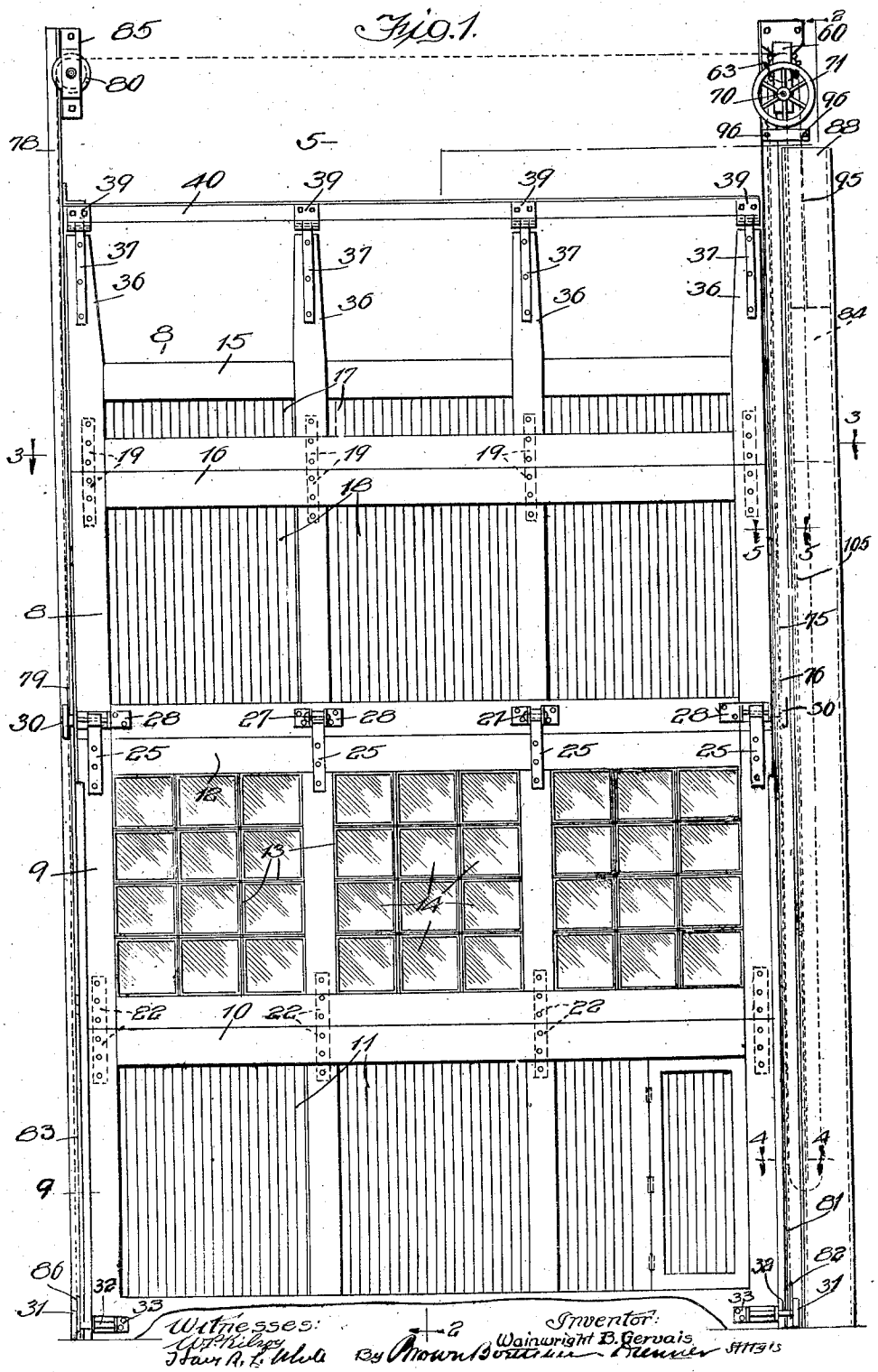
March 8, 1927. **1,619,816**

W. B. GERVAIS

FOLDING CLOSURE AND MEANS FOR OPERATING SAME

Filed Aug. 13, 1923 4 Sheets-Sheet 1

Fig. 1.




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March 8, 1927. W. B. GERVAIS 1,619,816

FOLDING CLOSURE AND MEANS FOR OPERATING SAME

Filed Aug. 13, 1923 4 Sheets-Sheet 2

Fig. 2.

