

Sept. 21, 1965

R. D. HOUK ETAL

3,207,208

DOOR OPERATOR

Filed June 12, 1963

4 Sheets-Sheet 1

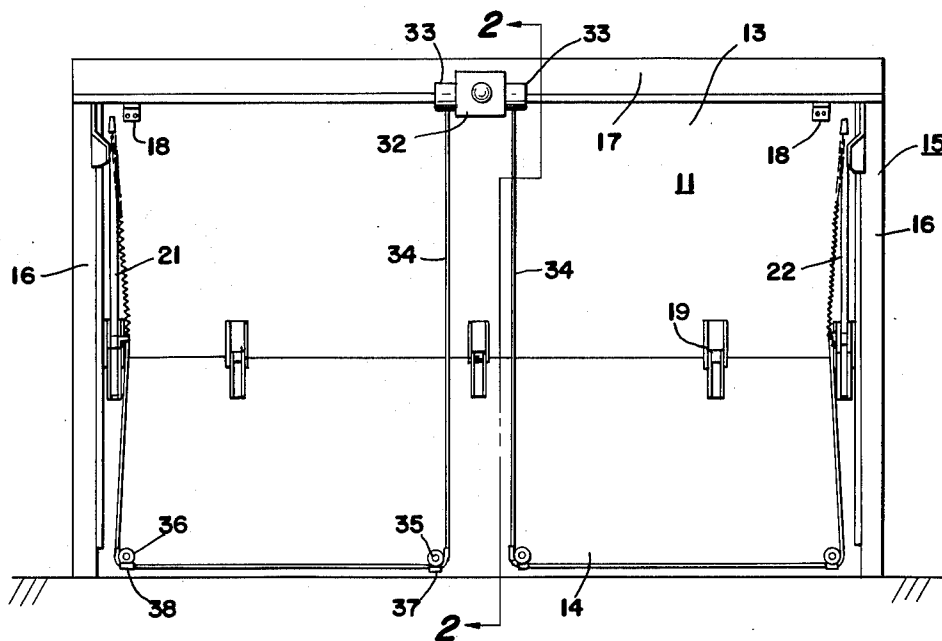
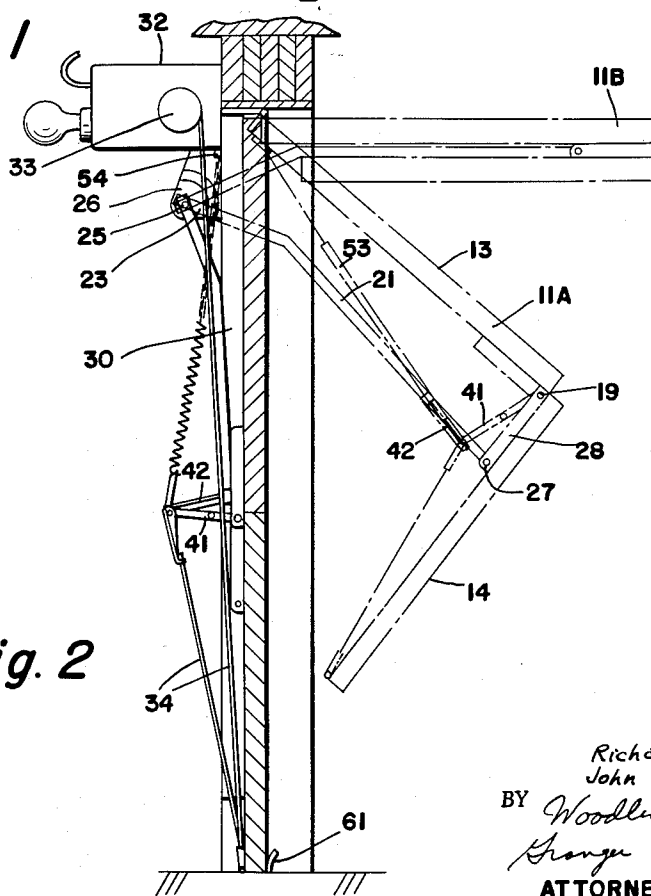


Fig. 1

Fig. 2



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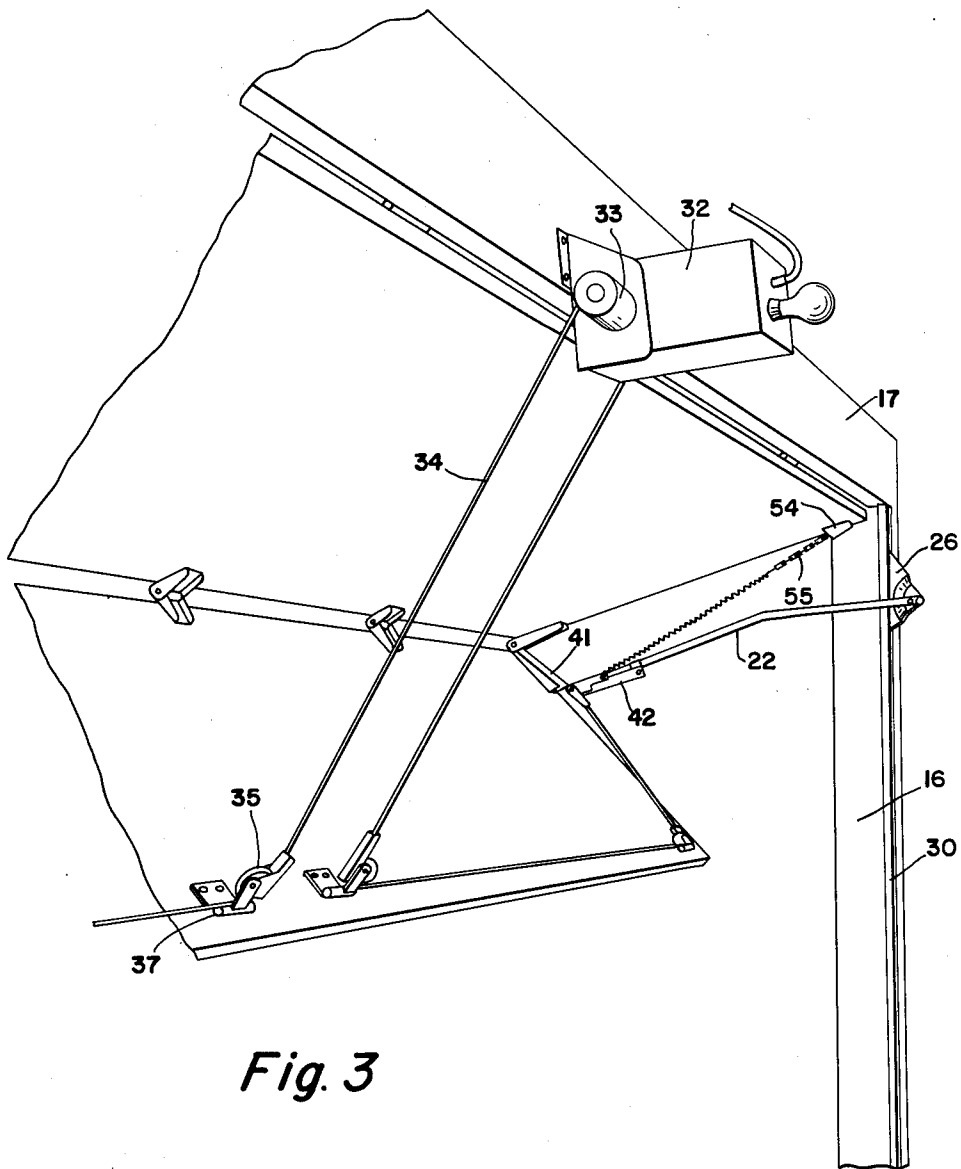
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4 Sheets-Sheet 2



