Jan. 18, 1938. T. McG. AIKEN 2,105,830

WINDOW OPERATING AND DOOR LOCKING MECHANISM

Filed March 5, 1932 4 Sheets-Sheet 1

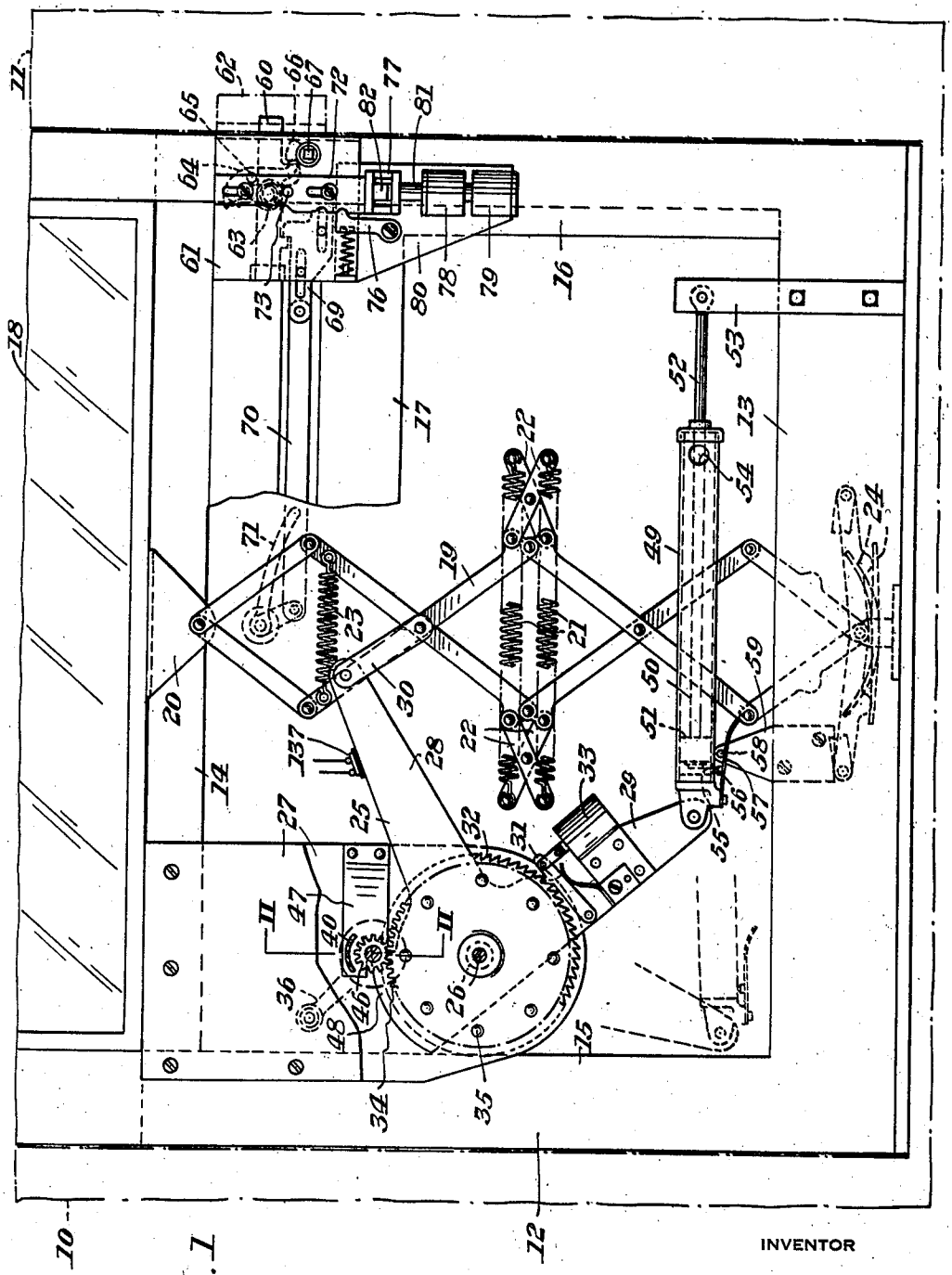


Fig. 1

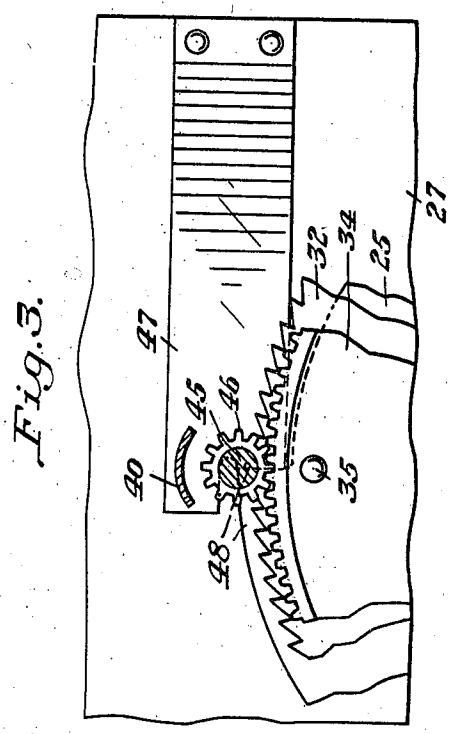
INVENTOR

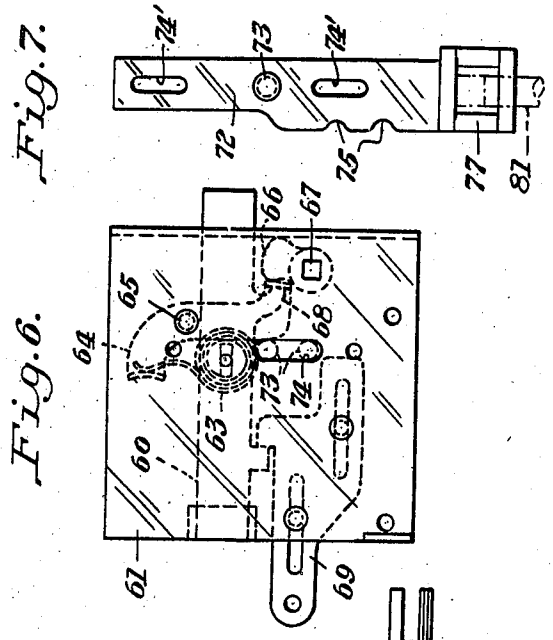
Thos. McG. Aiken by his attorneys
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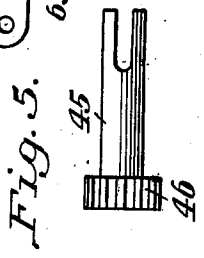