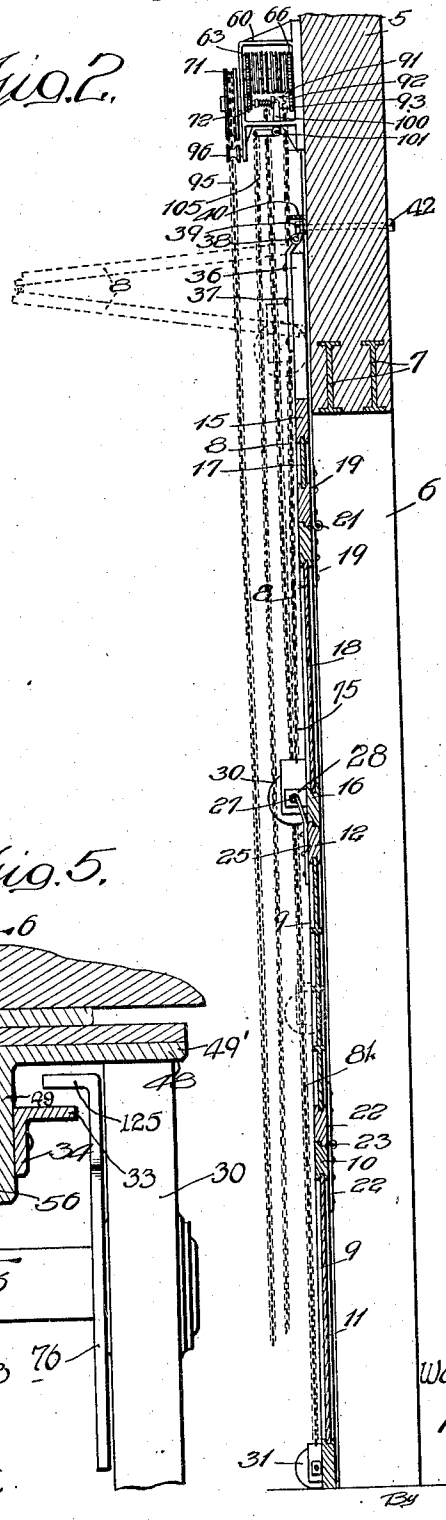



Fig. 6.

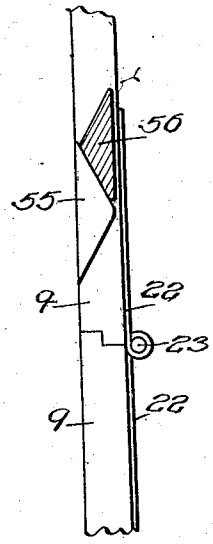
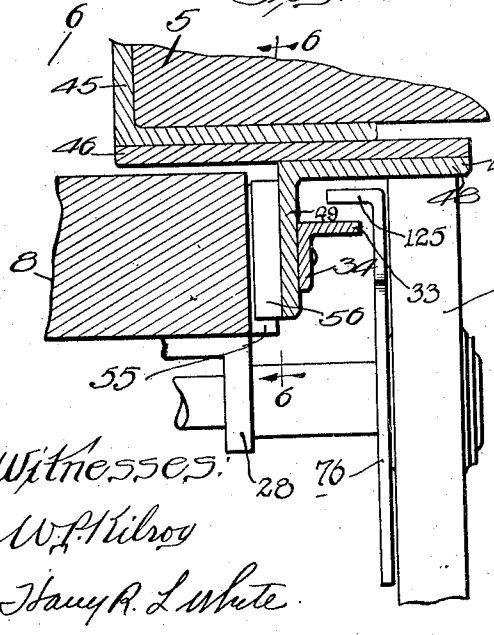



Fig. 5.




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FOLDING CLOSURE AND MEANS FOR OPERATING SAME

Filed Aug. 13, 1923 4 Sheets-Sheet 3

Fig. 3.

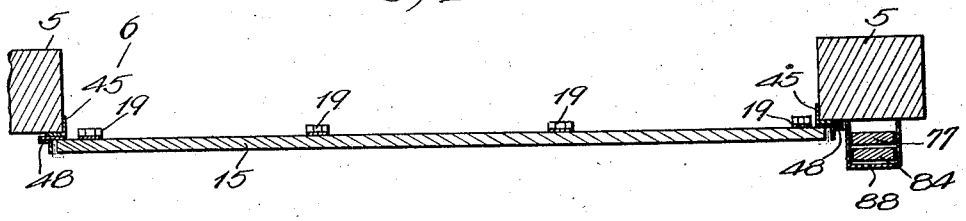



Fig. 4.