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DOOR OPERATOR

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4 Sheets-Sheet 3

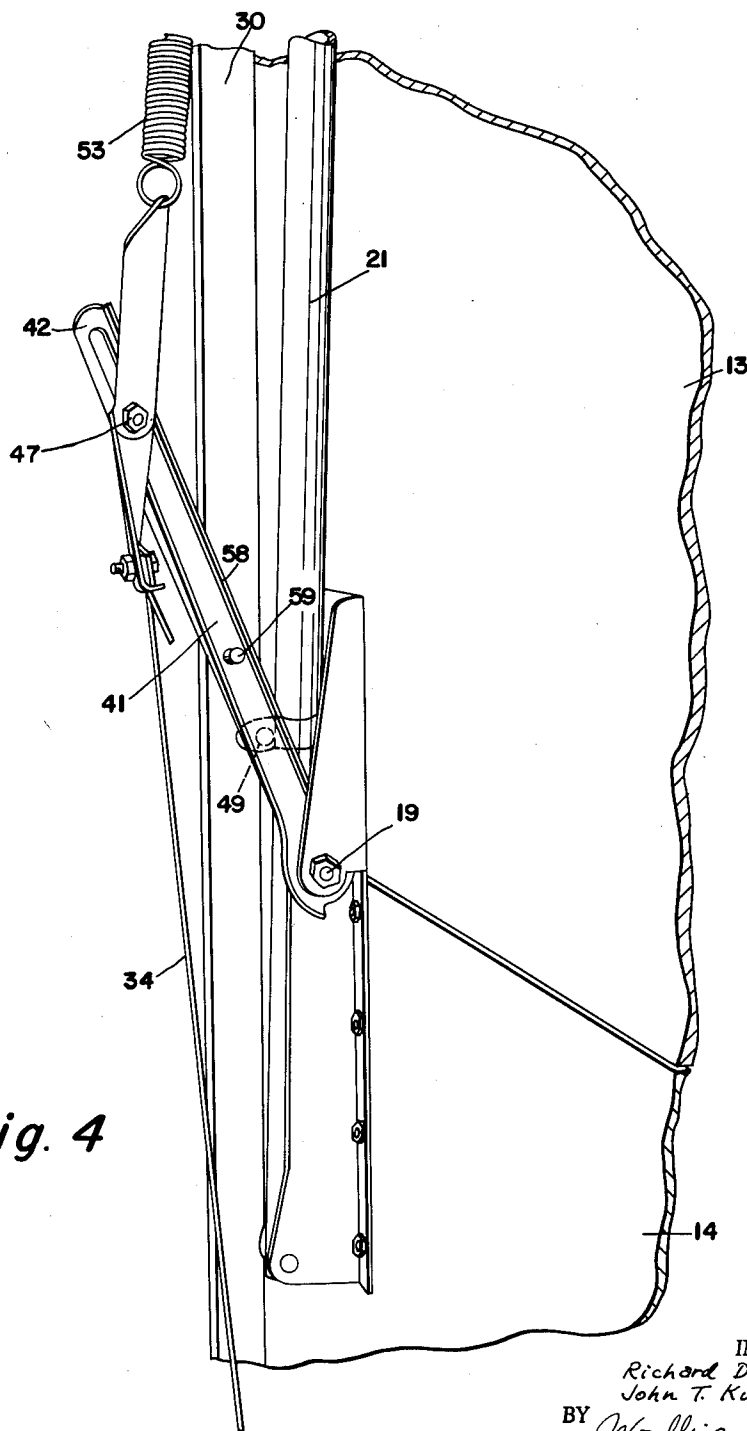


Fig. 4

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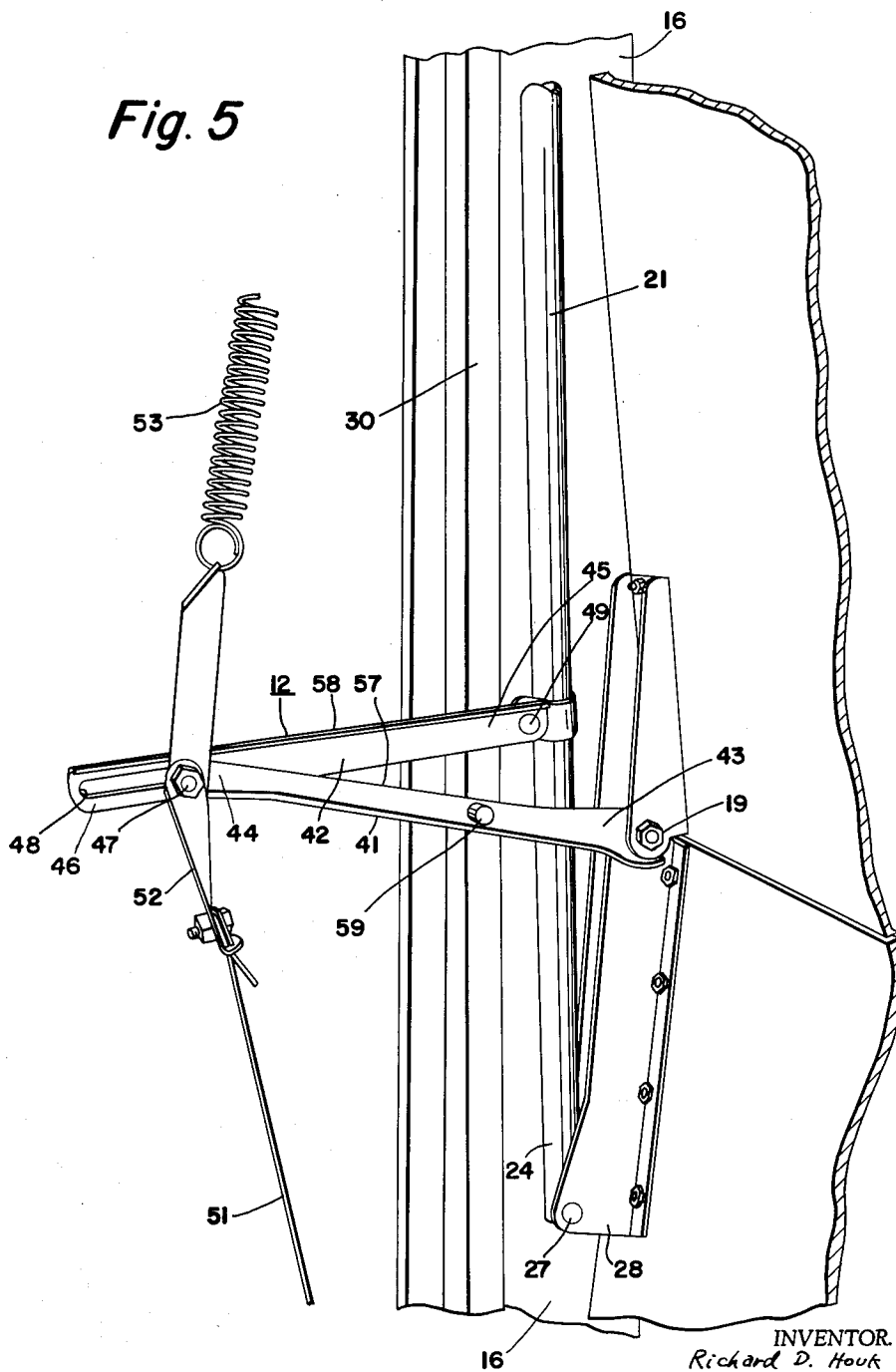
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4 Sheets-Sheet 4

