops to catch a prong **73** pressed through a hole in fork-handle **70'**. Latch **74** is mounted pivotally by pin **76** on bracket **77** fastened by screws to door-jamb **5**. The drop of latch **74** is effected by gravity and may be aided by spring **88**.

Disengagement of the clutch by a person within the garage is effected by manual movement leftward of Figure 2 by hand directly upon the handle **70'** of the clutch-fork. Engagement is effected by lifting latch **74** directly by hand. These means of clutch operation are sufficient for a garage that may be entered otherwise than by the main doorway through which the car passes. For a garage that may be entered only through the main doorway, a means is provided for disengaging the clutch from outside to permit hand-opening of door, as in the event of failure of electric current supply with the door-closed.

A box **80** is embedded in the wall of garage to one side of the doorway. This box has a cover, not shown, preferably hinged and opened by key in a lock. A bar **81** attaches pivotally by pin **82** to the handle **70'** of clutch-fork and extends through a hole in door-jamb **5** into box **80**, where it attaches pivotally by pin **83** to lever **85**. Lever **85** attaches pivotally by rivet **84** to bracket **86** held by rivets **87** to wall of box **80**. A finger-angle **85'** is riveted to the free end of lever **85**. Movement of lever **85** by hand leftward of Figure 2 effects disengagement of the clutch. Clutch may be re-engaged by finger pressure upon the bent end of rod **89** which goes from box **80** through a hole in frame **5** to latch **74**, in a hole of which latch it is held by cotter-pins **89'**. Spring **88** between a cotter-pin **89''** on rod **89** and a hole in bracket **86** overcomes inertia and friction of rod **89** to positively pull latch **74** into engagement with prong **73** on handle **70'** of clutch fork.

Controls

Within the box **80** is another box **90** meeting the standards of the National Board of Fire Underwriters and containing terminals of electric wiring to two switches. One of these switches **91** is called a "Night Lock" switch. When thrown downward it cuts off current to the motor so that the door may not be power-driven. The door could not be manually operated while clutch is engaged, for the worm-wheel cannot turn to rotate the worm. The other of the switches **92** is a momentary contact switch, normally open, with handle held in downward position by a spring, and making contact to close a circuit to a solenoid, later observed, to set off the motor drive when the switch-handle is lifted.

Control-box **100** carries parts shown in my application

Serial No. 290,859, filed May 31, 1952. It has some improvements such as being removably hung from the motor-shelf **32** and having a bottom-pan **100'** removable to bring switches and mechanism away for convenient access.

It has the motor-reversing switch **105** described in the said application, and a solenoid **110**, a power-switch **115**, a latch **120** pressed by spring **121**, for the same purposes as described and claimed in the said application.

Because the design here differs, the construction may be observed. The power-switch **115** is of a miniature design but having a substantial amperage-rating. It is held by strap **117** to bracket **118** riveted to pan **100'** and has an insulation strip **119** (Fig. 1) between it and the bracket.

On bracket **118** there is riveted at **124**, Fig. 2, a leaf **125** of tempered spring-steel, horizontally extending rightward of Figure 2 past actuating button **115'**, Fig. 2, of switch **115** and through and beyond a solenoid-clevis **113**, Fig. 1. Clevis **113** is fastened by cotter-pin **127** (Fig. 1) to yoke **112** on solenoid plunger **111**. It has another cotter-pin **128** which engages leaf **125** to press button **115'** of switch **115** to close the switch, and its circuit to the motor, when the solenoid, energized by electric momentary contact switches or other means, draws plunger **111** inward. On this cotter-pin **128** spring **121** attaches, its other end being attached by cotter-pin **129** to latch **120** which latch is pivotally mounted at **131** to bracket **132** riveted to pan **100'**. The spring has two functions: (1) to lift latch **120** to engage and hold leaf **125** with button **115'** pressed inward of switch **115** to hold the circuit to the motor closed; (2) to retract plunger **111** outward of solenoid **110** when the latch **120** is made to disengage the leaf **125** and release button **115'** to open the circuit to the motor to stop the motor.