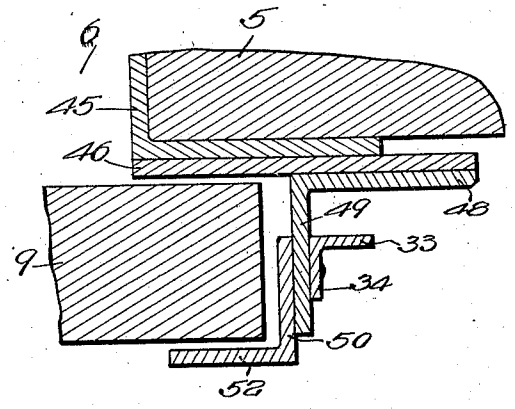
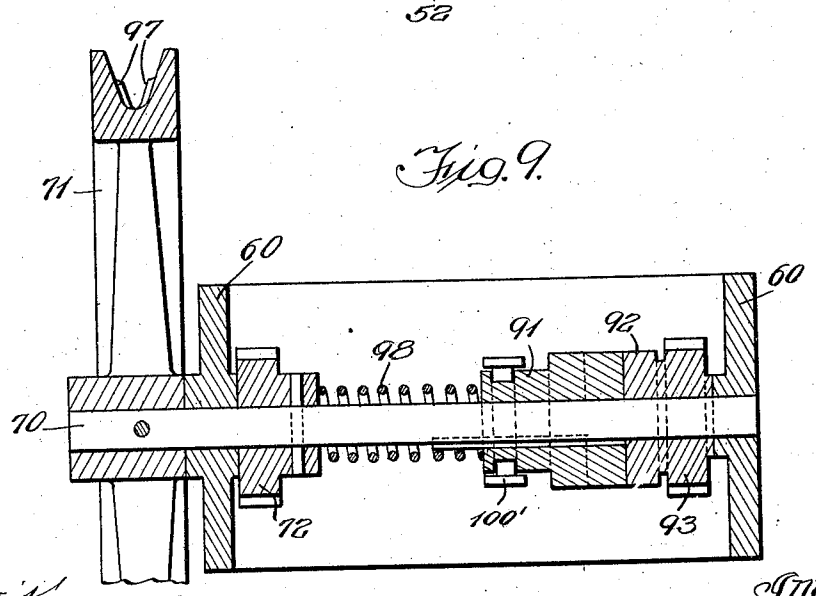



Fig. 9.




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FOLDING CLOSURE AND MEANS FOR OPERATING SAME

Filed Aug. 13, 1923 4 Sheets-Sheet 4

Fig. 8.