Jan. 18, 1938. T. McG. AIKEN 2,105,830

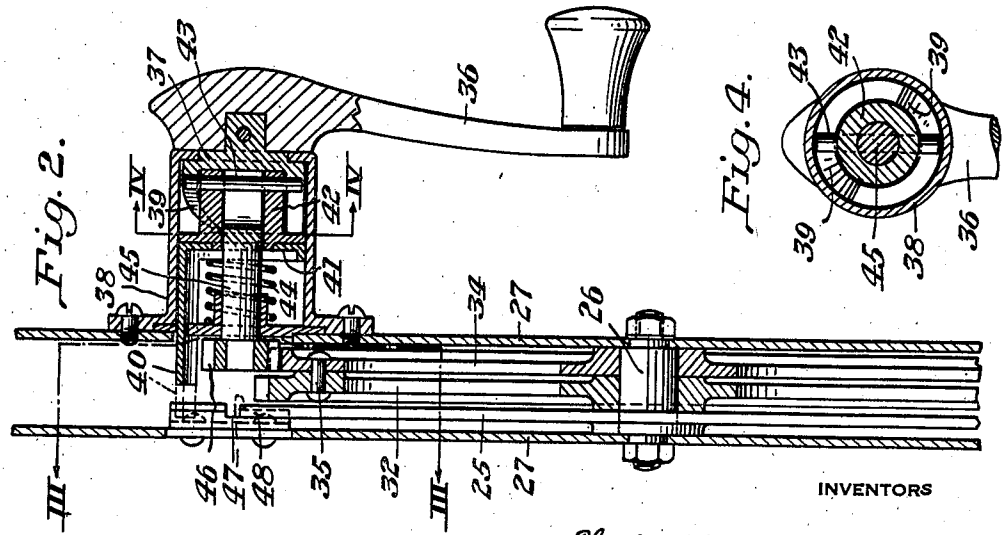
WINDOW OPERATING AND DOOR LOCKING MECHANISM

Filed March 5, 1932 4 Sheets-Sheet 2









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Jan. 18, 1938. T. McG. AIKEN 2,105,830

WINDOW OPERATING AND DOOR LOCKING MECHANISM

Filed March 5, 1932 4 Sheets-Sheet 3

Fig. 10.

