



**April 12, 1949.**

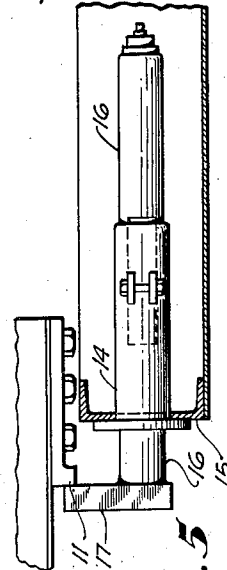
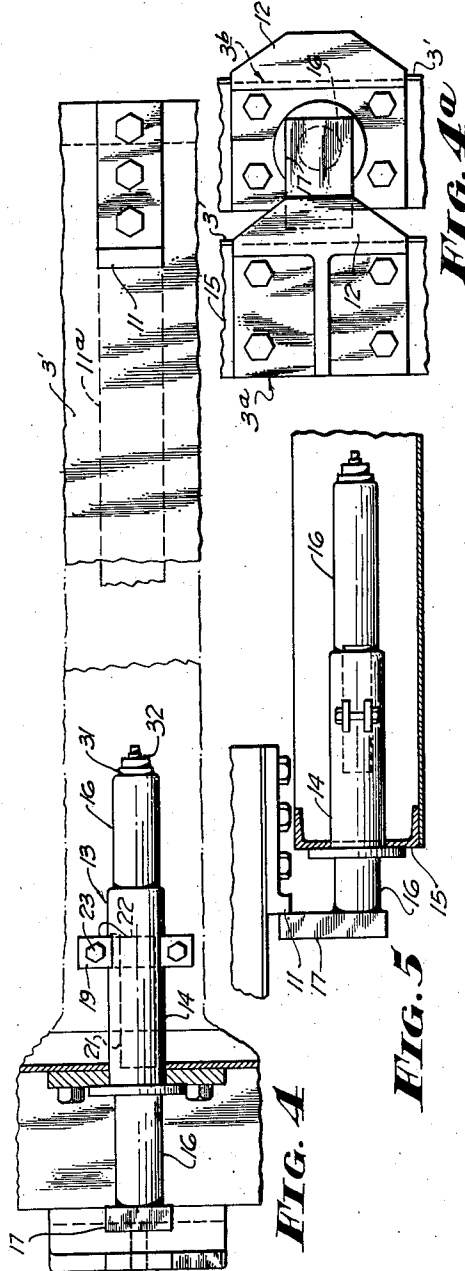
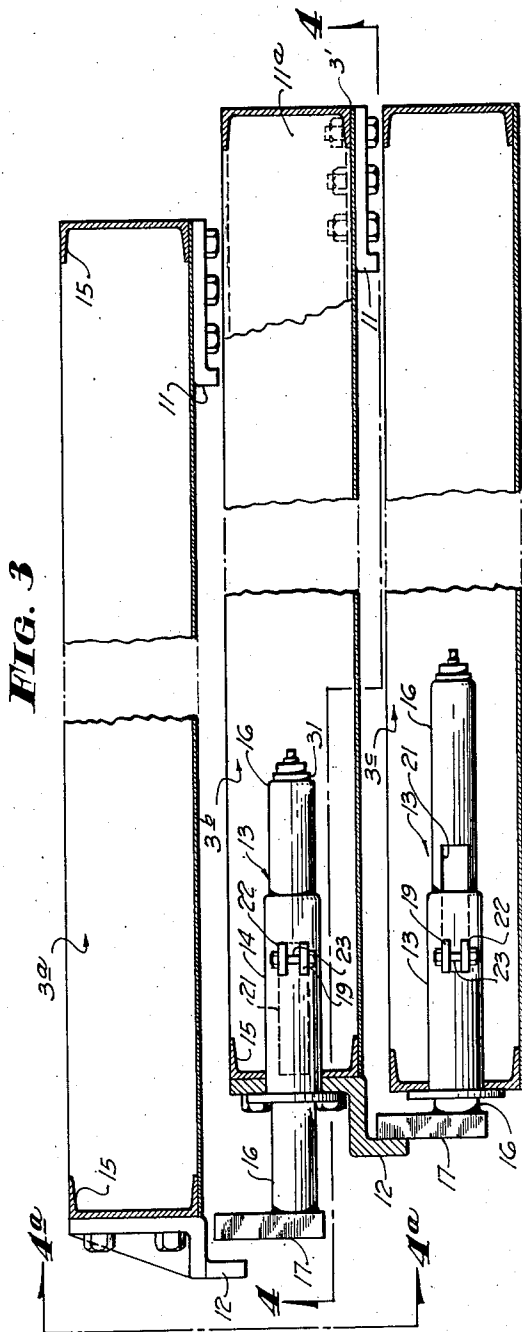
**G. S. ROGERS**