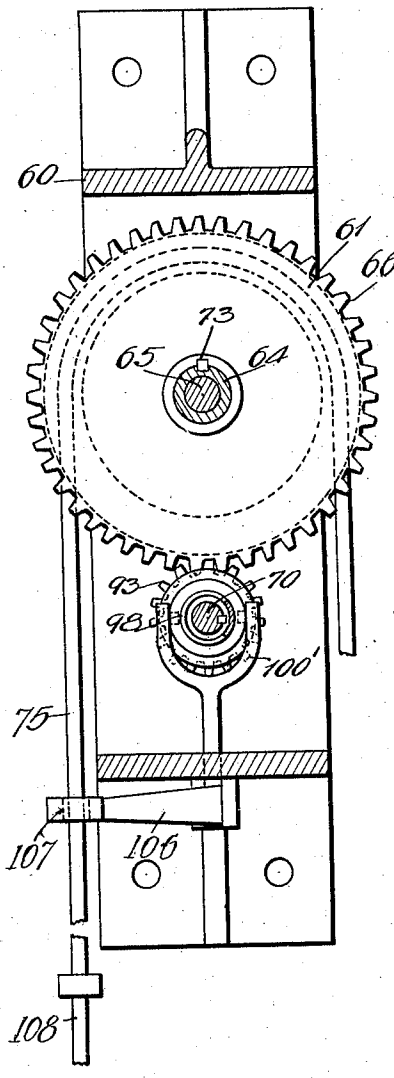
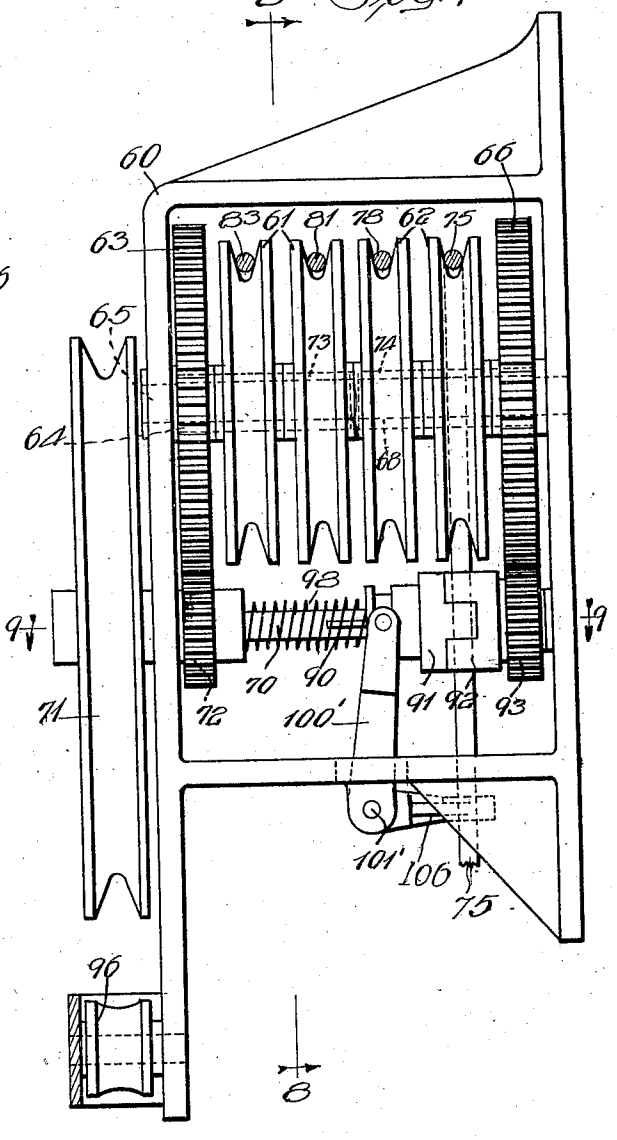



Fig. 7.




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Patented Mar. 8, 1927. 1,619,816

# UNITED STATES PATENT OFFICE.

WAINWRIGHT B. GERVAIS, OF CHICAGO, ILLINOIS, ASSIGNOR TO VARIETY FIRE DOOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## FOLDING CLOSURE AND MEANS FOR OPERATING SAME.

Application filed August 13, 1923. Serial No. 657,149.

My invention relates to improvements in folding closure and means for operating same.

Closures comprising a plurality of folding sections have been proposed before. Where they have comprised more than one pair of folding sections as in car shops, freight sheds, docks, warehouses and the like where relatively large doorway openings are required, it has been customary to fold more than one pair of door sections at the same time. The results have been unsatisfactory. Folding of more than one pair of sections at the same time imposes great and widely varying stresses, resulting from the different angular and vertical positions of the two pairs of sections and this makes operation and control difficult. Frequently uncovering of only a portion of the doorway opening is required, yet where two or more pairs of folding sections are folded simultaneously the same great range of varying stresses are imposed and operation and control complicated whether the closure is opened partially or entirely.

My invention contemplates specifically an improved closure comprising two pairs of folding sections mounted and connected to permit movement of one pair toward open position, without folding, with the folding of the other pair followed by folding of the first pair where further uncovering of the doorway or other opening is desired after folding of the second pair. Folding of the pairs of sections separately imposes the varying stresses of only one pair of sections at a time. Partial opening is secured by folding only one pair and complete opening is secured by folding the other pair after the first pair has been folded. While preferable and especially desirable movement of the first pair of sections toward open position with the folding of the second pair is not absolutely essential. Folding of one pair without movement of the other pair toward open position followed by folding of the second pair where a larger opening is desired after folding of the first pair of closure sections is contemplated within the spirit and scope of this invention. While the pairs of sections are preferably arranged one over the other with connections therebetween and the upper pair of sections are preferably arranged to fold first, variation and modification of these aspects of the invention and of the order of folding is contemplated.

Further features are an improved mechanism for operating the folding sections and means for controlling the operating mechanism manually or automatically as desired.

Details not already referred to and certain constructional features which are novel and important will appear from the following detailed description and the claims taken with an inspection of the accompanying drawings, in which;

Figure 1 is a front elevational view of a door embodying the invention.

Figure 2 is a vertical section on line 2—2 of Figure 1.

