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MECHANISM FOR LOCKING DOORS OR LIKE MOVABLE PANELS

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FIG. 1

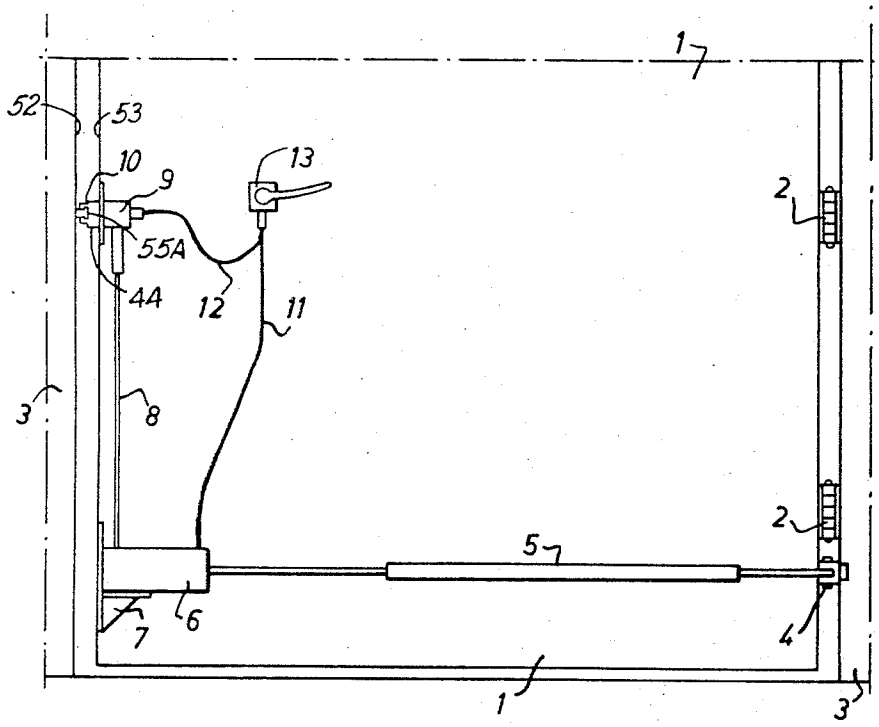
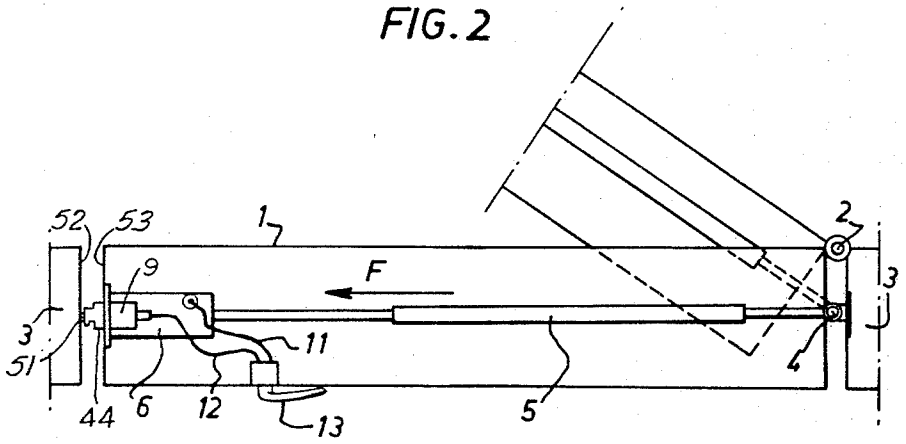