**2,466,913**

MULTIPLE SECTION DOOR CONSTRUCTION

Filed June 26, 1945

5 Sheets-Sheet 2



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MULTIPLE SECTION DOOR CONSTRUCTION

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Fig. 6

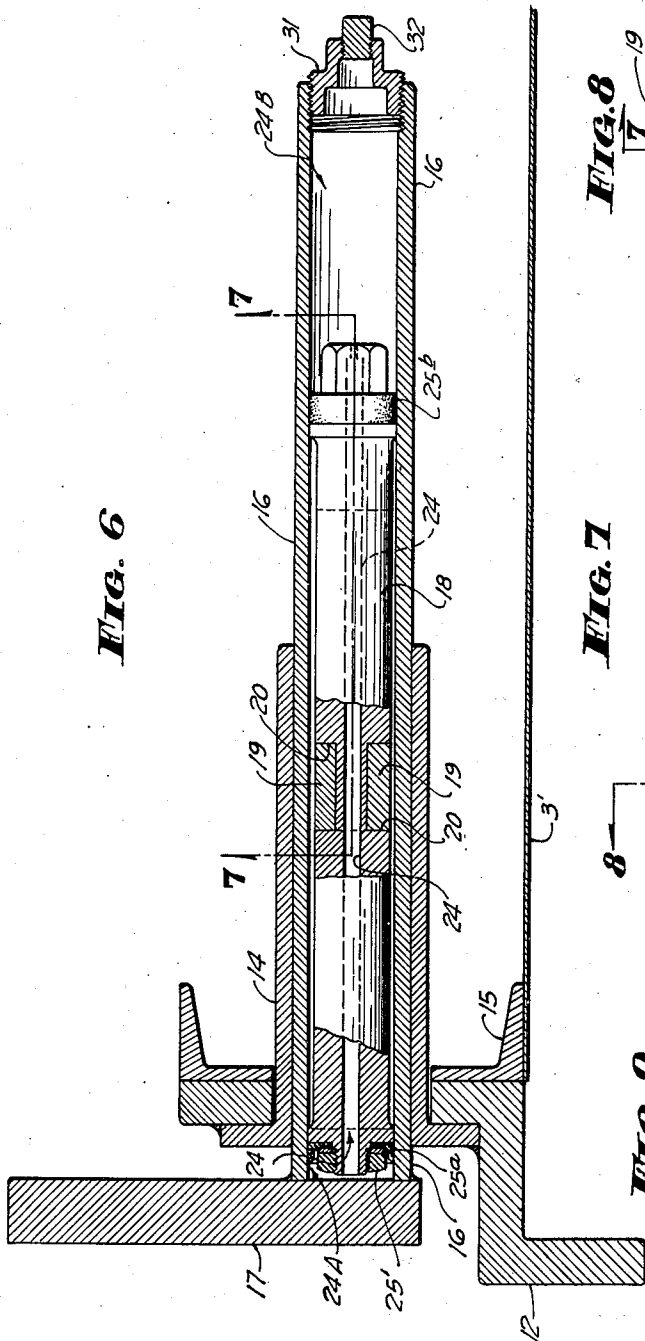


Fig. 7

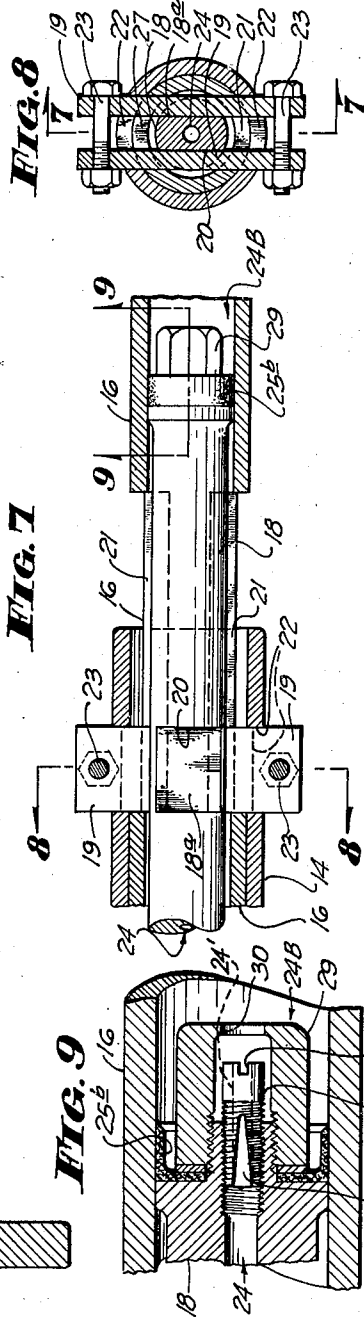
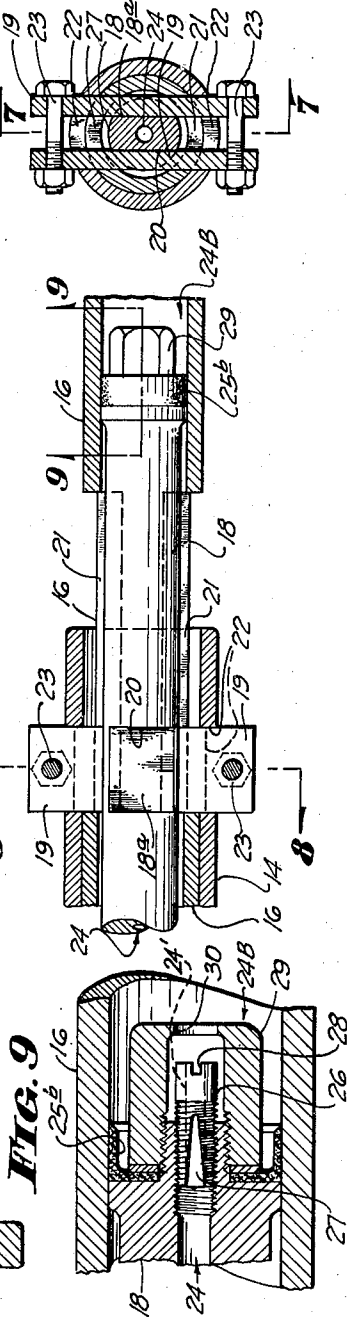