Figure 3 is a horizontal section on line 3—3 of Figure 1.

Fig. 4 is an enlarged detail section through one of the guides at opposite sides of the doorway and the adjacent jamb taken on line 4—4 of Fig. 1.

Fig. 5 is a similar section on line 5—5 of Fig. 1.

Fig. 6 is a vertical section through one of the stationary lower door breaking cams on line 6—6 of Fig. 5 showing fragmentarily the sections of the lower door in end elevation and the cooperating breaking cam carried thereby.

Fig. 7 is an enlarged side elevational view of the closure operating mechanism, showing an automatic throw-out for disconnecting the two pulleys which raise the upper door sections when said sections have been folded into open position.

Fig. 8 is a vertical section on line 8—8 of Fig. 7 and;

Fig. 9 is a horizontal section on line 9—9 of Fig. 7.

The embodiment of the invention illustrated is shown applied to wall 5 and is adapted when closed to completely cover doorway or opening 6 through said wall 5. Wall 5 which may be of brick or any other suitable or preferred construction has the usual jambs defining the sides of opening 6. Wall supporting and reinforcing beams 7 are shown along the top of opening 6.

The closure comprises an upper pair of door sections 8—8 and a lower pair of door sections 9—9 all of which are adapted to lie in the same plane in superposed relation when the door is closed. The lower of the

two bottom door sections 9—9 comprises a frame 10 preferably of wood, although metal or other suitable construction may be employed within which frame there are a plurality of panels 11 composed of inter-engaging tongued and grooved strips of thinner stock. As already pointed out the closure may be of metal or other suitable construction throughout, in which case corrugated sheet metal or other suitable panels may be employed. The upper of the two lower closure sections comprises a frame 12 having openings 13 in which panes 14 of glass or other suitable transparent material are secured.

While the upper of the two top door sections 8—8 is smaller than the lower one of said sections, these two sections may be of the same dimensions or otherwise formed as desired, as may be the two lower door sections 9—9. The upper of these sections comprises a frame 15 and the lower a frame 16, each preferably, although not necessarily of wood construction and each provided with panels 17 and 18 respectively which may be formed similar to the panels 11 or otherwise as desired. Variation and modification of the particular structural details, relative dimensioning and material of the two pairs of door sections are contemplated within the scope of my invention.

The adjacent horizontal edges of upper sections 8—8 are hingedly connected by a plurality of straps 19 of metallic or other suitable construction, one of each pair being secured to the back side (Fig. 1) of the frame of the upper of the two top sections and the other to the lower of said sections in a similar manner. The adjacent ends of each pair of straps 19 are rolled or beaded over suitable pins or pintles 21 about the axes of which the adjacent edges of the upper door sections are adapted to turn in folding. Lower door sections 9—9 are hingedly connected in a similar manner by straps 22 and pintles 23 about which the adjacent edges of said lower sections turn or revolve in folding.

The lower of the upper pair of door sections is hingedly connected to the upper of the lower pair of sections by straps 25 secured to the front side (Fig. 1) of the frame of the upper of the two lower sections and rolled at upper projecting ends over pintles or pins 27 about the axes of which the lower section of the upper door is adapted to swing downwardly away from the wall and toward a horizontal plane in opening. The upper section of the lower door is adapted to swing upwardly away from wall 5 and toward a horizontal plane about pins 27 in opening. Pins 27 are mounted in brackets 28 secured to frame 16 of the lower section of the upper door. This hinge connection between the upper and lower pair of doors is an important aspect of the invention. It permits the wide latitude of clearance for the proper breaking and folding of the sections at this point. The outermost pair of pins 27; that is, those at the opposite vertical edges of the door, have guide rollers 30 revolvably mounted thereon. Similar guide rollers 31 are mounted on pins 32 carried by brackets 33 secured to the lower section of the lower door adjacent the bottom thereof. Rollers 30 and 31 are adapted to run or travel in opening and closing the door, either partially or completely, along flanges 49′ of angle irons 48 arranged vertically and forming tracks along the opposite sides of the door.

Vertical frame members 36 of frame 15 of the upper of the top sections 8—8 project upwardly from the horizontal top defining frame member of said section and said section is hingedly hung by straps 37 secured to these projecting frame members. Straps 37 are turned inwardly along the upper ends of frame members 36 and are beaded or rolled over pins or pintles 38 carried by brackets 39 attached to the depending flange of an angle iron 40 which is in turn secured by bolts 42 to wall 5 in horizontal position above opening 6.