FIG. 2



INVENTOR
LOUIS LÉON JOSEPH MASSAL

BY
Woodhams Blanchard & Flynn
ATTORNEYS

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FIG. 3

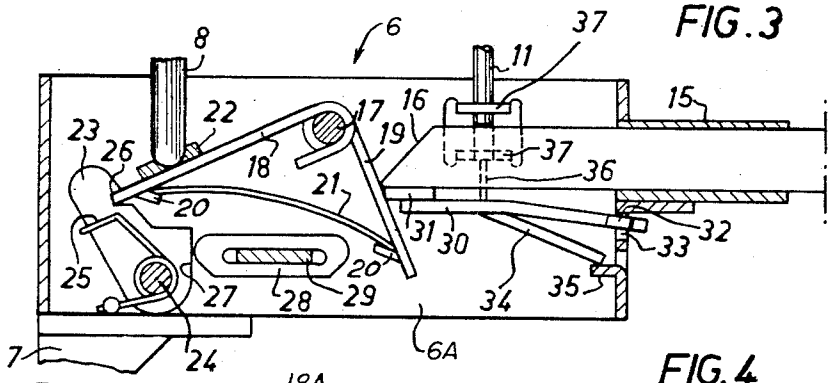


FIG. 4

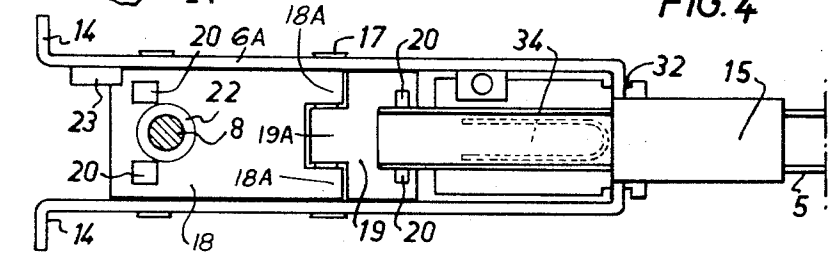


FIG. 5

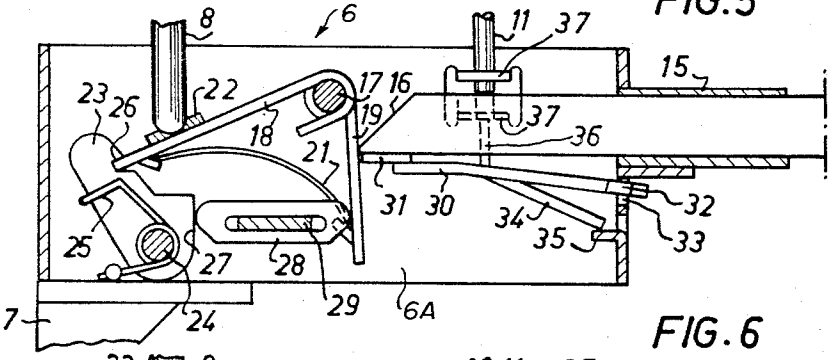
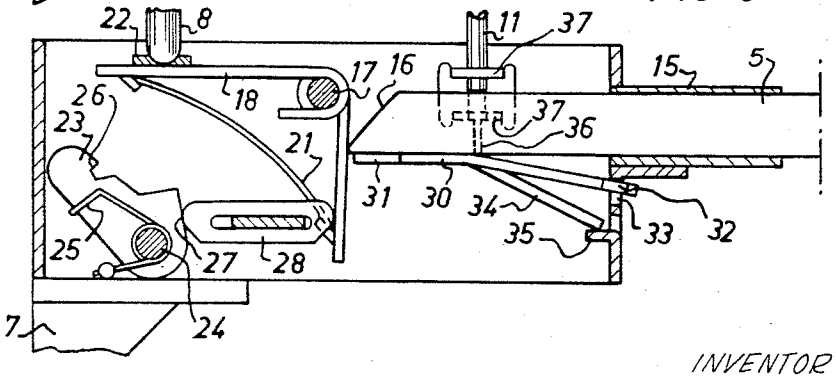