Fig. 5



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3,207,208

DOOR OPERATOR

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Filed June 12, 1963, Ser. No. 287,418

21 Claims. (Cl. 160—189)

This application is an improvement on the copending applications of Richard D. Houk, Serial Number 190,858, entitled Door; Serial Number 190,869, entitled Garage Door And Operator; and Serial Number 190,877, entitled Door And Control System Therefor, all filed April 30, 1962.

The invention relates in general to a door operator lever system which may be used with doors and, more particularly, to a lever locking and opening system used with a door having at least two relatively foldable panels.

The invention may be used with a bifold canopy door which has upper and lower panels hinged together and hinged to a door frame so that the upper panel swings upwardly and outwardly to form a canopy and, at the same time, a lower panel swings and folds upwardly against the inside of the upper panel. When the door is closed, it hangs in a generally vertical position and the two door panels effectively form a straightened toggle arrangement. The center hinge means which joins the two panels then must move outwardly and upwardly to open the door and its first movement breaks the effective toggle established by these upper and lower panels. Where such doors are used, as garage doors for example, a considerable wind force may be exerted against the door and, accordingly, difficulty has been experienced in starting the door in its opening movement. This is especially true where a motor driven operator has been provided to exert a lifting force on the door which lifts on the lower panel. With this lift being generally vertically, the lifting force is generally along the line of the upper and center hinges and the bottom edge of the door so that not much outward force is available to overcome any wind force which may be blowing against the door.

Also, where such bifold canopy doors are used as garage doors, it is highly desirable to establish some form of locking mechanism to lock the door in its closed position to prevent unauthorized entrance to the garage. Still further, such bifold canopy doors may be used with two car garages and in such cases the door is quite wide, presenting an even larger surface for wind to act against and also providing a large heavy expanse of door to be opened, and to be locked when closed.

Accordingly, an object of the present invention is to provide an improved door operating mechanism which obviates the above mentioned disadvantages.

Another object of the invention is to provide a lever system which is used both for locking the door and for unlocking the door and concurrently breaking the effective toggle of the door to start it in its opening movement.

Another object of the invention is to provide a door operating mechanism especially for use with two car garage doors which are wide in relation to their height wherein a center mounting of a motor operator permits lifting of the door from the center to avoid use of any truss rods on the door.

Another object of the invention is to provide a lever system for a bifold door which lever system is controlled directly by a motor driven cable which lifts the door.

Another object of the invention is to provide a bifold door with a toggle locking system acting on the center of the door near the central hinge.

Another object of the invention is to provide a bifold

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door with a leverage system to lever the door open against any wind or other force on the door.

Another object of the invention is to provide a bifold door with a leverage system which is urged by a spring toward locking position and may be pulled by a door lifting cable toward an unlocked position which also forces the door partly open.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is an interior elevational view of a closed bifold door incorporating the invention;

FIGURE 2 is a sectional view on line 2—2 of FIGURE 1, but with the lever system starting to open the door;

FIGURE 3 is a perspective view of the interior of the door partly opened;

FIGURE 4 is an enlarged perspective view of the lever system of the invention in locked position; and,

FIGURE 5 is an enlarged partial view of the lever system partly unlocking the door.

FIGURES 1, 2 and 3 generally show the construction of a door 11 on which the lever locking system 12 may be incorporated. The door 11 is a bifold door comprising two panels shown as an upper panel 13 and a lower panel 14. The door may be mounted on a door frame 15 having frame side members 16 and a header 17. First hinge means 18 hinges the upper edge of the upper panel 13 to the header 17 and second hinge means 19 hinges the upper edge of the lower panel 14 to the lower edge of the upper panel 13. Control arm means are provided to control the opening and closing movement of the door panels 13 and 14. In this case, first and second control arms 21 and 22 are provided, one on each side of the door near the side frame members 16. The mechanism on each side of the door near the respective frame side members may be identical and, accordingly, the mechanism on only one side of the door will be described. The control arm 21 has first and second ends 23 and 24, respectively, with the first end 23 pivoted at a third hinge means 25 to a bracket 26 fixed to the frame side member 16. The second end 24 of the control arm 21 is pivoted at fourth hinge means 27 to a lower extension 28 of one of the second hinge means 19. The third hinge means 25 is positioned a first distance vertically below the first hinge means 18 and is also positioned slightly inwardly of a vertical plane passing through this first hinge means 18. The fourth hinge means 27 is spaced from the second hinge means 19 a second distance substantially equal to said first distance. This establishes a form of parallelogram or quadrilateral movement for the door 11 during its opening and closing movements. This is illustrated by the partially open position 11A shown in phantom in FIGURE 2 and by the fully open position 11B, also shown in phantom in FIGURE 2. Thus, these control arms 21 and 22 are means to provide a predetermined path of movement during opening and closing of the door 11 without necessity for any upright track along the frame side members 16 to guide the lower edge of the lower panel 14. The control arms 21 and 22 thus assure that the lower panel folds inwardly and upwardly substantially against the inside of the upper panel 13 as the upper panel swings outwardly to a substantially horizontal door open position.

The above-described bifold door is one form of door having at least two relatively foldable panels with one panel hinged to a door frame, on which the lever locking system 12 of the present invention may be incorporated. The door panels 13 and 14 hang substantially vertically against a door stop 30 when the door is closed to close the opening of the door frame 15.

A motorized operator 32 may be mounted on the inside of the frame header 17 and may include an electric motor and speed reducing power train to cable drums 33. A cable 34 extends downwardly from each cable drum 33 and is connected to exert a lifting force on the door 11. Each cable 34 may be connected in the same way and with respect to one of these cables 34, it extends downwardly to a first cable sheave 35 and horizontally to a second cable sheave 36 and then upwardly to the lever locking system 12 on each side of the door. The first cable sheave 35 is mounted on a swivel 37 permitting movement of this cable sheave through about a 180 degree arc relative to the door panel 14 which is required as the door moves between closed and open positions. The second cable sheave 36 is also mounted on a swivel 38 to permit slight arcuate movements of this sheave 36 relative to the lower panel 14.