Jambs of wall 5 are provided with angle jambs 45 mounted over the corners of doorway 6 and extending vertically along the height of each side of the doorway. Secured to angle jambs 45 and extending vertically along each of the opposite sides of the doorway are plates 46 upon which are mounted guides for the opposite vertical edges of the door. These guides each comprises an angle iron 48 secured to plates 46 and extending vertically from the floor to the top of the operating mechanism. Angle irons 34 back of the flanges 33 of which travel inturned flanges 125 on brackets 76, 79, 82 and 86, are secured to the outwardly projecting flanges 49 of angles 48. Secured to the opposite sides of flanges 49 are angles 50 the flanges 52 of which overlap the edges of the two lower door sections 9—9 and prevent breaking or folding of said lower sections until the upper sections are folded and said lower sections are moved upwardly sufficiently to clear the upper ends of angles 50 which angles extend from the floor to about one foot from the top of the lower set of doors on each side.

To break the hinge line and start the folding of the two lower sections 9—9 when they have been moved up to their proper positions a cam 55 is provided on each of the opposite vertical edges of the upper of the lower two sections just above the lower edge thereof.

These cams 55 cooperate with cams 56 secured to angles 48 in the path of movement

100 (Fig. 2) pivoted at 101 and having an upwardly extending yoked arm for shifting clutch member 91 out of engagement with clutch member 92. Lever 100 has an outwardly extending arm having an eye in which is secured a cable, chain or other suitable means 105 for disengaging the clutch, from the bottom of the door. The clutch is adapted to be re-engaged by spring 98. It will now be apparent that upon complete folding of the upper sections and disengaging clutch 91 from clutch 92 that further operation of the hand chain operates only pulleys 61—61 to fold the bottom or lower door sections without further actuation of the upper door cables 75—78.

The operating device shown in Figures 7 and 8 is identical with that shown in Figure 2 with the exception that instead of manually disconnecting pulleys 62—62 when the upper sections are folded an automatic throw-out is provided for disconnecting pulleys 62—62 at the proper point. This comprises, in this instance, simply forming eye 107 in the outer end of the outwardly extending arm 106 of bell crank lever 100′ otherwise the same as lever 100 of Figure 2 to receive the chain or cable 75 of the upper door sections, which extends through this eye 107 and has a collar or other shoulder 108 thereon for striking the arm of the bell crank lever and throwing the clutch when the two upper door sections have been raised to their proper positions.

The independent folding of the pairs of door sections; the movement of one pair of sections toward open position without folding, with the folding of the other sections; the hanging and hinge connections for permitting breaking and proper folding of the door sections; the provisions for guiding and preventing folding of the lower sections until the upper sections have folded; the provision for breaking the hinge connections between the lower sections at the proper point and the actuating mechanism and means for manually or automatically uncoupling the upper door actuating means to permit further actuation of the lower door operating means without further actuation of the upper doors are highly important aspects of my invention.

I have described the invention, in connection with the details of a particular embodiment, but do not intend thereby to limit the invention to such details as changes and modifications are contemplated within the scope of the appended claims.

I claim:

1. In a closure, a pair of door portions, a flexible connection for opening one of said door portions, a second flexible connection for opening the other of said door portions, means for actuating one of said connections, means for actuating the other connection, separate drive means for said actuating means, said drive means being adapted for operation together until one door is moved into open position and independently to move the other door into open position, and means for automatically uncoupling said separate drive means as the first door reaches open position.

2. In a closure, a pair of door portions, a flexible connection for opening one of said door portions, a second flexible connection for opening the other of said door portions, means for actuating one of said connections, means for actuating the other connection, separate drive means for said actuating means, said drive means being adapted for operation together until one door is moved into open position and independently to move the other door into open position, and means for uncoupling said separate drive means as the first door reaches open position.

3. In combination, two lifting pulleys, drive members for the respective pulleys, continuously driven operating means for one of the pulleys, driving means for the other pulley, and means associated with the said continuously driven means for throwing said driving means into and out of operation.

4. In combination, two lifting pulleys, gears connected to the respective pulleys for driving the same, pinions meshing with said gears, means for supporting said pinions, said means having direct driving connection with one of the pinions, and clutch means associated with said supporting means for optionally establishing driving connection between the supporting means and the other pinion.