FIG. 6



INVENTOR
LOUIS LÉON JOSEPH MASSAL

BY
Woodhams, Blanchard and Flynn
ATTORNEYS

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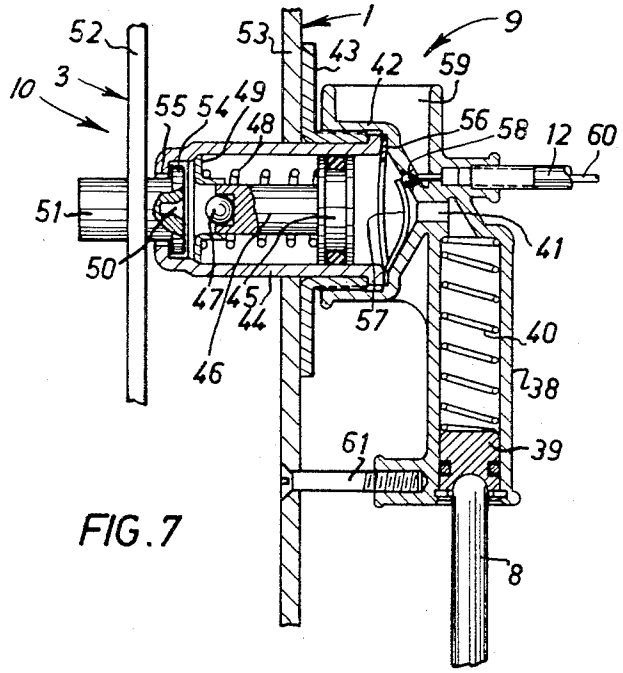


FIG. 7

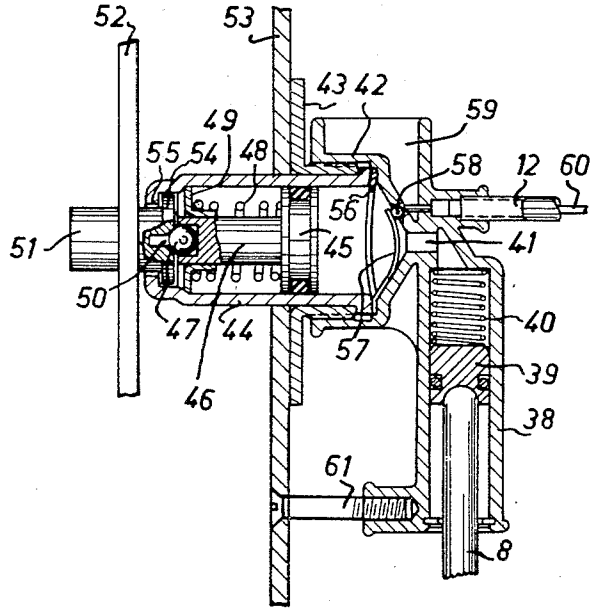


FIG. 8

INVENTOR
LOUIS LÉON JOSEPH MASSAL

BY
Woodhams, Blanchard & Flynn
ATTORNEYS

Oct. 10, 1967 L. L. J. MASSAL 3,346,291

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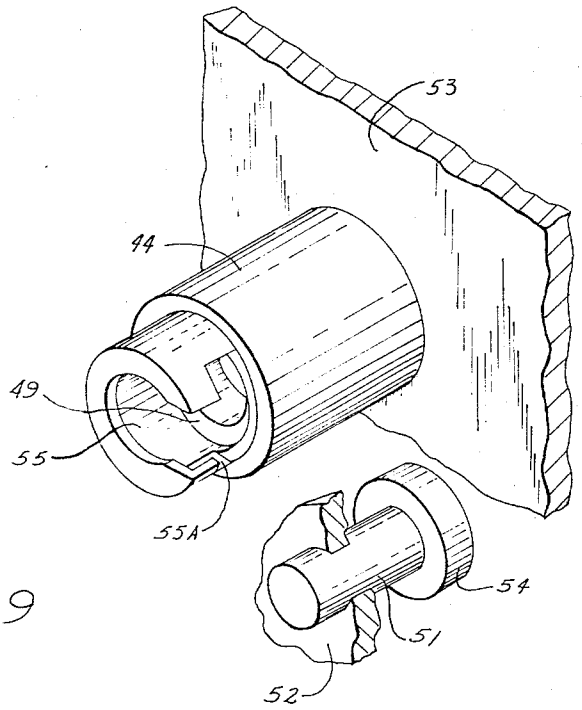


Fig. 9

INVENTOR.
LOUIS LEON JOSEPH MASSAL
BY
Woodhams, Blanchard & Flynn
ATTORNEYS

United States Patent Office

3,346,291
Patented Oct. 10, 1967

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MECHANISM FOR LOCKING DOORS OR LIKE MOVABLE PANELS

Louis Léon Joseph Massal, Nice, France, assignor to Societe d'Etudes et de Recherches Techniques (S.E.R.T.), Levallois-Perret, France, a French company

Filed Sept. 21, 1964, Ser. No. 397,854
Claims priority, application France, Sept. 25, 1963, 948,700, Patent 1,383,827
12 Claims. (Cl. 292—144)

The present invention relates to a mechanism for locking doors or like movable panels which will be referred to as "doors" in the following specification.