This disengagement occurs when a handle **106** of reversing switch **105** swings in either direction. The swing through brings the handle downward upon latch **120** to press the latch into position shown in Figure 1 below the leaf **125**.

The handle of reversing-switch is swung leftward of Figure 1 to stop the motor when the door reaches closed position, and rightward of Figure 1 to stop the motor when the door reaches open position.

The handle **106** extends through a slot **101** in the side of box **100** where it enters a hole **135'** in shifter **135**. Shifter **135** is threaded to fit pivotally on a stud **137** held by lock-nuts **138** either side of the wall of box **100**. It reaches up to a point near the door at which contact with it is made by two shifter knees **150** and **151** attached to respective door slats, one knee **150** throwing the top end of shifter **135** rightward of Figure 1 when door reaches closed position and the other knee **151** throwing that end of shifter leftward of Figure 1 when the door reaches open position.

Some rotation of the motor continues by momentum after the current to motor is thrown off. Accordingly, the shifter is given a longer travel at its upper end than at the lower end which throws the switch-handle, the throw-off of current occurring when switch handle reaches the mid-point of its swing-through. Timing of the throw-off of current to avoid undue slamming of the door is afforded by adjustment of the finger **140** (Figure 1) in the upper end of shifter **135**. A thimble **141** threaded outside is held by nuts **142** to shifter **135** and is adjustable either to left or right of Figure 1 as found desirable. A spring **143** embracing finger **140** and fastened at one end to the finger and at its other end to the thimble is strong enough to effect the throwing of the switch, but yields in either direction with the finger for a prescribed distance of door movement after the current is cut off.

A terminal strip **102** for wiring is provided within the control-box. The lower wiring connections on this may be unfastened when the pan **100'** is taken off.

Control switches mounted by the clamping device of their manufacturer, a "night lock" switch **103** and a momentary contact switch **104**, are provided in the end of the box **100** when installed at a garage having an access door other than the main door through which the car passes, such a garage not necessarily being provided with the box **80** for control from outside the garage.

It is contemplated that similar control switches may be located within a residence at any passageway used in reaching the garage.

Wiring

The number of night lock switches will bear upon how many of the terminals will be used at the terminal-strip **102**. The means used for setting off the motor-drive will bear upon this as well. Any practical setting-off means is contemplated for use with the motor-driven door, whether by radio-waves, sound-waves, tire-contact, trip-wire, post-switch, etc.

The wiring for the motor and controls here used is shown in the wiring-diagram of the above mentioned application. Electric current supply is brought to a terminal in the control-box, thence to a night-lock switch and back to another terminal in the control box, thence to any other night-lock switch, and back to another terminal in the control box, thence to the power-switch and back to another terminal, thence to one end of the reversing switch. The four wires from the reversing switch to the motor go through other terminals, this motor wiring and the reversing of the motor being described in that application. At each night-lock switch the power current is branched off by a jumper wire to the adjoining momentary contact switch, from which a third wire goes to a terminal that is connected to the solenoid, and from the solenoid the current is wired to a neutral terminal. Similarly a setting off device would have a three-wire cable from the control-box, one carrying power supply to operate the device, a second wire neutral, and a third through a relay or the equivalent to the solenoid.

Operation

Where a motor-drive is not used, the door is lifted by hand, the fingers being inserted into the hand holes **15**. The weight is greater at the beginning and diminishes as the door progressively rests its weight on the tracks overhead.

Sagging of the door in overhead position is resisted by the flanges of the slats which extend vertically downward, these flanges being reinforced by each rod-edge and socket-edge.

The door holds in open position by its friction on the tracks **12**.

It is closed by hand, reversing the opening operation.