5. In combination, a lifting pulley, a drive member therefor, a second lifting pulley, a second drive member for said second lifting pulley, means for driving the drive members, means for connecting said drive members to drive the lifting pulleys together and for disconnecting said drive members to permit driving of one pulley independently of the other, and means automatically controlling said connecting means.

6. In a closure, a pair of closure sections, a lifting pulley for one section, a lifting pulley for the other section, means for driving said pulleys together until one section is moved into open position, said means including a clutch, and means controlled automatically by the movement of said first section into open position for operating said clutch to permit driving of the pulley for the other section independently of said first pulley to move the other section into open position.

7. In a closure, a pair of upper folding closure sections, a pair of lifting pulleys for said sections, a counter-weight, flexible connections connected between said sections and the counter-weight and trained over said lift-

of cams 55, as the lower sections approach the upper ends of angles 50, forcing the hingedly connected edges of the lower door section outwardly and thereby starting the folding of said sections.

These cams may be arranged between the back side of the door section and the door jambs in which case they could be made smaller to not interfere with the proper closed position of the lower door sections. By arranging them as shown, however, there is no possibility of such interference and they may be made up as large as desired to secure the desired break. The top edges of cams 56 and the lower edges of cams 55 are shown inclined so that there will be no possible interference with the closing movement of the door sections. The adjacent horizontal edges of each pair of door sections and the adjacent horizontal edges of the lower section of the upper door and upper section of the lower door are preferably scarfed as shown, to interengage and form tight joints at said points.

Mounted upon wall 5 above doorway 6 and to one side thereof is an open frame 60 in which are mounted two pairs of pulleys 61—61 and 62—62. Pulleys 61—61 are driven together as by keying same at 73 with a spur gear 63 on a sleeve 64. Sleeve 64 is rotatably mounted on one end of a shaft 65 journaled at its opposite ends in frame 60. Pulleys 62—62 are similarly driven together and independently of pulleys 61—61 as by keying them at 74 with a gear 66 upon a sleeve 68 rotatable on the opposite end of shaft 65. The sheaves and gears which are locked together may run upon the shaft instead of the sleeve or be otherwise arranged. A cable 75 secured at 76 to the lower of the two upper sections at a point adjacent the bottom of one end of said section as through a suitable arm or bracket extends up and around one of the pulleys 62 and down and is connected at its opposite end to a counterweight 77. A cable 78 secured at 79 to the bottom of the opposite end of same section extends up over a sheave behind sheave 80 across and down over the other sheave 62 and is secured with cable 75 to counterweight 77. Counterweight 77 counterbalances the weight of the upper door sections so that said sections will be retained in any folded position in which released.

A cable 81 secured at 82 to the lower of the two lower door sections at a point adjacent the bottom of one end of said section extends up and around one of the pulleys 61—61 and down and is secured with a cable 83 to a counterweight 84. Cable 83 is trained over sheave 80 in block 85 and extends down and is secured at 86 to the bottom of the opposite end of the same section. Counterweight 84 counterbalances the weight of the lower door sections so that said sections will be retained in any vertical or folded position in which released. Counterweights 77 and 84 travel and are guided in a guide channel 88 extending vertically along one side of the doorway.

A shaft 70 rotatably journaled in frame 60 has a hand chain sheave 71 fixed on its outer end and within the frame a pinion 72 fixed on shaft 70 for rotation therewith meshes with spur gear 63. Splined at 90 for longitudinal movement along shaft 70 is a clutch member 91. A cooperating clutch member 92 loose on shaft 70 has a pinion 93 fixed thereon, which pinion 93 meshes with gear 66. A hand chain 95 (Fig. 1) trained over sheave 71 and down between idlers 96—96 may hang loosely to a point conveniently accessible from the bottom of the door as shown or it may be trained over a second sheave at said point if desired. The groove in sheave 71 may be formed irregular as shown at 97 in Fig. 9 for proper engagement with hand chain 95. A coiled spring 98 interposed between pinion 72 and clutch member 91 normally maintains said clutch member in engagement with clutch member 92.

When the upper and lower door sections are in closed position and it is desired to open same, hand chain 95 is grasped and drawn downwardly to rotate sheave 71 and thereby shaft 70. Clutch members 91 and 92 being in driving engagement both pinions 72 and 93 are rotated, with a resulting rotation of both pairs of pulleys 61—61 and 62—62 through gears 63 and 66. Cables 75—78 and 81—83 are thereby drawn upwardly simultaneously. The upper edge of the upper section of the upper door being fixed, sections 8—8 immediately break at the hinge connection therebetween and fold outwardly toward the dotted line position shown in Figure 2. Simultaneously with the folding of the upper door sections, lower sections 9—9 are moved upwardly without folding through their connection with the upper sections and through cables 81 and 83.