It is known that doors, and especially vehicle doors, do not contribute to the strength and rigidity of the vehicle body and, on the contrary, constitute weak points which have to be reinforced.

Furthermore, such doors have to be slammed in order to close them and are sometimes subjected to vibrations while in service.

The main object of this invention is to overcome the above disadvantages by making use of the substantial mechanical advantage of the door itself when this latter moves towards its closed position so as to produce without either effort or shock, and therefore noiselessly, a powerful locking action which prevents any vibration and enables the door to contribute to the strength and rigidity of the vehicle body.

To this end, a mechanism in accordance with the invention is characterized in that it comprises an energy accumulator, means for loading said accumulator under the action of at least the last portion of travel of the door towards the locking position thereof, means for relieving the load on the accumulator in a position of the door which is at least very close to its locking position, a locking bolt, and a transmission unit for setting said locking bolt in the operative position when the load on the accumulator is relieved.

As an advantageous feature, the means for loading the accumulator consists of an arm pivotally mounted on a pin which is parallel to the axis of the door and displaced transversely.

Preferably, the energy accumulator consists of a blade-spring which is interposed between two coaxial levers, namely a loading lever which is placed under the influence of the loading means and a releasing lever which produces action on the transmission unit.

The means releasing the accumulator can be provided simply by employing a pawl which is engaged with the releasing lever and which is thrust back in opposition to a spring by the loading means when said loading means is located in the vicinity of its loading position, which corresponds to a position of the door which is at least very near the closed position thereof. The loading means can also produce action on the pawl through the intermediary of a slide which is influenced by the loading lever.

It will be apparent that there has thus been provided a device which is so designed that, when the door closes, the energy accumulator is accordingly loaded as a result of the substantial mechanical advantage of the door itself, and therefore without effort.

The energy which is thus stored is then transmitted to the locking bolt which therefore produces a positive locking action.

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The closing of the door is thus carried out without either shock, noise or effort. In addition, the door forms with the vehicle body a perfectly uniform mechanical assembly and therefore takes part in the strength and rigidity of said body.

In one particularly advantageous form of embodiment of the invention, the transmission unit comprises a motion-reduction system and preferably consists of a rod which is influenced by the energy accumulator and two cylinder-piston assemblies with restoring spring which communicate with each other and which are filled with a hydraulic fluid, the piston of the first assembly being actuated by the rod and the piston of the second assembly having a larger diameter and being integral with the locking-bolt.

It will be understood that, by virtue of this arrangement, the force with which the locking-bolt, the travel of which is small, is applied against the vehicle body can be a multiple of the force which is transmitted by the energy accumulator.

According to a further improvement, provision is made for a manually-operated relief valve for the hydraulic fluid. This arrangement makes it possible to disengage the locking bolt without effort, whereupon the discharge fluid is again sucked-in automatically without any loss as a result of the return motion of the components to the open position of the door.

Although the mechanism according to the invention is completely safe and reliable, provision can be made in order to meet the requirements of certain users for a manually-operated non-return stop for the loading means.

Fully independent mechanical locking of the door in the closed position is thus achieved.

As an advantageous feature, the two manual controls are operated by means of a single handle which initiates at the same time the opening of the relief valve and the withdrawal of the non-return stop.

A clear understanding of the invention will in any case be gained from the following description, reference being made to the accompanying drawings which show by way of non-limitative example one form of embodiment of the invention, and in which:

FIGS.1 and 2 are diagrammatic vertical and horizontal cross-sections respectively of a door which is fitted with a mechanism in accordance with the invention.

FIGS. 3 and 4 vertical and horizontal cross-sections respectively, takenon a larger scale, of the energy accumulator in the rest position.

FIGS. 5 and 6 show the energy accumulator in the loaded position then in the released position.

And finally, FIGS. 7 and 8 are vertical cross-sections of the locking-bolt and of the transmission system, respectively in the open position and in the closed position.