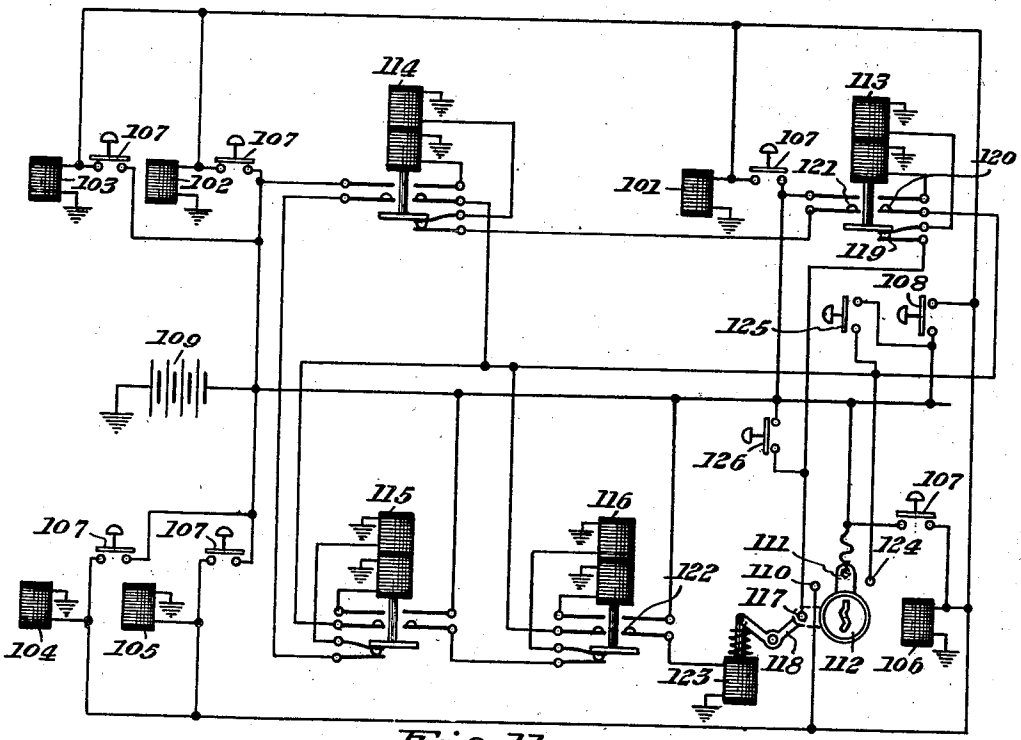


Fig. 8.

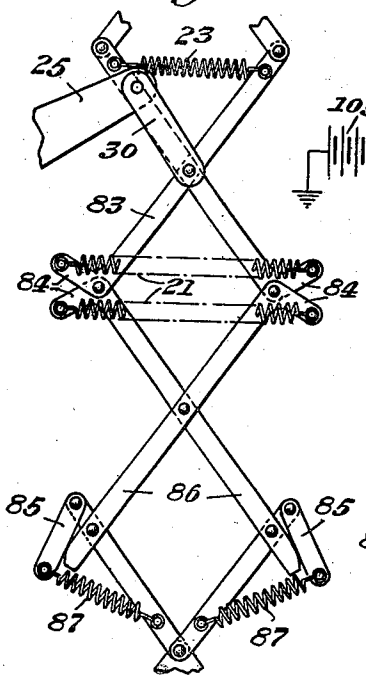


Fig. 11.

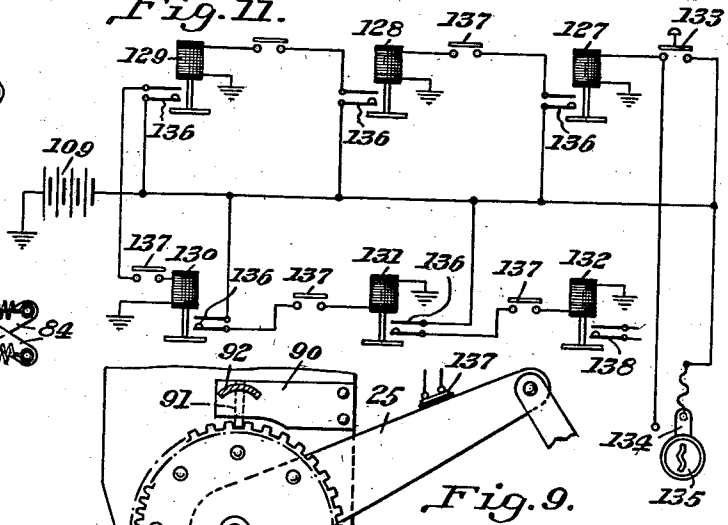


Fig. 9.

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Jan. 18, 1938. T. McG. AIKEN 2,105,830

WINDOW OPERATING AND DOOR LOCKING MECHANISM

Filed March 5, 1932 4 Sheets-Sheet 4

Fig. 12.