Fig. 9



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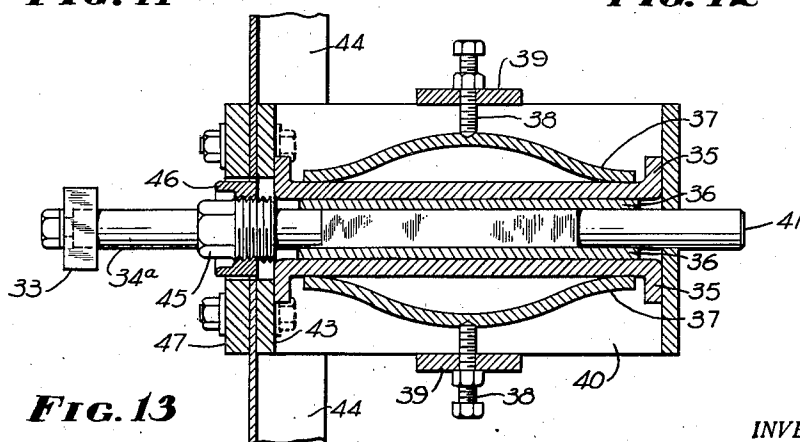
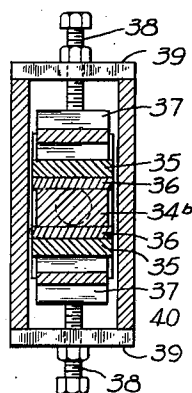
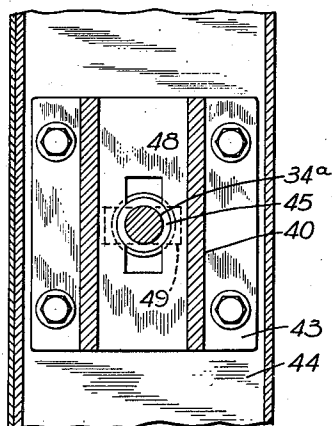
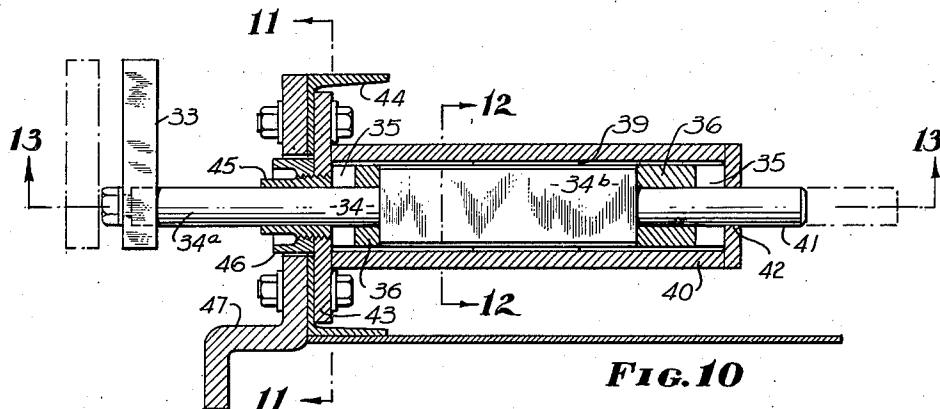
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### MULTIPLE SECTION DOOR CONSTRUCTION