There can be seen in FIG. 1, a door **1** which is illustrated diagrammatically in the form of a hollow parallelipiped and which is pivoted by means of hinges **2** on a body or frame **3**.

An arm **5** which is strengthened at the center is pivotally mounted on the right-hand frame element **3** (FIGURES 1 and 2) by a pin **4**, said pin being offset transversely from the hinges **2**. The arm **5** extends into the energy accumulator **6** which is supported by a bracket **7** on the left-hand edge of the door (FIGURES 1 and 2).

A vertical rod **8** extends out of the accumulator **6** and

extends to the locking-bolt structure **9** which cooperates with a lock-catch **10** which is mounted on the body **3**.

Two cables **11** and **12** which are operated by means of a handle **13** extend respectively to the accumulator **6** and to the locking-bolt **9**.

FIG. 2 shows that the movement of the door from the open position (as shown partially in the drawing) to the closed position results in a translation movement of the arm **5** relatively to the accumulator **6** in the direction of the arrow F.

As shown in FIGS. 3 and 4, the accumulator **6** is constituted by a plate **6A** which is bent into a U shape (see FIGURE 4), said plate being provided with assembly flanges **14** and with an inlet orifice from which a tube **15** extends for the purpose of receiving the arm **5**, said arm being designed in the form of a channel-iron having an inclined end wall **16**.

A pin **17** extends between the legs of the plate **6A**. A strip **18** has two lateral tongues **18A** which are folded back around the pin **17** so that said strip **18** forms a releasing lever. A second strip **19** has a central tongue **19A** which is also folded back around the pin **17** so that said strip **19** forms a loading lever.

Four lanced-out portions **20** which are arranged in pairs, one pair in each of the levers **18** and **19**, serve to retain a blade-spring **21** which forms the energy accumulator proper and which is arched between the two levers so as to urge these latter away from each other.

A knuckle-joint socket **22** which is integral with the lever **18** is designed to accommodate the base of the rod **8** which serves to transmit motion to the locking-bolt **9**.

The lever **18** is retained by means of a pawl **23** which is pivotally mounted on a pin **24** and acted upon by a spring **25**, said pawl being provided with a nose **26** for engagement with the lever **18** and an edge **27** which is adapted to cooperate with a slide **28**. The said slide is carried by a flange **29** which is cut out from the wall **6A** and folded back.

The assembly is completed by a non-return stop **30** and this latter is adapted to cooperate with a strip **31** which is fixed on the arm **5**. Said non-return stop consists of a blade in which are formed two lateral recesses **32** so as to permit the pivotal mounting of said blade in a window **33** of the plate **6A** and a central cut-out portion forming a flexible tongue **34** which is bent downward so as to be brought to bear on a support **35** which is cut out in the plate **6A** and folded down.

The stop **30** which is thus elastically urged upwards can be withdrawn by means of the piano wire **36** which passes out of the cable sheath **11**, said sheath being fixed in two tongues **37** which are cut out in the plate **6A** and then folded back.

FIG. 4 shows the components in the open position of the door wherein the pawl **23** retains the lever **18** and therefore maintains the rod **8** in the bottom position thereof.

If the arm **5** moves in the direction of the arrow F (as shown in FIG. 2) the first position reached is that shown in FIG. 5 wherein the spring **21** is arched and the lever **19** accordingly comes into contact with the slide **28**.

If the movement is continued when the door is very near the closed position, the slide **28** also moves in the direction of the arrow F and produces action on the pawl **23** which accordingly releases the lever **18**. The said lever **18**, which is thrust back by the spring **21** suddenly displaces the rod **8** in an upward direction (FIGURE 6).

At the same time, the stop **30** has moved into the active position behind the strip **31** and the position then reached is that shown in FIG. 6 wherein the door is closed by the rod **8** as will be explained hereinafter and is also mechanically locked in position by the stop **30** which prevents the arm **5** from performing any movement in a direction opposite to that of the arrow F.

When the door is opened, the piano wire **36** withdraws the stop **30**. In addition, the rod **8** carries out a downward movement as will be apparent hereinafter, while the arm **5** moves in the direction opposite to that of the arrow F.

Finally, the components revert to the position which is shown in FIG. 3.