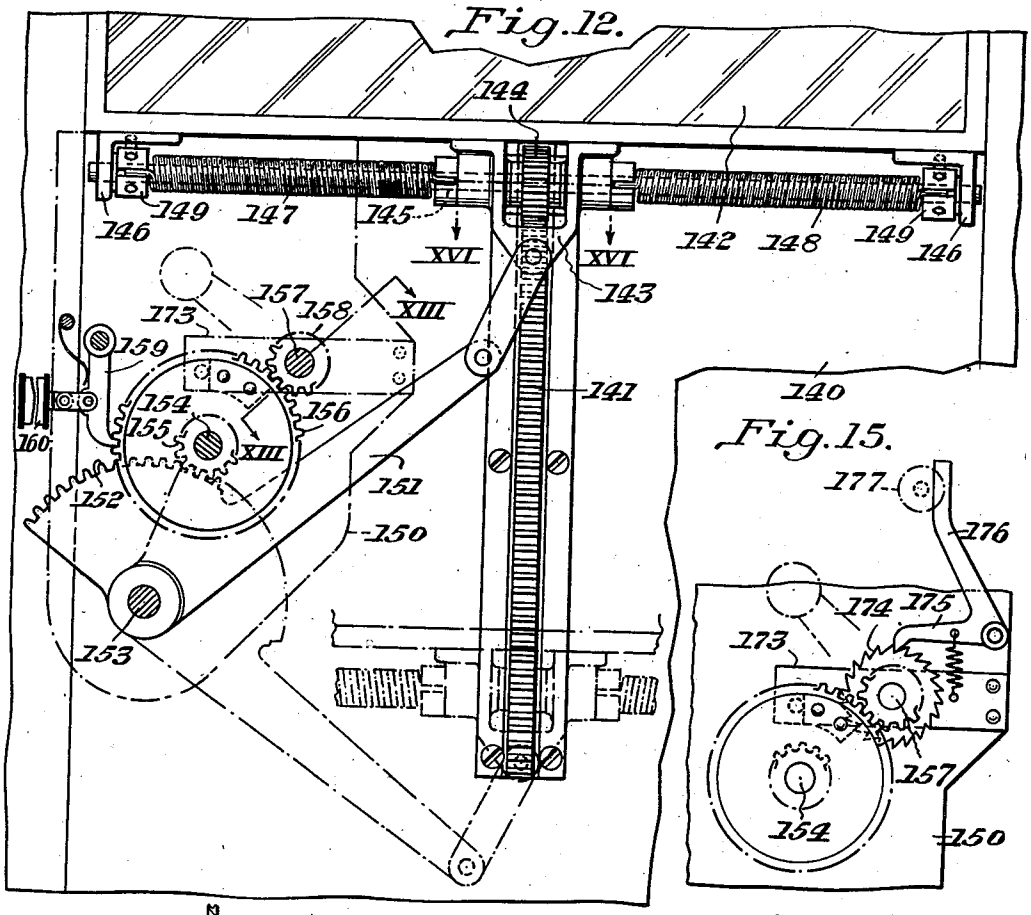


Fig. 15.

Fig. 13.

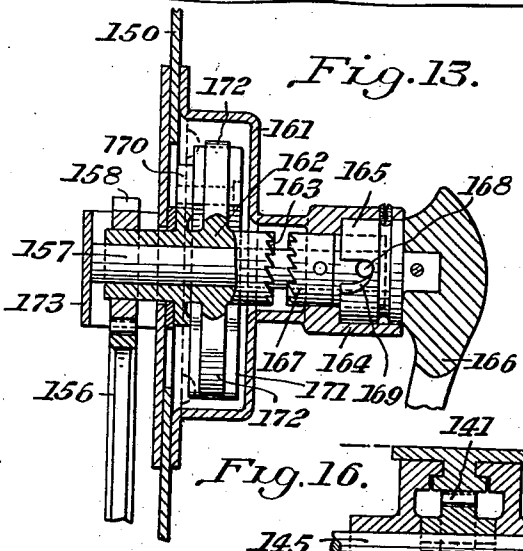


Fig. 14.

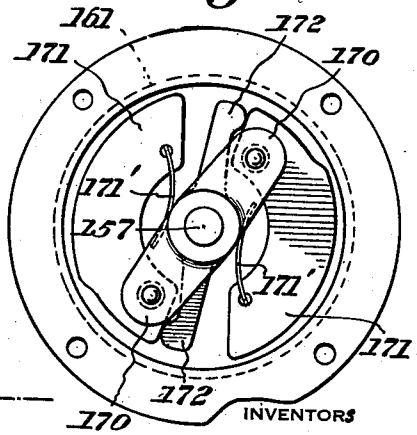


Fig. 16.

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UNITED STATES PATENT OFFICE

2,105,830

WINDOW OPERATING AND DOOR LOCKING MECHANISM

Thomas McG. Aiken, Pittsburgh, Pa.

Application March 5, 1932, Serial No. 596,942

6 Claims. (Cl. 268—127)

The invention relates to an apparatus for automatically actuating the windows of a vehicle, such as a motor car, to their closed positions and for automatically operating the locking devices associated with the doors thereof.

Present day construction of motor cars necessitates the manual actuation of the windows and the door locking devices thereof in order to secure the car against unauthorized entrance in the absence of the owner or operator. It is obvious that such manual operation of the windows and the door locking mechanisms is inconvenient and awkward, especially in the case of the larger models such as sedans in which there are four doors to be locked and six windows to be closed. It is an object of the invention, therefore, to provide means for performing these operations automatically whereby the inconvenience and difficulty encountered under the present practice and construction are entirely avoided.

In accordance with the invention, I provide an automatic window closing mechanism for each of the windows of a motor car, including a spring actuated lazy-tongs. The springs for actuating the lazy-tongs are designed and located so as to close the window when the latter is released and so as to provide a substantially constant closing force regardless of the position of the window. I utilize the usual manual crank for lowering the windows. The invention embodies also means for locking the window in different positions. Means actuated by the initial turning of the window lowering crank releases the locking means. Each window closing mechanism includes a spring actuated pawl having a retracting magnet for automatically closing the window on energization of the magnet. An air cushion or dashpot forms part of the apparatus to absorb the shock of the closing of the window under the spring force. Toward the end of the closing movement the dashpot is released and the full spring pressure applied to the window so that a firm closure is effected.

A modified form of the invention includes a rack bar mounted in the door and a pinion carried by the window for cooperation with the bar. The pinion is mounted on a shaft which is provided with spiral springs. The springs are so connected that they are coiled when the window is lowered. A locking mechanism similar to that mentioned is included and when the locking mechanism is released, the springs turn the shaft and the rotation of the pinion in cooperation with the rack forces the window up. In this embodiment of the invention, I include a releasable clutch in the driving mechanism for lowering the window, and a friction brake or governor for maintaining constant the speed of the window as it moves automatically to the closed position.

The door locking mechanism comprises a locking plate actuated by electromagnets, for cooperation with the locking mechanism which is now generally used in motor car doors. By a suitable control system, the operation of the locks on all the doors may be caused to take place successively. The successive operation may be initiated by the initial movement of the lock barrel in the right-hand front door when turned by the key provided for manual locking thereof. The operation of the window closing mechanisms may also be simultaneously started and means are provided for preventing the completion of the turning of the key until the windows have been closed and the doors locked. Unlocking of the manually locked door releases the locking mechanisms in the other doors. The opening of the doors from either the inside or the outside of the car by the usual means is not interfered with by the automatic mechanism mentioned.