The lever locking system 12 is duplicated on each side of the door 11 adjacent each frame side member and includes generally first and second levers or links 41 and 42, respectively, as better seen in FIGURE 5. The first lever 41 has first and second ends 43 and 44, respectively, and the second lever 42 has first and second ends 45 and 46, respectively. The first end 43 of the first lever 41 is positively connected to the door 11 and conveniently may be pivoted at the second hinge means 19. The second ends 44 and 46 of the levers 41 and 42 are interconnected and, as shown, are slidably pivoted by a pivot pin 47 in the first lever second end 44 passing through an elongated slot 48 in the second end 46 of the second lever 42. This first end 45 of the second lever 42 acts on the control arm 21 and does this by being pivotally connected thereto at a pivot 49. In the closed position of the door, the pivot 49 is above the second hinge means 19 which establishes that the distance between pivot 49 and the fourth hinge means 27 is slightly greater than the second distance between the second and fourth hinge means 19 and 27.

The cable 34 has an upwardly extending run 51 extending upwardly from the cable sheave 36 and fastened by a connector 52 to the pivot pin 47. A tension spring 53 is also connected to the pivot pin 47 and the upper end of this spring is connected near the top of the door 11 to an anchor 54 by an adjusting chain 55. A stop 57 on the first lever 41 is adapted to engage a stop flange 58 on the second lever 42 when the two levers 41 and 42 are substantially parallel as shown in FIGURE 4. A stop pin 59 is fixed on the first lever 41 to engage the hinge extension 28 when the door is in the fully open position. This assures proper closing operation of the lever locking system 12.

Operation

The FIGURE 2 shows in solid lines the door 11 in the closed condition and with the lever locking system just starting to open the door. The upper and lower panels 13 and 14 are vertical against the door stop 30. This is also shown in FIGURE 4 with the levers in fully locked position. In this position the tension spring 53 pulls upwardly on the levers 41 and 42 which are a toggle linkage or toggle lever system. In this fully locked position the stop 57 is against the stop flange 58 on the second lever 42, preventing any further upward arcuate movement of these levers 41 and 42, and the levers are parallel at about a twenty to thirty degree angle relative to the upper panel 13. When the door is to be opened, the motorized operator 32 is actuated to rotate the cable drums 33 and pull on the cable 34. Because of the cable sheaves 35 and 36, this upward pull on cable 34 pulls downwardly on the cable run 51. The first action of this force is to stretch the spring 53 and to swing the levers 41 and 42 downwardly from the position shown in FIGURE 4 to the position shown in FIGURE 5. This first arcuate movement unlocks the door and starts to move the second hinge means 19 outwardly. The down-

ward swinging movement of the first lever 41, together with the interconnection with second lever 42, gives a mechanical advantage lever force to push the second hinge means 19 laterally outwardly. The pull of the cable run 51 has an outward component as does the force of the spring 53. Accordingly, if there is no wind on the outside of the door 11, this outward force of the cable 51 and spring 53 will be enough to retain the pivot pin 47 at the right end of the elongated slot 48 as viewed in FIGURE 5. However, if there is a sufficient wind blowing against the outside of the door 11, the pivot pin 47 will move to the left end of the elongated slot 48 as the levers 41 and 42 move from the position shown in FIGURE 4 to the position shown in FIGURE 5. This is generally as shown in FIGURE 2, with the panels 13 and 14 still against the door stop 30 and the pivot pin 47 moved to the outer end of the elongated slot 48. At least from this point on, the force multiplying leverage of the levers 41 and 42 will force the second hinge means 19 laterally outwardly. This is a type of toggle lever system which has practically an infinite force multiplication ratio initially as it starts away from the locked position shown in FIGURE 4. Accordingly, the lever locking system 12 of the present invention has more than adequate force capabilities to overcome even a 2,000 lb. force from wind on the outside of the door 11.

Continued downward arcuate movement of the levers 41 and 42 progressively forces the second hinge means 19 outwardly, thus effectively breaking the toggle established by the previously vertically disposed door panels 13 and 14. For a garage door which is about seven feet high, for example, this forces the second hinge means 19 outwardly about 3-4 inches by the time the first lever 41 is moved downwardly to be about at a 45 degree angle relative to the lower panel 14. During all this movement, the cable run 51 is continuing its downward pull and the upward pull on the cable 34 exerts a lifting force on the lower portion of the lower panel 14 because it is passing through the cable sheaves 35 and 36. Accordingly, the door 11 starts its upward lifting movement at the same time that the first and second levers 41 and 42 are swinging downwardly. The door opening position of the first lever 41 is with this first lever 41 substantially parallel to the lower panel 14. In this position, the first lever 41 effectively anchors the end of the cable 34 so that any further pull on the cable 34 is converted directly into an upward lifting force on the door 11.

The door 11 moves through the intermediate position 11A shown in FIGURE 2 to reach the fully open door position 11B. At this point the cable 34 extends almost horizontally to reach the first cable sheave 35. At this door open position, the cable 34 comes under sufficient tension to stall the cable drum 33 and this actuates a torque switch to de-energize the motor 32 and set a brake to hold the door 11 in its open position 11B. This is shown in the copending application, Serial Number 287,419 filed concurrently herewith entitled Door Operator Control.

When the door is desired to be closed, the motor operator is energized to turn the cable drums 33 in the opposite direction, thus paying out the cable 34. This permits closing of the door 11 by gravity and it moves from the position 11B through position 11A to the closed position shown in solid lines in FIGURE 2. As the door comes down, it moves behind a foot bracket 61 which holds the lower edge of this lower panel 14 from moving horizontally outwardly. As cable tension relaxes during the unwinding of the drums 33, the tension spring 53 pulls the levers 41 and 42 in an upward arcuate movement. These levers 41 and 42 move upwardly to the position shown in FIGURE 5 and these levers 41 and 42 thus have a toggle leverage to pull the second hinge means 19 generally horizontally inwardly toward the door stop 30. Continued pulling by the spring 53 as the cable 34 relaxes its tension moves the levers 41 and 42 from

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the position shown in FIGURE 5 toward the locked position shown in FIGURE 4. This is the final locking movement of these levers and the force multiplying leverage of these levers pulls the doors toward a completely vertical position against the door stop 30 even though a strong wind force may be blowing through a garage window onto the inside surface of the door 11. The upward arcuate movement of the levers 41 and 42 continues until the position of FIGURE 4 is reached whereat the stop 57 on lever 41 engages the stop flange 58 on lever 42. At this position, the two levers 41 and 42 are substantially parallel and in locked position. At this position, it will be noted that the second hinge means 19, the pivot 49 and the pivot pin 47 are substantially in a straight line which is a toggle effectively locking the door in its closed position. Also, it will be noted that unauthorized entry to the garage is prevented because there need not be any door hardware whatever on the outside of the door 11. Thus, there is nothing for a person to grasp to pull the second hinge means 19 outwardly and upwardly from the outside of the door. Even if one should somewhat pull outwardly on the second hinge means 19, the lever locking system 12 will prevent such movement. Besides these levers 41 and 42 acting as a toggle linkage mechanism which locks the door 11, they may be considered as a lever system wherein the stops 57 and 58 prevent unlocking the door. If an outward force is directed on the second hinge means 19, it will be seen that the levers 41 and 42 attempt to pivot about the pivot pin 47, since it is stationary in space at that time. This outward movement on the second hinge means 19 is prevented by the interengagement of the stop 57 with stop flange 58 and thus this lever locking system 12 not only locks by a toggle linkage mechanism but also because of the interengaging stops 57 and 58.