Filed June 26, 1945

5 Sheets-Sheet 4



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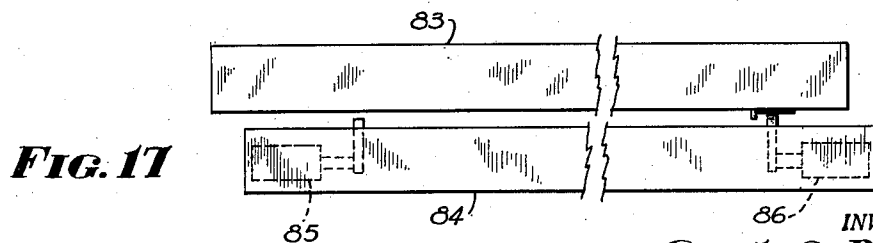
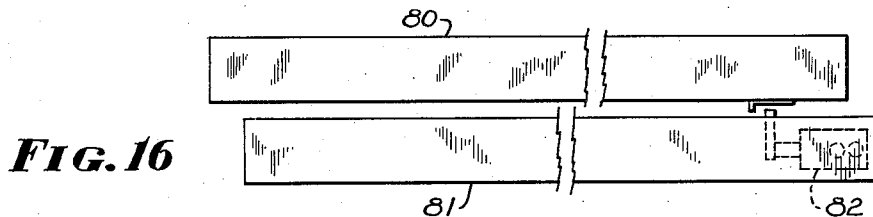
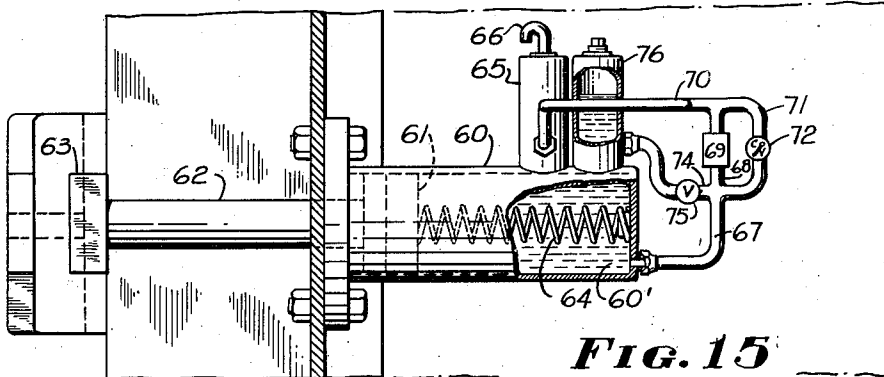
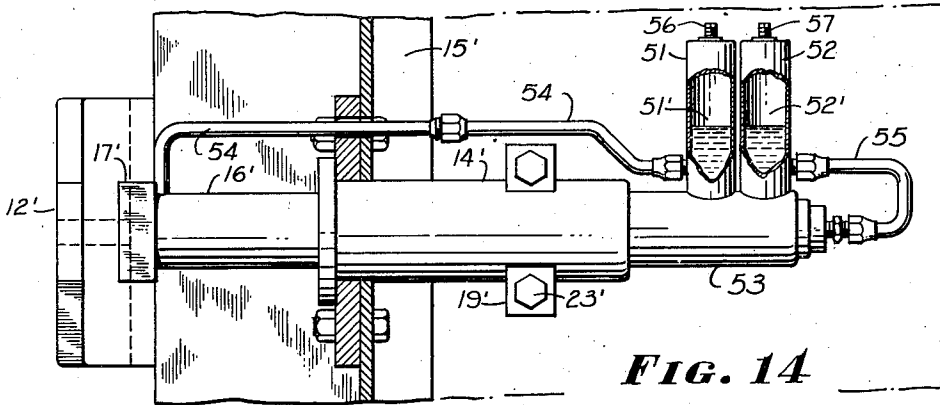
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2,466,913

MULTIPLE SECTION DOOR CONSTRUCTION

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5 Sheets-Sheet 5



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## UNITED STATES PATENT OFFICE

2,466,913

## MULTIPLE SECTION DOOR CONSTRUCTION

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Application June 26, 1945, Serial No. 601,669

14 Claims. (Cl. 160-224)

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This application relates to multiple section door constructions in which a plurality of smaller sections or door elements are employed to close a relatively large opening by arranging the door sections for movement in separate paths from a nested association such as to expose the door opening, to a relatively extended but overlapping association such as to close the door opening.

More particularly, the construction of this invention contemplates the provision of a plural door assembly in which each of the individual door elements making up the plurality is adapted for movement, relative both to the door opening and to the other door elements of the plurality, the movement of such door elements being effected by a direct drive of one of such elements and an indirect drive of the other elements being obtained by cooperative interengagement of the elements, whereby the motion directly imparted to such one element is indirectly applied to such other element to effect the desired opening and closing movement of the door structure as a whole.

One of the particular objects of the invention is to provide a plural door assembly of the character set forth, wherein the indirect operative driving interengagement between adjacent door elements is effected through a yielding drive means whereby the momentum of a moving door element is imposed upon the adjacent door element under conditions such as to minimize the shock of impact and such momentum is applied to such adjacent door element over an appreciable time interval sufficient to effect acceleration of such adjacent door element to the speed of movement of such moving door element.

In multiple section door constructions of the type with which the present invention is concerned, considerable difficulty is encountered in the operation of the individual door sections as a result of the necessarily massive construction and the necessity for securing rather rapid operation. Where such structures are employed for aircraft hangars and the like, or comparable structures in which a relatively large span is required in the full open position of the door, the movement of the door into closing position or opening position should be relatively rapid, and where a construction is employed in which the respective elements of the door structure are interengaged with one another to secure the desired movement, the impact of a moving door section or group of door sections upon an adjacent door section to pick it up to the speed of the moving element is deleteriously high in many instances. This is particularly true where mate-

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rial such as sand, gravel, small stones or the like is likely to accumulate upon the supporting tracks on which the door sections ride in their movement, inasmuch as this condition results in a rather important resistance to be overcome by the door which is being set in motion, and the momentum of the moving door section has to be absorbed by the adjacent door as it is accelerated to the speed of the moving door section.