The description which now follows in reference to FIGS. 7 and 8 is concerned with the locking bolt structure **9** which first of all comprises a cylinder **38** containing a piston **39** which is urged downwardly by a light spring **40**, said piston being integral with the rod **8**.

A threaded socket **42** communicates with the cylinder **38** by means of an opening **41** and is adapted to threadedly cooperate with a locking plate **43** for the purpose of securing the cylinder **44** in position. Fitted within said cylinder is a piston **45** which is integral with the locking-bolt **46** in the extremity of which is inserted a ball **47**, said locking-bolt being urged rightwardly as appearing in FIGURES 7 and 8 by a spring **48** which bears against a stationary ring **49**.

The ball **47** is adapted to cooperate with a funnel-shaped recess **50** in the lock-catch **10**. The lock catch **10** is comprised of a post **51** set in that edge element **52** of the body or frame **3** which is located opposite the edge **53** of the door. The post **51** has an annular shoulder **54**. Said post and said shoulder are receivable through a generally T-shaped lateral opening **55A** into the stepped central opening **55** at one end of cylinder **44** (FIGURE 9) whereby the locking-bolt structure comes into engagement with the lock-catch.

Provision is made at the rear end of the cylinder **44** for a sealing washer **56** which is cut out in such a manner as to form within its opening a flexible strip **57** which is applied against a ball **58** forming a relief valve behind the piston **45** and urges said ball towards a chamber **59** which is open to the ambient air. The ball is controlled by the piano wire **60** of the cable sheath **12**. The assembly is completed by a tie-rod **61** for the purpose of preventing any overhang.

When the accumulator moves from the position according to FIG. 5 to the position according to FIG. 6, the rod **8** causes the piston **39** to carry out the movement which brings this latter from the position shown in FIG. 7 to the position shown in FIG. 8.

The hydraulic fluid which is thus forced from cylinder **38** displaces the piston **45** so as to force the ball **47** into the funnel-shaped recess **50**. As can be visualized, a substantial reduction or mechanical advantage has been obtained by virtue of the cross-sectional area of the piston **45** which is considerably larger than the cross-sectional area of the piston **39**. The result thereby achieved is a veritable clamping action which causes the door to contribute to the structural rigidity of the body. In order to open the door, it is merely necessary to operate the handle **13** so as to open the relief valve provided by ball **58**, thereby causing the ball **47** to withdraw to a sufficient extent to enable the user to operate the door by hand; the rod **8** then falls freely under the action of the springs **40** and **48**; the cylinder **38** is again filled, first of all sucking-in the fluid which had escaped into the chamber **59** and the components are finally located in the position shown in FIG. 7.

It is clear from the foregoing that, in the final analysis, the door-closing operation has resulted automatically, without either shock, noise or effort, in the locking of the door by means of the ball **47** and in addition by means of the stop **30**.

Conversely, in order to open the door, it was merely necessary to manipulate the handle **13** in order to release both locking devices, whereupon the operation of the door takes place naturally and returns all the components to their rest position.

It will also be understood that the form of embodiment of the invention which has just been described has been given solely by way of non-limitative example and

that a large number of modifications can be made in the foregoing without thereby departing either from the scope or the spirit of this invention.

In particular, the motion transmission between the accumulator and the locking-bolt could be carried out solely by hydraulic means or solely by mechanical means. Similarly, various accessories could be incorporated with the handle and with the cable element which have been illustrated in the drawings for the purpose, for example, of performing the operation either from the interior or from the exterior or with a view to providing a locking system of the so-called "child-safety" type.

What I claim is:

1. A door structure comprising:

frame means defining an opening;

a lock catch mounted on said frame means on one side of said opening;

a door and means mounting said door for movement with respect to said frame means between an open and a closed position;

latch operating structure mounted on said door, said latch operating structure comprising a movable locking bolt, a leaf spring for storing energy, two coaxial levers engaging said leaf spring and mounted for relative pivotal movement, means coupled to one of said levers for moving said one lever and thereby deforming said spring to store energy therein during at least the last portion of the travel of said door toward said closed position, holding means for releasably holding the other lever against the urging of said spring, and releasing means for releasing said holding means when said door is at least very close to said closed position whereby said spring can effect movement of said other lever, and connecting means connecting said locking bolt to said other lever so that said locking bolt is urged into its locking position with said lock catch in response to movement of said other lever.