For a complete understanding of the invention, reference is made to the accompanying drawings illustrating a present preferred embodiment, although it is to be understood that many changes in the system disclosed may be made without departing from the scope of my broader claims.

In the drawings:—

Figure 1 is a partial side elevation of a motor car door having the invention applied thereto, the usual inner cover being removed from the door frame to expose the working parts;

Figure 2 is a partial sectional view to enlarged scale along the line II—II of Figure 1;

Figure 3 is a partial sectional view substantially along the plane of line III—III of Figure 2;

Figure 4 is a sectional view along the plane of line IV—IV of Figure 2;

Figure 5 is a side elevation of a detail;

Figure 6 is a side elevation to enlarged scale of the door locking mechanism shown in Figure 1;

Figure 7 is a partial side elevation of the automatic locking mechanism;

Figure 8 is a partial side elevation of a form of lazy-tongs representing a slight modification of that of Figure 1;

Figure 9 is a partial side elevation showing a modified form of window locking and control mechanism;

Figure 10 is a circuit diagram showing the con-

nections between the various electromagnets and control devices;

Figure 11 is a diagram illustrating a partial modification of the circuit of Figure 10;

Figure 12 is a side elevation of the door having a modified form of operating mechanism incorporated therein, the inner panel of the door being removed;

Figure 13 is a sectional view taken through the manual drive for the operating mechanism of Figure 12;

Figure 14 is a side elevational view of the mechanism of Figure 13 with its cover removed;

Figure 15 is a partial view similar to Figure 12 showing a modified form of locking means; and

Figure 16 is a sectional view along the line XVI—XVI of Figure 12.

Referring now in detail to the drawings and, in particular, to Figure 1 for the present, the usual construction of motor car includes door frame members **10** and **11** forming part of the car body. A door **12** having frame members **13**, **14**, **15**, **16**, **17**, and a plate glass window **18** slidable therein, is hinged to the member **10**.

The actuating mechanism for closing the window **18** includes a spring actuated lazy-tongs **19** pivoted to the door frame member **13** and carrying a stirrup **20** for engaging the lower edge of the window. The construction of the lazy-tongs **19** will be obvious from the illustration in Figure 1. Main springs **21** therefor extend between auxiliary links **22** pivoted to each other and to the lazy-tong links proper. An auxiliary spring **23** is also employed as well as a starting spring **24** adapted to give the lazy-tongs an initial push when it is collapsed in such position that the springs **21** and **23** exert only a portion of their normal force.

A bell crank **25** is rotatable on a shaft **26** journaled in bearing plates **27** secured to the door frame members **14** and **15**. The bell crank **25** has an arm **28** and an arm **29**. The arm **28** is connected to one of the central pivots of the lazy-tongs by a link **30**. The arm **29** carries a spring-pressed pawl **31** and cooperating with a ratchet wheel **32** rotatable on the shaft **26**. An electromagnet **33** on the arm **29** serves, when energized, to retract the pawl **31**.

A gear **34** is also rotatable on the shaft **26** but is rigidly secured to the ratchet wheel **32** by rivets **35** so as to move only in unison with the ratchet wheel.

Rotation of the gear **34** and the ratchet wheel **32** is effected by means of a crank **36** similar to the ordinary window operating crank. The crank is secured to a sleeve **37** rotatable within a cylindrical casing **38** secured to the inner bearing plate **27**. The sleeve **37** has cam surfaces **39**. A plunger **40** integral with the bearing disk **41** is slidable axially in the housing **38**. Axial movement is imparted to the plunger **40** by means of a thimble **42** bearing against the disk **41**. A transverse pin **43** carried by the thimble has protruding ends adapted to be engaged by the cam surfaces **39** of the sleeve **37**. A spring **44** normally maintains the plunger **40** and the disk **41** retracted.

A pinion shaft **45** traverses the disk **41** and the thimble **42** and has a slotted end for embracing the pin **43**. A pinion **46** on the shaft **45** meshes with the gear **34**.

A spring locking finger **47** is adapted to engage behind a projection **48** on the bell crank **25** when the window **18** is raised, to prevent the unauthorized opening of the window. This locking spring is automatically moved out of line with the projection **48** when the window is lowered by turning the crank **36**. The initial movement of the crank in a counter-clockwise direction turns the sleeve **37** and forces the pin **43**, thimble **42**, the disk **41** and the plunger **40** to the left, as shown in Figure 2. The plunger **40** engages the finger **47** and forces it out of the plane of the projection **48**. Further rotation of the crank **36** lowers the window by driving the bell crank through the pinion **46** and gear **34** in a clockwise direction. Since the magnet **33** is normally de-energized, the pawl **31** engages the ratchet wheel **32** and the bell crank is thereby driven positively by the gear **34**. The rotation of the bell crank, of course, lowers the window **18**, collapses the lazy-tongs **19**, and extends the springs associated therewith. The friction in the mechanism for lowering the window will usually be sufficient to hold it in any desired position but if not, a mechanical brake may be applied to the bell crank, for example, a pad bearing on the crank at a convenient distance from the shaft **26**.