For the above reasons, it has heretofore been considered impracticable to employ multiple door structures of the "pick-up" type, i. e., door structures wherein the moving effort is applied to but one door section of the multiple structure and the movement of the adjacent door sections obtained upon engagement by such one door section, wherever the construction requirements call for relatively heavy or large door sections. Instead, the art has consistently called for installations in which all of the door sections are driven concurrently, at differential speeds, wherefore the multiple door structure is moved as a unit into and out of door-open position. This requires rather large or powerful drive means, inasmuch as each of the sections of the door structure must be accelerated, i. e., the mass of the entire door structure has to be acted upon by the drive means at once, albeit part is accelerated at a lesser rate than another part.

According to the present invention, a "pick-up" type of multiple door construction is provided which is subject to operation at a reduced power requirement as compared to the power requirement of door constructions of comparable size and weight which provide for concurrent operation of the several door sections constituting the multiple structure, and is characterized by the absence of excessive impact loads in operation.

It is a further particular object of this invention to provide a yielding driving connection between adjacent door sections in a multiple-section structure of the "pick-up" type, so that as a moving door reaches a standing door section the momentum of the moving door is gradually imposed upon this standing door to accelerate it to the speed of the moving portions of the structure without undue shock on the structure as a whole.

A particular object of the invention is to provide a hydraulic structure adapted to be set into operation when adjacent door sections are brought into interengaging relation, to reduce the force applied to a door section to be moved by a moving door section and distribute the application of such force over a significant time interval, whereby the desired acceleration of the door to

be moved is attained in the substantial absence of detrimental shock from impact.

The construction of the present invention may comprise, substantially, a plurality of door sections arranged in position to move in substantially parallel paths from a nested association in which they overlap each other and establish an open condition for the door opening, and a relatively extended and preferably partially overlapping position in which they are offset in the direction of movement into a position closing the door opening, one of said sections being provided with means defining a bearing surface, and a door section adjacent said one section being provided with a portion defining a bearing surface in position to engage the first-named bearing surface and move the one door section upon movement of said adjacent door section in one direction, and one of said door sections being provided with cushioning means yieldingly supporting the associated bearing surface to permit limited motion of such bearing surface relative to this one section upon such engagement, while resisting such motion, whereby the movement of the moving section in said direction causes gradual acceleration of the other section.

A further object of the invention is to provide a "pick-up" type of multiple door construction provided with cushioning means adapted to be caused to function upon interengagement of a moving door section with an adjacent less-rapidly moving section, in which the cushioning means is adapted to cause the interengaging door sections to establish a given relative positional relationship independent of the operating forces imposed upon such door sections.

A further object of the invention is to provide a multiple structure door assembly of the "pick-up" type provided with resilient yielding cushioning means interposed between adjacent door sections which are adapted for interengagement for the purpose of imposing a moving effort upon an adjacent door section by a given moving door section, in which the resilient yielding means is adapted to resiliently cushion the impact of said moving door section upon such adjacent door section and distribute the accelerating effort of such moving door section upon such adjacent door section over a period of time controlled by a given relative movement between such door sections, said resilient yielding cushioning means being adapted to establish such given relative movement in such manner that such given relative movement is caused to take place independent of the operating load existing at the position of interengagement of said door sections.