With the motor-drive, the door is actuated to open and close by momentary lifting of the handle of a momentary contact switch such as **92** or **104**. Electric current then flows to energize the solenoid **110**, causing plunger **111** to draw in to pull leaf **125** against button **115'** of power switch **115**, supplying current to motor **30** to actuate the motor, rotating rotor-shaft **50** in the required direction to open the door or close it according to the positioning of the handle of **106** of reversing switch **105** as effected by one or other of the shifter knees **150** and **151** when in the preceding operation of door the door was brought to a stop. If the preceding operation closed the door, knee **150** will have moved shifter **135** to throw handle **106** to the left of Figure 1, that being the position of handle **106** which provides that the next direction of rotation of rotor-shaft **50** will be effective to drive the door open. If the preceding operation opened the door, knee **151** will have moved shifter **135** to throw handle **106** to the right of Figure 1, that being the position of handle **106** which provides that the next direction of rotation of rotor shaft **50** will be effective to drive the door closed. Reversing the direction of rotation of

motor by reversing its field leads through switch **105** is described in the above application.

The rotation of rotor-shaft **50** drives worm **45** to rotate worm-wheel **42**, gear-shaft **40**, clutch shaft **41**, and cross-shaft **65**, to turn door-gears **60** and **60'**, meshing into door-slats **10**, to lift or lower the door.

When desired to open or close the door by hand, as in the event of failure of electric power supply, the gear-shaft **40** may be disengaged from its drive upon clutch-shaft **41** and cross shaft **65**, by disengagement of clutch element **55** from clutch element **56**, effected, as already described, by manual movement of handle **70'** of clutch fork **70**. As described, the clutch may be re-engaged by lifting the latch **74**, permitting springs **59** to press clutch jaw **56''** into engagement with clutch jaws **55'**.

I claim:

1. An overhead door construction for a garage having a doorway opening provided in a wall thereof, said wall having a passageway therethrough at each side of said opening, each passageway extending laterally from said opening at the top thereof and communicating with the opening, a vertical track secured to the outwardly facing surface of said wall along each side of said opening from the bottom thereof to the bottom of the corresponding passageway, said vertical tracks providing, at said outwardly facing surface of said wall, channels having their open sides facing toward each other across the doorway opening, a horizontal track extending inwardly into said garage at each side of said opening just below the top thereof and in alignment with the corresponding passageway, a door comprising a large number of relatively narrow slats hinged one to another and adapted to be shifted from a vertical position outwardly of said doorway opening to a horizontal position within the garage, said slats extending substantially the full width of said doorway opening and having their ends arranged to extend into and be guided by said vertical and horizontal tracks at the opposite sides of said opening, and means at each of said passageways for supporting and guiding the related ends of said slats in their movement from the upper ends of said vertical tracks towards the adjacent ends of said horizontal tracks and vice versa in the course of opening and closing said door.

2. An overhead door construction as set forth in claim 1 in which said supporting and guiding means comprises a wheel at each side of said doorway arranged for rotation about a horizontal axis at substantially the level of the upper ends of said vertical tracks.

3. An overhead door construction as set forth in claim 1 in which said slats are formed of a rigid plastic material.

4. An overhead door construction as set forth in claim 1 in which the width of each of said slats is less than the depth of said doorway opening from the outer to the inner side of said wall.

5. An overhead door construction as set forth in claim 2 in which the radius of said wheel at each side of the doorway is less than the depth of said doorway opening from the outer to the inner side of said wall.

6. An overhead door construction as set forth in claim 1 having a member secured to said wall adjacent the top of said opening and extending completely across the same and downwardly in front of said opening to substantially the level of the upper ends of said vertical tracks to provide a canopy over the door and the upper ends of the vertical tracks.

7. A door comprising a series of slats in channel form horizontally disposed and interconnected, means to guide and hold the series vertically when door is closed, means to guide the series into horizontal position overhead to open the door, gears having teeth both faces of which fit against the sides of certain of the channels of the series to drive the door open and closed, a shaft across the doorway carrying said gears one either side of doorway, a worm-wheel located between the gears and through which the shaft extends, a motor driven worm in mesh with the worm-wheel, a clutch on said shaft between the worm-wheel and one of the gears, and means to engage and disengage said clutch.

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