It will be noted that the lever locking system 12 acts generally at the vertical center of the bifold door 11, in this case at the second hinge means 19, which is at the mutual hinge point of these two panels 13 and 14. Accordingly, this is the most effective point for such locking action to exert forces on the door 11. It will also be noticed that the motorized operator 32 is in the horizontal center of the door and, even though this may be a double width door for a double car garage, the two cables 34 act on the center of the lower edge of the lower panel 14 and thus there is no cantilever support of the door from the two sides, instead, the door is lifted from the horizontal center and this eliminates need for any truss rods on the door panels 13 and 14.

Still further, it will be noticed that the spring 53 acts through levers 41 and 42 to pull the door into a locked position with an increasing ratio of leverage to positively close and lock the door despite any wind force on the inside of the door 11. Also, during opening this leverage system of levers 41 and 42 provides a very powerful lever action to force the door open to break the effective toggle of the upper and lower panels 13 and 14 despite any wind force or other force which may be exerted on the outside of the door 11.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of a lower door panel to the lower edge of said upper panel, said panels hanging substantially vertically to close said door frame opening, said operator comprising, in combination, means in-

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cluding control arm means connected to said lower panel to control the movement of said lower panel to cause same to fold upwardly substantially against said upper panel as the upper panel swings to a substantially horizontal position,

toggle lever means having first and second pivot points, said first pivot point acting on said door lower panel, stop means acting between said toggle lever means and said control arm means, said stop means locking said door in the closed position against opening of said door by a force exerted laterally at said second hinge means, said toggle lever means having locked and door opening positions,

and power means connected to exert a force on said toggle lever means to move same from said locked toward said door opening position to unlock said door and connected to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means laterally relative to said control arm means to thus break the effective toggle of said upper and lower door panels.

2. An operator for a bifold door having first and second door panels mutually hinged together and with said first panel hinged to a door frame,

said door panels lying substantially in the same plane in the closed position to close the door frame opening, means including control arm means connected to said second panel to control the opening movement of said door by causing said second panel to fold substantially against said first panel as said first panel swings through a substantially ninety degree arc,

first and second levers each having first and second portions,

said first portion of said first lever being connected to act on said lower panel,

said second portions of said first and second levers being pivotally interconnected,

said first portion of said second lever acting on said control arm means,

spring means connected to urge said first and second levers in a first direction to a locked position of said door,

power means connected to said door and to said levers to concurrently exert a door opening force on said door and to move said levers in the opposite direction to swing said first and second levers through an arc unlocking the door and breaking the toggle of the substantially planar door panels in the closed position and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally of the plane thereof.

3. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of a lower door panel to the lower edge of said upper panel,

said panels hanging substantially vertically to close said door frame opening,

said operator comprising, in combination, means including control arm means connected to said lower panel to control the movement of said lower panel to cause same to fold upwardly substantially against said upper panel as the upper panel swings to a substantially horizontal door open position,

power means to open said door including a cable connected to exert a lifting force on said door,

toggle lever means having first and second pivot points with stop means therebetween,

said first pivot point acting on said door lower panel, said stop means acting between said toggle lever means and said control arm means,

said stop means locking said door in the closed position against opening of said door by a force exerted laterally at said second hinge means,

means connecting said cable to exert a force on said toggle lever means at said second pivot point, said toggle lever means having locked and door opening positions, and a lifting force on said door exerted by said cable also establishing a force on said toggle lever means to first move same from said locked toward said door opening position to unlock said door and to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means laterally relative to said control arm means to thus break the effective toggle of said upper and lower door panels.

4. An operator for a bifold door having upper and lower door panels mutually hinged together and with said upper panel hinged to a door frame header, said door panels hanging substantially vertically in the closed position to close the door frame opening, means including control arm means connected to said lower panel to control the opening movement of said door by causing said lower panel to fold upwardly substantially against said upper panel as said upper panel swings to a substantially horizontal position, first and second toggle levers each having first and second portions, said first portion of said first lever being connected to act on said lower panel, said second portions of said first and second levers being pivotally interconnected, said first portion of said second lever acting on said control arm means, spring means connected to urge said first and second levers in a first direction to a locked position of said door, power means connected to said door and to said levers to concurrently exert a door opening lifting force on said door and to move said levers in the opposite direction to swing said first and second levers through an arc unlocking the door and breaking the toggle of said door panels in the closed position and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally at the same time that the door is lifted, and means to move said power means in the opposite direction to establish a closing movement of said door with said levers being moved to said locked position by said spring means upon said door reaching the closed position.

5. An operator for a bifold door having first and second door panels mutually hinged together and with said first panel hinged to a door frame, said door panels lying substantially in the same plane in the closed position to close the door frame opening, means including control arm means connected to said second panel to control the opening movement of said door by causing said second panel to fold substantially against said first panel as said first panel swings through a substantially ninety degree arc, first and second levers each having first and second portions, said first portions of said first lever being connected to act on said lower panel, said second portions of said first and second levers being pivotally interconnected, said first portion of said second lever acting on said control arm means, a motorized operator including cable means connected to be pulled thereby, means connecting said cable means to exert a door opening force on said door and connected to said levers to move same in a first direction, spring means connected to urge said first and second levers in the opposite direction to a locked position, 75

means to energize said motorized operator to pull on said cable means in opposition to said spring means to swing said first and second levers in said first direction through an arc unlocking the door and breaking the toggle of the substantially planar door panels in the closed position and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally of the plane thereof, and continued pull on said cable means exerting a continued door opening force to open said door by folding said second panel substantially against said first panel.

6. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of a lower door panel to the lower edge of said upper panel, said panels hanging substantially vertically to close said door frame opening, said operator comprising, in combination, means including control arm means connected to said lower panel to control the movement of said lower panel to cause same to fold upwardly substantially against said upper panel as the upper panel swings to a substantially horizontal door open position, power means to open said door including a motorized operator having a cable connected to exert a lifting force on said lower panel, toggle lever means having first and second pivot points with stop means therebetween, said first pivot point being positively connected to said door lower panel, said toggle lever means having locked and door opening positions, said stop means acting between said toggle lever means and said control arm means, said stop means locking said door in the closed position against opening of said door by a force exerted laterally at said second hinge means, means connecting said cable to exert a force on said toggle lever means at said second pivot point, a lifting force on said door exerted by said power means through said cable to said lower panel also establishing a force on said toggle lever means to first move same from said locked toward said door opening position to unlock said door and to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means laterally relative to said control arm means to thus break the effective toggle of said upper and lower door panels, and said toggle lever means in said door opening position effectively anchoring said cable to establish a lifting force by said cable on said lower door panel.

7. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of said lower door panel to the lower edge of said upper panel, said panels hanging substantially vertically to close said door frame opening, said operator comprising, in combination, means including control arm means connected to said lower panel to control the movement of said lower panel to cause same to fold inwardly and upwardly substantially against the inside of said upper panel as the upper panel swings outwardly to a substantially horizontal door open position, power means to open said door including a motorized operator and having a cable connected to exert a lifting force on said lower panel, toggle lever means including first and second levers, said toggle lever means having first and second pivot means with stop means therebetween, means connecting said first lever to act on said door lower panel at said first pivot means,

means connecting said second lever to act on said control arm means,
 said stop means locking said door in the closed position against opening of said door by a force exerted outwardly at said second hinge means,
 means connecting said cable to exert a force on said toggle lever means at said second pivot means,
 said toggle lever means having locked and door opening positions,
 a lifting force on said door exerted by said power means through said cable to said lower panel also establishing a force on said toggle lever means to first move same from said locked toward said door opening position to unlock said door and to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means outwardly relative to said control arm means to thus break the effective toggle of said upper and lower door panels,
 and said toggle lever means in said door opening position effectively anchoring said cable to establish a lifting force by said cable on said lower door panel.

8. An operator for a bifold door having upper and lower door panels hinged together and with said upper panel hinged to a door frame header,
 said door panels hanging substantially vertically in the closed position to close the door frame opening,
 means including control arm means connected to said lower panel to control the opening movement of said door by causing said lower panel to fold upwardly substantially against said upper panel as said upper panel swings to a substantially horizontal position,
 first and second levers each having first and second portions,
 said first portion of said first lever being connected to act on said lower panel,
 said second portions of said first and second levers being pivotally interconnected,
 said first portion of said second lever acting on said control arm means,
 a motorized operator including cable means connected to be pulled thereby,
 means connecting said cable means to exert a door opening lifting force on said door and connected to said levers to move same in a first direction,
 spring means connected to urge said first and second levers in the opposite direction to a locked position,
 means to energize said motorized operator to pull on said cable means in opposition to said spring means to swing said first and second levers in said first direction through an arc unlocking the door and breaking the toggle of said door panels and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally at the same time that the lower panel is lifted,
 and continued pull on said cable means exerting a continued lifting force on said lower panel to open said door by folding said lower panel substantially up against said upper panel.

9. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of a lower door panel to the lower edge of said upper panel,
 said panels hanging substantially vertically to close said door frame opening,
 said operator comprising, in combination, means including control arm means having first and second ends and connected between said door frame and said lower panel to control the movement of said lower panel to cause same to fold inwardly and upwardly substantially against the inside of said upper panel as the upper panel swings outwardly to a substantially horizontal door open position,
 power means to open said door including a cable connected to exert a lifting force on said lower panel,

toggle lever means having first and second pivot points with stop means therebetween,
 said first pivot point being positively connected to said door lower panel,
 said stop means acting between said toggle lever means and said control arm means,
 said toggle lever means having locked and door opening positions,
 spring means urging said toggle lever means to said locked position with said stop means engaged to lock said door in the closed position against opening of said door by a force exerted outwardly at said second hinge means,
 means connecting said cable to exert a force on said toggle lever means at said second pivot point,
 a lifting force on said door exerted by said power means through said cable to said lower panel also establishing a force on said toggle lever means to first move same from said locked toward said door opening position to unlock said door and next to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means outwardly relative to said control arm means to thus break the effective toggle of said upper and lower door panels,
 and said toggle lever means in said door opening position effectively anchoring said cable to establish a lifting force by said cable on said lower door panel.

10. An operator for a bifold door having upper and lower door panels hinged together and with said upper panel hinged to a door frame header,
 said door panels hanging substantially vertically in the closed position to close said door opening,
 means including control arm means connected to said lower panel to control the opening movement of said door by causing said lower panel to fold upwardly substantially against said upper panel as said upper panel swings to a substantially horizontal position,
 first and second levers,
 said first lever having a first portion connected to act on said lower panel,
 second portions of said first and second levers being pivotally interconnected,
 said second lever having a first portion acting on said control arm means,
 a motorized operator including cable means connected to be pulled thereby,
 means connecting said cable means to exert a door opening lifting force on said lower panel and connected to said levers to move same in a first direction,
 stop means coacting between said first and second levers with said levers disposed in a first position,
 spring means connected to urge said first and second levers to said first position with said stop means interengaging to establish locking of said door in the closed position,
 means to energize said motorized operator to pull on said cable means in opposition to said spring means to swing said first and second levers in said first direction through an arc unlocking the door and breaking the toggle of said door panels and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally at the same time that the lower panel is lifted,
 and continued pull on said cable means exerting a continued lifting force on said lower panel to open said door by folding said lower panel substantially up against said upper panel.

11. A bifold door for a door frame having a header comprising, in combination, upper and lower door panels,
 first means hinging said upper panel relative to said door frame header,

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second means hinging the upper edge of said lower panel to the lower edge of said upper panel, said panels hanging substantially vertically to close said door frame opening,

control arm means having first and second ends and connected between said door frame and said lower panel to control the movement of said lower panel to cause same to fold inwardly and upwardly substantially against the inside of said upper panel as the upper panel swings outwardly to a substantially horizontal door open position,

power means to open said door including a motorized operator,

cable means connected to said motorized operator and connected to exert a lifting force on the lower portion of said lower panel to cause said bifold door to swing outwardly and upwardly as controlled by said control arm means to said door open position,

toggle lever means having first and second pivot points with stop means therebetween,

said first pivot point being positively connected to said door lower panel,

said stop means acting between said toggle lever means and said control arm means,

said stop means locking said door in the closed position against opening of said door by a force exerted outwardly at said second hinge means,

means connecting said cable means to exert a force on said toggle lever means at said second pivot point,

said toggle lever means having locked and door opening positions,

a lifting force on said door exerted by said power means through said cable means to said lower panel also establishing a force on said toggle lever means to first move same from said locked toward said door opening position to unlock said door and next moving said toggle lever means toward said door opening position to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means outwardly relative to said control arm means to thus break the effective toggle of said upper and lower door panels, and said toggle lever means in said door opening position effectively anchoring said cable means to establish a lifting force by said cable means on said lower portion of said lower door panel.