Other objects and features of this invention will be brought out in, or will be apparent from, the following description of certain preferred embodiments of the invention as illustrated in the accompanying drawings, in which:

Fig. 1 is a front elevation, partly broken away, showing a plurality of door sections in relatively extended position to close a door opening;

Fig. 2 is a partly broken away plan view thereof, looking down upon the plurality of door sections arranged in the relative position shown in Fig. 1;

Fig. 3 is a horizontal section showing an assembly of three door sections and illustrating the relative positions of the door sections in movement thereof to expose the door opening, wherein the outermost door section has engaged and moved an intermediate door section into position where it is just about ready to engage

the last door section of the group to move it and thus expose the entire door opening;

Fig. 4 is a partly sectional elevation as taken on line 4-4 of Fig. 3;

Fig. 4a is a partly broken end elevation as taken on line 4a-4a in Fig. 3;

Fig. 5 illustrates the operation of the yielding cushioning means as an outer door section is brought into engagement with an adjacent door section in movement of the door sections to a relatively extended position such as to close the door opening;

Fig. 6 is a longitudinal section through the form of cushioning means shown in Figs. 1 through 5, embodying a hydraulic cushioning member;

Fig. 7 is a longitudinal sectional detail of the structure shown in Fig. 6, as taken on line 7-7 therein and as shown by co-related line 7-7 in Fig. 8;

Fig. 8 is a transverse section as taken on line 8-8 in Fig. 7;

Fig. 9 is an enlarged sectional detail as taken on line 9-9 in Fig. 7;

Fig. 10 is a view corresponding to Fig. 6, showing a modified embodiment of the invention;

Fig. 11 is a transverse sectional view as taken on line 11-11 in Fig. 10;

Fig. 12 is a transverse sectional view as taken on line 12-12 in Fig. 10;

Fig. 13 is a longitudinal sectional view as taken on line 13-13 in Fig. 10;

Fig. 14 is a view corresponding generally to Fig. 4, showing a modified form of fluid-displacement type of cushioning means, provided with means for causing a resilient operation of the structure;

Fig. 15 is a view corresponding generally to Fig. 4, showing a yielding cushioning means adapted for operation in but one direction of force application, with automatic means for returning the device to operative position after operation in said one direction; and

Figs. 16 and 17 show varied arrangements of cushioning means which may be established according to this invention, depending upon the character of the cushioning means provided.

Referring to Figs. 1 through 9 of the drawings, I have illustrated the arrangement of a plurality of door sections adjacent the door opening associated with a building wall in Figs. 1 and 2, while in Figs. 3 through 9 I have illustrated certain details of construction which may be incorporated in the structure shown in Figs. 1 and 2. Referring more particularly to Figs. 1 and 2, a portion of the building wall is indicated at 1, at one side of which a door opening 2 is provided. This door opening may extend from the wall portion 1 to the mid-point of the complete door opening in installations where the door opens at the center and the door sections are moved respectively to each side of the center to full open position of the doorway, or it may be considered that the door opening shown at 2 represents the full size of the opening.

A plurality of door sections 3a, 3b and 3c are provided for this particular installation, it being appreciated that substantially any desired plural number of door sections may be provided, depending upon the size of the installation involved. The door sections are adapted for translatory movement, preferably in substantially parallel paths and for this purpose may be supported on suitable flanged wheels 4 riding on separate sets of tracks or rails as shown at 5a, 5b and 5c for

the respective door sections. In the ordinary case these rails will be placed with their upper surfaces in line with the plane of the floor of the building, wherefore wheeled traffic in and out of the building will be unimpeded. The upper edges of the door sections 3a-3c may be supported by a guide rail assembly shown generally at 8, according to conventional practice.

Suitable power means are preferably provided for causing the desired movement of the door sections between door-open and door-closed positions, and such power means may be provided through a driving chain 7 disposed on suitable sprocket 8 in the overhead structure of the door, said chain 7 being adapted to engage an operating bracket or lug 9 upon the door section which is caused to have the greatest movement, which in this case is door section 3c. A suitable driving element may be attached to one of the sprockets 8, such as an electric motor 10, connecting with the adjacent sprocket preferably through suitable speed-reducing means, not shown.

It will be appreciated that it is not essential that the door sections be power driven, in spite of the fact that in large structures the power driven arrangement is by far the most useful, inasmuch as the features of this invention are quite useful where the doors are hand-operated or operated by a removable or temporary power means, such as a tractor or truck. The accompanying claims, for this reason, are not specifically limited to the provision of power operating means for the plural sections.