2. A door structure according to claim **1**, in which said holding means comprises a pawl, and spring means coupled to said pawl for urging same towards a position in which it releasably engages said other lever and holds same against pivotal movement.

3. A door structure according to claim **2**, in which said releasing means comprises a slideable member engageable with said pawl for moving same against the urging of said spring means out of engagement with said other lever and means operable when said door is at least very close to said closed position to move said slideable member.

4. A door structure according to claim **1**, in which said connecting means comprises force multiplying means.

5. A door structure according to claim **1**, in which said connecting means comprises a movable rod coupled to said other lever, two piston and cylinder assemblies which are in communication with each other so that pressure fluid displaced from one cylinder flows into the other cylinder, said rod being coupled to one of said pistons, the other piston being of larger diameter than said one piston and being coupled to said locking bolt, and return springs urging said pistons in directions in which said locking bolt is out of locking engagement with said lock catch.

6. A door structure according to claim **5**, including a manually operable pressure relief valve for relieving pressure on said pressure fluid.

7. A door structure according to claim **6**, including a manually operable stop for preventing movement of said one lever in a direction for releasing the energy stored in said leaf spring, and a single handle connected for simultaneously operating said valve and said stop.

8. A door structure according to claim **5**, in which said lock catch comprises an elongated post having an enlarged head adjacent its free end and having a recess in its end wall, said latch operating structure comprising a tubular housing surrounding said locking bolt, said housing having a transverse internal wall portion and having a lateral opening through the side thereof through which said head and post can be received so that said lock catch can be disposed within said housing with said end wall being opposed to said locking bolt and said head abutting against said transverse wall portion, said locking bolt having a ball on the end thereof, said ball being receivable in said recess, said locking bolt being movable toward and away from said end wall of said lock catch.

9. A door structure according to claim **1**, including a manually operable stop for preventing movement of said one lever in a direction for releasing the energy stored in said leaf spring.

10. A door structure comprising:

a frame means defining an opening;

a lock catch mounted on said frame on one side of said opening;

a door and means mounting said door for movement with respect to said frame means between an open and a closed position;

latch operating structure mounted on said door, said latch operating structure comprising a movable locking bolt, energy storage means, means for actuating said energy storage means to store energy therein in response to at least the last portion of travel of said door toward said closed position, means for releasing the energy stored in said energy storage means when said door is at least very close to its closed position, means for transmitting the energy released from said energy storage means to move said locking bolt into locking engagement with said lock catch, said last-named means comprising a movable rod, a pair of piston and cylinder assemblies arranged in series and which are in communication with each other so that pressure fluid displaced from one cylinder flows into the other cylinder, said rod being coupled to one piston so that movement of said rod causes movement of said one piston to displace pressure fluid into the other cylinder, the other piston being of larger diameter than said one piston and being coupled to said locking bolt, and return springs urging said pistons in directions in which said locking bolt is out of locking engagement with said lock catch.

11. A door structure according to claim **10**, including a manually operable pressure relief valve for relieving pressure on said pressure fluid.

12. A door structure comprising:

frame means defining an opening;

a lock catch mounted on said frame on one side of said opening;

a door and means mounting said door for movement with respect to said frame means between an open and a closed position;

latch operating structure mounted on said door, said latch operating structure comprising a movable locking bolt, energy storage means, actuating means movable from a first position into a second position for actuating said storage means to store energy therein in response to at least the last portion of travel of said door toward said closed position, holding means for releasably locking said actuating means in said second position, means for releasing the energy stored in said energy storage means when said door is at least very close to its closed position, means for transmitting the energy released from said storage means to move said locking bolt into locking engagement with said lock catch, said last-named means comprising a pressure fluid operated means, relief valve means for releasing the pressure on the fluid in said pressure fluid operated means, means for moving said locking bolt out of locking engagement with said lock catch, and means for operating said relief valve means and said holding means to return said actuating means to its first position and to re-

lease the pressure on said fluid to permit said locking bolt to be moved out of locking engagement with said lock catch.

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MARVIN A. CHAMPION, *Primary Examiner.*

EDWARD C. ALLEN, *Examiner.*

J. R. MOSES, *Assistant Examiner.*