An air cushion **49** is also operated by movement of the bell crank **25**. The air cushion comprises a cylinder **50** pivoted to the arm **29** of the bell crank **25** and a piston **51** connected by a rod **52** to a fixed support, such as a brake **53**, to which the rod **52** is pivoted. The cylinder **50** has a port **54** in its wall which is permanently open, and also a port **55** which is normally closed by a valve **56** when the window **18** is open. The valve **56** is carried on a spring **57** secured to the cylinder **50**. A pin **58** on a bracket **59** secured to the door frame member **13** is positioned so as to open the valve **56** just before the window reaches its fully closed position. The positions of the arm **29** of the bell crank **25**, the cylinder **50** and the valve **56** when the window is opened are indicated in dotted lines in Figure 1.

If the window is fully opened by the procedure described above, the lazy-tongs **19** will be completely collapsed as indicated in dotted lines in Figure 1, and the spring **24** will be flattened out. When it is desired to close the window **18** automatically, it is only necessary to energize the magnet **33** by means which will be described hereinafter. The energization of the magnet retracts the pawl **31** and releases the positive connection between the ratchet wheel and gear and the bell crank **25**. This permits the springs **21**, **23** and **24** to extend the lazy-tongs and close the window **18**, simultaneously forcing the cylinder **50** home on its piston **51**. As before stated, the function of the spring **24** is merely to start the elevation of the lazy-tongs since, in the collapsed position, the main and auxiliary springs **21** and **23** are not very effective. As the cylinder **50** is thrust home on the piston **51**, the accumulation of air in the cylinder prevents too violent closure of the window. When the window is nearly closed, however, the pin **58** on the bracket **59** engages the spring **57** carrying the valve **56** to withdraw the latter from its port **55**. This releases the air accumulated in the cylinder and permits the lazy-tongs springs to exert a strong lifting effort on the window **18** to close it tightly.

The door locking mechanism is illustrated in Figures 1, 6 and 7. The usual mechanism for maintaining the door closed comprises a latch bar **60** slidably carried on a plate **61** mounted on the door frame adjacent the body member **11**. The latch bar cooperates with a striking plate **62**. A coiled spring **63** is carried on the bar, the inner end being secured thereto and the outer

end bears against a turned-up end of a lever 64 pivoted to the plate 61 at 65. The lower end of the lever 64 is adapted to be engaged by a cam 66 actuated by the outside door handle, the inner end of the shank of which is shown at 67. The cam 66 also engages a projection 68 on the bar 60 so that when the shank 67 is turned by the outside handle, the cam 67 forces the lever 64 clockwise and retracts the bar 60. A slide 69 is adapted to be actuated by a linkage 70 extending to the inner door-opening handle 71.

The locking mechanism comprises a slide plate 72 having a pin 73 adapted to traverse a slot 74 in the plate 61. The slide 72 may be secured to the plate 61 by screws extending through slots 74'. One edge of the slide is notched at 75 to receive spring-pressed detent 76 (Figure 1) for yieldingly maintaining the slide in raised or lowered position. A yoke 77 is formed at the lower end of the slide 72. Electromagnets 78 and 79 are mounted on a supporting plate 80 for successively operating a plunger 81 having a crosshead 82 extending through the yoke 77. Clearance is provided between the yoke and the crosshead so that engagement therebetween does not occur until the plunger 81 has been accelerated. This provides for a hammer blow on the slide 72 to positively actuate it. The magnet 78 raises the plunger 81 and the slide 72. When the slide is raised, the pin 73 prevents rotation of the lever 64 so that the latch bar cannot be withdrawn by turning the outside handle. The door can be opened, however, by the operation of the inside handle 71. When the slide is lowered, the pin 73 thereon is retracted and free rotation of the lever 64 by the cam 66 is permitted so that the bar 60 can be withdrawn by turning the outside handle. The detent 76 holds the slide 72 in either of its positions until energization of the appropriate actuating magnet.

Figure 8 illustrates a modified form of lazy-tongs 83. Instead of the links 22 shown in Figure 1, the tongs 83 have angularly disposed ends 84 for receiving the main springs. Auxiliary links 85 exert a camming action on the ends of members 86 which are appropriately rounded. Springs 87 force the links 85 against the cam surfaces and thus provide the initial effort for starting the lazy-tongs upwardly. The arrangement of springs and tongs shown in Figure 8 provides for a substantially uniform upward force throughout the travel of the tongs.

Figure 9 illustrates a modified form of window lowering and locking mechanism. Instead of the ratchet wheel 32 of Figure 1, Figure 9 shows a square toothed ratchet wheel 88 associated with a gear 89 similar to the gear 34. A locking spring finger 90 has a pin 91 adapted to project between the teeth of the wheel 88 and is moved out of locking relation by a plunger 92 identical with that shown in Figure 2. The finger 91, together with the pawl 93 similar to that shown at 31, cooperate to lock the window in any adjusted position.

With the locking mechanism of Figure 1, it is possible if the windows have been lowered slightly, to lower them the rest of the way against the spring pressure, by pressing downwardly thereon. This is an advantage in some cases, for example, in case of an accident where the door could not be opened and a hasty exit is imperative. The mechanism of Figure 9, however, prevents operation of the window at any point in its travel except through the manual crank.