Where only a partial uncovering of the doorway is required folding of the upper sections may suffice, or it may not even be necessary to completely fold said sections. Where a greater opening is required, however, operation of hand chain 95 is continued. As the hinge connection between the lower door sections properly clears the upper ends of angles 50 and cams 55 engage cams 56 the hinge connection between sections 9—9 is broken and said sections fold upwardly until the entire doorway or opening 6 is uncovered.

In Fig. 2, I show means for manually disconnecting upper door pulleys 62—62 when the upper sections have been completely folded. This comprises a bell crank lever

ing pulleys, a pair of lower folding sections, a pair of lifting pulleys for said lower sections, a second counter-weight, flexible connections connected between said lower sections and said second counter-weight and trained over said second lifting pulleys, driving means for said flexible connections and a clutch for connecting all of said pulleys to move the upper and lower pairs of sections together until the upper sections are moved into open position and for disconnecting the pulleys to permit independent movement of the lower sections thereafter.

8. In a folding closure of the character described, a plurality of hingedly connected sections, certain of said sections constituting an upper portion of the closure and the other sections constituting the lower portion of the closure, a cable secured at its ends to the sides of the upper portion of the closure, a second cable secured at its ends to the sides of the lower portion of the closure, and means for operating said cables including means for discontinuing operation of the first cable when the upper portion of the closure is moved into full raised position while permitting optional continuation of the operation of the second cable for moving the lower portion of the closure into full raised position.

9. In a folding closure of the character described, a plurality of hingedly connected sections, certain of said sections constituting an upper portion of the closure and the other sections constituting the lower portion of the closure, a cable secured at its ends to the sides of the upper portion of the closure, a second cable secured at its ends to the sides of the lower portion of the closure, and means for operating said cables including means for discontinuing operation of the first cable when the upper portion of the closure is moved into full raised position while continuing operation of the second cable for moving the lower portion of the closure into full raised position.

10. In a folding closure of the character described, an upper portion and a lower portion, and positively driven operating means connected to the respective portions at the sides thereof, said means acting to first move the upper portion into full raised position by a positive lifting action applied simultaneously to both sides of said upper means and to subsequently move the lower portion into full raised position by applying to both sides of the lower portion simultaneously a positive lifting action.

11. In a folding closure of the character described, an upper portion and a lower portion, lifting members connected to the sides of the upper portion, lifting members connected to the sides of the lower portion, and means for driving said members, said means acting to positively drive all of said members until the upper portion of the closure is in raised position and thereafter drive the lifting members of the lower portion only until the lower portion is in raised position.

12. In a folding closure of the character described, an upper portion and a lower portion, lifting members connected to the sides of the upper portion, lifting members connected to the sides of the lower portion, means for driving said members acting to positively drive all of the members, and means controlled by movement of the upper portion for disconnecting from said driving means the lifting members connected to said upper portion when the upper portion of the closure member has been moved into full raised position.

13. In a folding closure of the character described, an upper portion and a lower portion, lifting members connected to the sides of the upper portion, lifting members attached to the sides of the lower portion, and means for positively driving all of said members, said means permitting the respective sets of lifting members to be moved through different distances in accordance with the distance through which the respective portions of the closure are moved in opening the same.

14. In a folding closure of the character described, an upper portion and a lower portion, a pair of lifting members connected to the sides of the upper portion, operating members having direct driving connection with both of said members, a pair of lifting members connected to the sides of the lower portion, operating members having direct driving connection with the second pair of lifting members, and means for driving all of said operating members simultaneously until the upper portion is moved into full raised position and thereafter driving said second pair only of lifting members until the lower portion of the closure is moved into raised position.

15. In a folding closure of the character described, an upper portion and a lower portion, two pairs of pulleys, a cable passing over the pulleys of one pair and having its ends attached to the sides of the upper portion, a second cable passed over the other pair of pulleys and having its ends attached to the sides of the lower portion of the closure, all of the pulleys having driving engagement with the cables, counter weights suspended from the bight portions of the cables, and means for driving all of the pulleys simultaneously until the upper portion of the closure is moved into full raised position and thereafter driving only the pulleys over which said second cable is passed.

In witness whereof, I hereunto subscribe my name this 10th day of August, 1923.

WAINWRIGHT B. GERVAIS.