12. An operator for a bifold door for a door frame having a header, comprising in combination, upper and lower door panels hinged together and with said upper panel hinged to a door frame header,

said door panels hanging substantially vertically in the closed position to close said door opening,

means including control arm means connected to said door frame and to said lower panel to control the opening movement of said door by causing said lower panel to fold upwardly substantially against said upper panel as said upper panel swings to a substantially horizontal position,

first and second levers each having first and second ends,

said first lever first end connected to act on said lower panel,

said first and second levers being pivotally interconnected,

said first end of said second lever acting on said control arm means,

a motorized operator fastened to said door frame,

cable means connected to be pulled by said motorized operator and connected to said levers to pull same downwardly and also to exert a door opening lifting force on said lower panel,

stop means coacting between said first and second levers with said levers disposed at an acute angle inwardly relative to said upper panel,

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spring means connected to urge said first and second levers to a position with said stop means interengaging to establish locking of said door in the closed position,

means to energize said motorized operator to pull on said cable means in opposition to said spring means to swing said first and second levers downwardly through an arc unlocking the door and breaking the toggle of said door panels and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally at the same time that the lower panel is lifted,

and continued pull on said cable means exerting a continued lifting force on said lower panel to open said door by folding said lower panel substantially up against said upper panel with both said panels in a generally horizontal position.

13. A bifold door for a door frame having a header, comprising in combination, upper and lower door panels hinged together and with said upper panel hinged to a door frame header,

said door panels hanging substantially vertically in the closed position to close said door opening,

means including control arm means connected to said door frame and to said lower panel to control the opening movement of said door by causing said lower panel to fold upwardly substantially against the inside of said upper panel as said upper panel swings outwardly to a substantially horizontal position,

first and second levers each having first and second ends,

said first lever first end connected to act on said lower panel,

said second ends of said first and second levers being pivotally interconnected,

said first end of said second lever acting on said control arm means,

a motorized operator fastened to said door frame,

cable means connected to be pulled by said motorized operator and connected to said second ends of said first and second levers to pull same downwardly and also to exert a door opening lifting force on said lower panel,

stop means coacting between said first and second levers with said levers disposed substantially parallel at an acute angle inwardly relative to said upper panel,

spring means connected to urge said first and second levers to a position of substantial parallelism and with said stop means interengaging to establish locking of said door in the closed position,

means to energize said motorized operator to pull on said cable means in opposition to said spring means to swing said first and second levers downwardly through a first arc unlocking the door and through a second arc breaking the toggle of said door panels and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels outwardly at the same time that the lower panel is lifted,

and continued pull on said cable means with said first lever substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel substantially up against the underside of said upper panel with both said panels in a generally horizontally outward position.

14. A bifold door for a door frame having a header, comprising in combination, upper and lower door panels hinged together and with said upper panel hinged to a door frame header,

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a control arm having a first end hinged to the side of said door frame at a point slightly below and slightly inwardly of said header and having a second end hinged to said lower panel at a point below the mutual hinging of said panels to control the opening movement of said door by causing said lower panel to fold upwardly against the inside of said upper panel as said upper panel swings outwardly to a substantially horizontal position,

a lever having first and second ends,

said lever first end being hinged near the mutual hinge point of said panels,

a portion of said lever being connected to act on said control arm,

said door panels hanging substantially vertically in the closed position to close said door opening,

a motorized operator fastened to said door frame,

a cable connected to said second end of said lever and extending downwardly to a first sheave near the bottom of said lower panel and then extending horizontally to the horizontal center of said lower door panel to a second sheave and then upwardly to said motorized operator,

stop means coacting between said lever and said control arm with said lever disposed at approximately a twenty degree angle inwardly relative to said upper panel,

spring means connected to urge said lever to a position with said stop means interengaging to establish locking of said door in the closed position,

means to energize said motorized operator to pull on said cable in opposition to said spring means to swing said lever downwardly through an arc of about 160 degrees with the first about 70 degrees of such movement unlocking the door and the last about 90 degrees of such movement breaking the toggle of said door panels and exerting a mechanical advantage between said control arm and said door panels to move said mutual hinge means of the door panels outwardly at the same time that the lower edge of the lower panel is lifted,

and continued pull on said cable with said first lever substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel up against the underside of said upper panel with both said panels in a generally horizontally outward position.

15. A bifold door for a door frame having a header, comprising in combination, upper and lower door panels hinged together and with said upper panel hinged to a door frame header,

a control arm having a first end hinged to the side of said door frame at a point slightly below and slightly inwardly of said header and having a second end hinged to said lower panel at a point below the mutual hinging of said panels to control the opening movement of said door by causing said lower panel to fold upwardly against the inside of said upper panel as said upper panel swings outwardly to a substantially horizontal position,

first and second links each having first and second ends,

said first link first end being hinged near the mutual hinge point of said panels,

said second ends of said first and second links being pivotally pivoted together,

said first end of said second link being pivoted to said control arm,

said door panels hanging substantially vertically in the closed position to close said door opening,

a motorized operator fastened to said door frame,

a cable connected near said second ends of said first and second links and extending downwardly to a first sheave near the bottom of said lower panel and then extending horizontally to the horizontal center

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of said lower door panel to a second sheave and then upwardly to said motorized operator,

stop means coacting between said first and second links with one of said links disposed at an acute angle inwardly relative to said upper panel,

spring means connected to urge said first and second links to a position with said stop means interengaging to establish a toggle linkage mechanism locking said door in the closed position,

means to energize said motorized operator to pull on said cable in opposition to said spring means to swing said first and second links downwardly through a first arc unlocking the door and through a second arc breaking the toggle of said door panels and exerting a mechanical advantage to move said mutual hinge means of the door panels outwardly at the same time that the lower edge of the lower panel is lifted,

and continued pull on said cable with said first link substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel up against the underside of said upper panel with both said panels in a generally horizontally outward position.

16. A bifold door for a door frame having a header, comprising in combination, upper and lower door panels hinged together and with said upper panel hinged to a door frame header,

a control arm having a first end hinged to the side of said door frame at a point slightly below and slightly inwardly of said header and having a second end hinged to said lower panel at a point below the mutual hinging of said panels to control the opening movement of said door by causing said lower panel to fold upwardly against the inside of said upper panel as said upper panel swings outwardly to a substantially horizontal position,

first and second links each having first and second ends,

said first link first end being hinged near the mutual hinge point of said panels,

said second ends of said first and second links being slidably pivoted together with a slot in said second link and a pin in said first link,

said first end of said second link being pivoted to said control arm,

said door panels hanging substantially vertically in the closed position to close said door opening,

a motorized operator fastened to said door frame,

a cable connected to said second ends of said first and second links at said pivot pin and extending downwardly to a first sheave near the bottom of said lower panel and then extending horizontally to the horizontal center of said lower door panel to a second sheave and then upwardly to said motorized operator,

stop means coacting between said first and second links with said links disposed substantially parallel at approximately a twenty degree angle inwardly relative to said upper panel,

spring means connected to urge said first and second links to a position of substantial parallelism and with said stop means interengaging to establish a toggle linkage mechanism locking said door in the closed position,

means to energize said motorized operator to pull on said cable in opposition to said spring means to swing said first and second links downwardly through an arc of about 160 degrees with the first about 70 degrees of such movement unlocking the door and the last about 90 degrees of such movement breaking the toggle of said door panels and exerting a mechanical advantage to move said mutual hinge means of the door panels outwardly at the same time that the lower edge of the lower panel is lifted,

and continued pull on said cable with said first link substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel up against the underside of said upper panel with both said panels in a generally horizontally outward position.