Having described the apparatus which I employ, it now remains to explain the circuits by which the various automatic elements are controlled. Referring to Figure 10, I have illustrated window-releasing magnets corresponding to the magnet 33 of Figure 1 at 101, 102, 103, 104, 105 and 106. Associated with each magnet is an individual control switch 107 of the push button type. A master switch 108, which may be mounted on the dash-board, causes all the window closing magnets to be connected in parallel to a source of current such as a starting and lighting battery 109. The windows may thus be operated individually or simultaneously to the closed position. A contact 110, adapted to be engaged by a moving contact 111 actuated by the movement of the key locking mechanism 112, completes a circuit in parallel with that of the switch 108, so that if the windows have not been closed either by the individual push buttons 107 or the master button 108, they will be closed automatically when the key is put in the lock and turned. I also utilize the latter movement to control the door locking devices illustrated at 113, 114, 115 and 116. Each of these devices is similar to that shown on the door in Figure 1, except that auxiliary contact mechanisms are shown schematically in Figure 10 but are not illustrated in Figure 1 since they are of standard design. The arrangement of the circuits for the locking devices is such that turning the key in the lock 112 completes a circuit through a contact 117 for energizing the upper, raising, or locking magnet of the mechanism 113. When the contact 111 engages the contact 117, it also engages a pivoted stop 118 which prevents further turning of the key for the time being.

The circuit for the raising magnet of the locking device 113 includes a contact 119 which is closed when the locking device is in the unlocked position. Upon the completion of the circuit for the locking magnet of the mechanism 113, the plunger 81 strikes a hammer blow on the slide 72 to lock the bar against retraction. The movement of the plunger also opens the contact 119 to deenergize the locking magnet and closes a contact 120 which prepares a circuit for the unlocking magnet. The locking of the device 113 also closes a contact 121 which completes a circuit for the locking magnet of the device 114. The latter operates in the same manner as the device 113 and the same sequence is completed for the devices 115 and 116.

When the last locking device, 116, is actuated, a contact 122 is closed to energize the magnet 123 for retracting the stop 118 from the path of the contact 111 on the locking mechanism 112. It will be apparent that automatic operation of the locks on all four doors is thus effected and the removal of the key from the mechanical lock usually provided on the right-hand front door is prevented until the locking mechanisms of all the doors have properly operated.

When it is desired to open the car, the key is inserted in the lock 112 and turned in the unlocking direction until the contact 111 engages a contact 124. In its reverse movement, the contact 111 will engage contacts 117 and 110. Engagement with contact 117 has no effect since the circuit extending from said contact is open at contact 119. Engagement of the contact 110 by the moving contact 111 merely reenergizes instantaneously the window releasing magnets, but since the windows are already closed, nothing else happens. The engagement of the contact 111 with the contact 124 energizes all the unlocking

magnets of the units 113 through 116, in parallel. Sequential operation of the unlocking magnets may be obtained if desired, by means similar to that shown for the locking operation. The locking mechanisms are therefore actuated to the unlocked position and the circuits thereof are opened at contacts 120. The whole system is then ready for a repetition of the above cycle. A switch 125 is connected in parallel with the contact 124 and a similar switch 126 may be provided in parallel with the contact 117 for locking and unlocking the doors from within the car should such operation be desirable.

Figure 11 illustrates a slight modification of the circuit of Figure 10 for the window closing magnets. In Figure 11, these magnets are designated at 127, 128, 129, 130, 131 and 132. The circuit of Figure 11 is arranged so that the window closing magnets are energized in sequence similar to the manner in which the locking devices operate in Figure 10. A push button switch 133 or, alternatively, a contact 134 actuated by the lock indicated at 135, completes a circuit for the first window closing magnet 127. A contact 136 closed by the energization of the magnet extends the circuit to the next magnet 128, and so on. If desired, interlocking contacts 137 closed by the completion of the closing movement of each window (see Figures 1 and 9) may be connected in the circuit for the next magnet to prevent continuation of the sequence if anything should prevent the closing of the first or any succeeding window. These contacts, however, are not essential and may be omitted, or they may be used alone instead of in combination with the contacts 136. Upon the operation of the last window closing magnet 132, a contact 138 closed thereby initiates the sequential operation of the locking mechanisms, as described in Figure 10.

The electrical locking means on the right front door may be omitted and the usual mechanical lock relied on exclusively. In such case, the electromagnetic lock 115 may be used to control the magnet 123.

A somewhat simpler form of window closing mechanism is shown in Figures 12 through 16. According to the modified form of the invention, a motor car door 140 is provided with a vertical rack bar 141. A window 142 is slidable in the door. A yoke 143 secured to the window carries a pinion 144 meshing with the rack 141. The yoke is dovetailed to the rack as shown in Figure 16. The pinion 144 is mounted on a shaft 145 journaled in brackets 146 carried on the window. Right and left hand springs 147 and 148 are connected at their inner ends to the shaft 145. The outer ends of the springs are secured to the sleeves 149 which are adjustable on the brackets 146 and locked thereto when adjusted.