17. A bifold door comprising in combination, upper and lower door panels,
 first means hinging said upper edge of said upper panel to a door frame header,
 second means hinging the upper edge of the lower panel to the lower edge of said upper panel,
 a control arm having first and second ends,
 third means hinging said first end of said control arm to the side of said door frame at a point a first distance below and slightly inwardly of said first hinge means,
 fourth means hinging said second end of said control arm to said lower panel at a point below said second hinge means a distance substantially equal to said first distance,
 first and second links each having first and second ends,
 said first link first end being hinged at said second hinge means,
 said second ends of said first and second links being slidably pivoted together with a slot in said second link and a pin in said first link,
 said first end of said second link being pivoted to said control arm at a second distance from said fourth hinge means,
 said second distance being slightly greater than said first distance,
 said door panels hanging substantially vertically in the closed position to close said door opening,
 a cable connected to said second ends of said first and second links at said pivot pin and extending downwardly to a first sheave near the bottom of said lower panel and then extending horizontally to the horizontal center of said lower door panel to a second sheave and then upwardly to a motorized operator,
 stop means coacting between said first and second links with said links substantially parallel and disposed at approximately a twenty degree angle inwardly relative to said upper panel,
 spring means connected to said first and second links to urge said links upwardly to a position whereat said first and second links are substantially parallel and with said stop means interengaging to establish a toggle linkage mechanism locking said door in the closed position,
 means to energize said motorized operator to pull on said cable in opposition to said spring means to swing said first and second links downwardly through an arc of about 160 degrees with the first about 70 degrees of such movement unlocking the door and the last about 90 degrees of such movement breaking the toggle of said door panels and exerting a mechanical advantage to move said second hinge means of the door panels outwardly at the same time that the lower edge of the lower panel is lifted by force exerted on said sheaves,
 and continued pull on said cable with said first link substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel up against the underside of said upper panel with both said panels in a generally horizontal outward position.

18. A bifold door comprising in combination, upper and lower door panels,
 first means hinging said upper edge of said upper panel to a door frame header,
 second means hinging the upper edge of the lower panel to the lower edge of said upper panel,
 a control arm having first and second ends,

third means hinging said first end of said control arm to the side of said door frame at a point a first distance below and slightly inwardly of said first hinge means,
 fourth means hinging said second end of said control arm to said lower panel at a point below said second hinge means a distance substantially equal to the said first distance of said control arm first end below said first hinge means,
 first and second links each having first and second ends, said first link first end being hinged at said second hinge means,
 said second ends of said first and second links being slidably pivoted together with a slot in said second link and a pin in said first link,
 said first end of said second link being pivoted to said control arm at a second distance from said fourth hinge means,
 said second distance being slightly greater than said first distance,
 said door panels hanging substantially vertically in the closed position to close said door opening,
 a cable connected to said second ends of said first and second links at said pivot pin and extending downwardly to a first sheave near the bottom of said lower panel and then extending horizontally to the horizontal center of said lower door panel to a second sheave and then upwardly to a motorized operator,
 stop means coacting between said first and second links with said links substantially parallel and disposed at approximately a twenty degree angle inwardly relative to said upper panel,
 a coil tension spring connecting said second ends of said first and second links to a point near the upper edge of said upper panel to urge said links upwardly to a position whereat said first and second links are substantially parallel and with said stop means interengaging to establish a toggle linkage mechanism locking said door in the closed position,
 means to energize said motorized operator to pull on said cable in opposition to said tension spring to swing said first and second links downwardly through an arc of about 160 degrees with the first about 70 degrees of such movement unlocking the door and the last about 90 degrees of such movement breaking the toggle of said door panels and exerting a mechanical advantage to move said second hinge means of the door panels outwardly at the same time that the lower edge of the lower panel is lifted by force exerted at said sheaves,
 the downward pull on said cable having an outward component as well as a downward component to aid in breaking the toggle of said door panels,
 continued pull on said cables with said first link substantially parallel to said lower panel exerting a continued lifting force on said lower panel to open said door by folding said lower panel up against the underside of said upper panel with both said panels in a generally horizontally outward position,
 and said mechanism being duplicated on the other side of said door with said door operator being positioned in the horizontal center of said door header to exert a lifting force substantially on the center of said lower door panel to obviate the need for truss rods on said lower door panel.

19. An operator for a door having first and second door panels mutually hinged together and with said first panel hinged to a door frame,

said door panels lying substantially in the same plane in the closed position to close the door frame opening,
 means including control arm means connected to said second panel to control the opening movement of said door by causing said second panel to fold toward said first panel as said first panel swings to an open position,

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first and second toggle levers each having first and second portions,
 said first portion of said first lever being connected to act on said lower panel,
 said second portions of said first and second levers being pivotally interconnected,
 said first portion of said second lever acting on said control arm means,
 said toggle levers having toggle locked and door open positions,
 power means connected to said door and to said toggle levers to concurrently exert a door opening force on said door and to move said levers from said locked toward said door open position to exert a force on said door breaking the toggle of the substantially planar door panels in the closed position and exerting a mechanical advantage between said control arm means and said door panels to move said mutual hinge means of the door panels laterally of the plane thereof.

20. An operator for a bifold door having first means hinging an upper door panel relative to a door frame and having second means hinging the upper edge of a lower door panel to the lower edge of said upper panel,
 said panels hanging substantially vertically to close said door frame opening,
 said operator comprising, in combination, means including control arm means connected to said lower panel to control the movement of said lower panel to cause same to fold upwardly substantially against said upper panel as the upper panel swings to a substantially horizontal position,
 toggle lever means having first and second pivot points, said first pivot point acting on said door lower panel,
 said toggle lever means having toggle locked and door opening positions,
 and power means connected to exert a force on said toggle lever means to move same from said locked toward said door opening position to unlock said door and connected to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means laterally relative to said control arm means to thus break

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the effective toggle of said upper and lower door panels.

21. An operator for a door having first means hinging a first portion of a first door panel relative to a door frame and having second means hinging a second door panel to a second portion of said first panel,
 said panels lying substantially in a plane to close said door frame opening,
 said operator comprising, in combination, means including control arm means connected to said second panel to control the movement of said second panel to cause same to fold toward said first panel as the first panel swings to an open position,
 toggle lever means acting on said door second panel, stop means acting between said toggle lever means and said control arm means,
 said stop means locking said door in the closed position against opening of said door by a force exerted laterally at said second hinge means,
 said toggle lever means having toggle locked and door opening positions,
 and power means connected to exert a force on said toggle lever means to move same from said locked toward said door opening position to unlock said door and connected to exert a force multiplied lever action on said door relative to said control arm means to move said second hinge means laterally relative to said control arm means to thus break the effective toggle of the planar position of said first and second door panels.

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