Plates 150 mounted within the door provide bearings for a bell crank 151 having a gear segment 152. The bell crank 151 turns on a shaft 153. A shaft 154 carries a pinion 155 meshing with the gear segment 152 and a gear 156. A shaft 157 has a pinion 158 meshing with the gear 156. A spring-pressed pawl 159 having a retracting magnet 160 engages the gear 156 to lock the window in adjusted position. The shaft 157 extends through a brake drum 161 secured to the inner plate 150. A bushing 162 is rigidly mounted on the shaft 157 and has clutch teeth 163 formed thereon. An axial boss 164 on the drum 161 provides a seat for a cam sleeve 165 rotatable by a crank 166. A sliding clutch sleeve 167 mounted on the shaft 157 has a pin 168 cooperating with cam surfaces 169 on the sleeve 165 so that when the crank 166 is turned in a clockwise direction, the effect of the cam surfaces and the pin is to force the sleeve 167 in contact with the bushing 162 so that the clutch teeth thereof engage and form a positive drive for the shaft 157 and the pinion 158.

The bushing 162 is provided with arms 170. Brake shoes 171 are pivoted to the arms 170 and are adapted to engage the interior of the drum 161 when thrown outwardly by centrifugal force on rotation of the bushing. The shoes are normally forced against the drum by the springs 171. The bushing also has fingers 172 for retracting the brake shoes from engagement with the drum when the bushing 162 is rotated in a clockwise direction by the crank 166.

The method of operation is similar to that of the modification previously described. The window may be lowered by operating the crank 166. The clutch sleeve 167 engages the toothed end of the bushing 162 to drive the pinion 158 and through the gear train, the bell crank 151 to lower the window. When the window has been lowered to the desired point, the pawl 159 locks it at that position and release of the handle 167 disengages the latter from the bushing 162. While the window is being lowered, the fingers 172 render the brake shoes ineffective to resist turning of the bushing 162. As the window is lowered, of course, the pinion 144 turns the shaft 145 and winds up the springs 147 and 148. When it is desired to raise the window, the magnet 160 may be energized, for example, by one of the circuits shown in Figures 10 and 11. When the pawl is withdrawn, the springs 147 and 148 turn the pinion 144 so as to force the window to its closed position.

A spring locking lever 173 has a function similar to that of the lever 47 of Figure 1 and, in addition, serves to shift the clutch sleeve 167 away from the bushing 162 when the crank 166 is released.

As the window is being raised by the springs, the rotation of the bushing 162 causes the shoes 171 to be thrown outwardly into engagement with the interior of the drum 161 by centrifugal force. The brake shoes act as a governor to prevent the movement of the window from exceeding a limiting speed determined by the design of the brake. The window thus moves upwardly at a uniform rate which may be adjusted by changing the initial spring tension or by an adjustment of the brake.

Figure 15 shows a modified form of locking mechanism for holding the window in adjusted lowered position. This mechanism is similar to that shown in Figure 12 except that instead of having the pawl 159 engage the gear 156, a ratchet wheel 174 is mounted on the bushing 162 and a pawl 175 is pivoted within the door for engaging the ratchet wheel. The pawl 175 has an extension 176 which may be operated by a push button 177 mounted in the door and having a cam face for engagement therewith.

It will be apparent from the foregoing description that the invention provides means for facilitating the operation of the windows and door locks in motor cars. The apparatus is characterized by positive operation, comparatively low cost, and extreme flexibility. No extensive changes in present construction or designs are necessitated and the invention may be incorporated in present day models of motor cars without unduly increasing the cost thereof. The inven-

tion does not affect the normal operation of present types of window operating and door locking mechanisms. The windows may be closed by hand as at present instead of automatically should the automatic system fail for any reason. Manually operated mechanical door locks may also be supplied in addition to the automatic locks. The added convenience afforded motor car owners by my invention needs no discussion.

Although I have illustrated and described herein but a single present preferred embodiment of the invention, together with modifications of parts thereof, the invention may be embodied otherwise than as herein disclosed, since numerous changes may be made in the embodiment described without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. In a window operating mechanism, a bell crank for raising and lowering the window, spring actuated lazy-tongs compressed by lowering of the window for automatically raising it, a gear and pinion for operating said bell crank, said gear having a releasable connection with the crank, and means for freeing the bell crank from the gear whereby the lazy-tongs raises the window.

2. In a window operating mechanism, means for lowering the window, and means energized thereby for closing the window, means yieldingly opposing the closing force exerted on the window by said second mentioned means, and means for rendering said opposing means ineffective as the window approaches its fully closed position.

3. In a window operating mechanism, a bell crank for raising and lowering the window, spring actuated means made effective by lowering of the window for closing it, a ratchet and pawl for driving said bell crank in one direction only, manual means for driving the ratchet, and a magnet for retracting said pawl to release the bell crank from the ratchet whereby said spring actuated means is released to close the window.

4. A control system for the doors and windows of a motor car including closing means for each of said windows and locking means for each of said doors, means for successively actuating the window closing means, and means responsive to the closing of the windows for successively locking each of the doors.

5. A control system for the doors and windows of a motor car having a key lock in one door, means responsive to the initial turning of a key in said lock for closing said windows and locking said doors, means for preventing complete rotation of said key until all said locking means have been actuated, and means responsive to actuation of all said locking means for rendering ineffective the means for preventing complete rotation of said key.

6. In a window closing mechanism, energy-storing means actuated by opening of the window for subsequently closing it, a governor effective continuously to maintain the closing speed of the window substantially constant, and means for opening the window, said means being effective positively to render said governor ineffective.

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