In the ensuing description, where the expression "outer" door section is used, it will be understood to refer to the door section which has the greatest movement, i. e., the door section 2c in the specific illustrations in Figs. 1 and 2, and where the expression "inner" door section is used it will refer to the door section having the least movement, i. e., the door section 3a of Figs. 1 and 2. The remaining door section 3b will be termed an "intermediate" door section, with the understanding that there may be any desired number of such intermediate door sections, or such intermediate section may be omitted, in any given construction.

It will be comprehended also, that the door section which is innermost with respect to the door opening itself (i. e., in the plane of door section 3a) may actually constitute the door section which is required to move to the greatest distance, wherefore the expressions "inner" and "outer" door sections will be taken as referring mainly to the physical layout of the structure shown specifically in Figs. 1 and 2, rather than to a limitation that either the inner or the outer door section is the one which requires the greatest movement.

In my specific showing, the door section 3c is the operating door member for the plurality of door sections, i. e., is the door section which is driven directly by the driving means 7, 8, 9 and 10 and in turn acts to operate the adjacent door sections 3b and 3a, and the door sections 3a and 3b are provided with brackets 11 which serve to cause movement of the door sections in the right-hand direction in Figs. 3 through 5, hereinafter termed "closing" bracket, and bracket 12 which may be termed "opening" bracket. The closing and opening brackets of section 3b are disposed in position to be operated upon by the door section 3c, and similarly, the opening and closing brackets 11 and 12 of section 3a are disposed in position to be operated upon by the door section

3b. The outer door section 3c and the intermediate door section 3b are each shown as provided with cushioning means 13 adapted to engage the brackets 11 and 12 on the next adjacent door section, and in this embodiment of the invention the cushioning means may comprise fluid displacement assembly including a fixed support sleeve 14 secured to a door element frame member or upright 15, and carrying a movable cylinder 16 provided with an actuating foot member 17 positioned to engage the respective brackets 11 and 12 of the next adjacent door section. Within the movable cylinder 16 I provide a piston member 18, said piston member being caused to persist in fixed position with respect to the frame 15 of the door section and the thereto-attached fixed support sleeve 14. This positioning of the member 18 with respect to the fixed support sleeve 14 may be obtained through the agency of cross arms 19 disposed in suitable notches 20 in the piston 18 and extending through an elongated slot 21 in the movable cylinder 16 and through coacting shaped slots 22 in the fixed support sleeve 14, the cross arm 19 being clamped about the center section 18a of the piston member 18 through the agency of suitable bolts 23 or the like. A suitable communicating passage is provided to connect the compression spaces or cylinders 24A and 24B at the respective ends of the movable cylinder member 16, and I may for this purpose provide the piston member 18 with an axial bore 24. Suitable composition or leather cups 25a and 25b are provided at the respective ends of the piston member 18, a nut 25' being provided to hold the cup leather 25a at the left-hand end of the piston 18.

At one end of the piston member 18, such as the right-hand end in the figures of drawings, I have provided a suitable form of metering or flow-controlling means to limit the fluid displacement between cylinder spaces 24A and 24B at the respective ends of the cylinder 16 through the passage 24. Such a metering means may comprise a metering screw 26 threadedly disposed in the cylinder member 18 at the position of the passage 24 and provided with a bore or passage 24' communicating with the bore 24; the screw 26 may further be provided with a flat 27 which is inclined with respect to the axis of the screw 26 so that upon adjustment of the screw along its length a greater or lesser opening is provided at the position of flat 27, and thus augment the fluid flow through bore 24' to various degrees. A key slot 28 may be provided in the metering screw 26 and the nut 29 which is adapted to hold a piston leather 25b at the right-hand end of the piston 18 may be provided with an opening 30 so that access to the key slot may be had through the open end of the cylinder member 16 by means of a screw driver or the like. A removable plug 31 is provided in the right-hand end of the cylinder 16, with a smaller plug 32 to provide access to the metering screw and to facilitate filling the system with suitable fluid. This fluid may comprise a compressible medium such as a gas or air, or an incompressible medium such as oil or other suitable liquid.

The operation of the construction is as follows:

Assuming the doors to be in the position shown in full lines in Figs. 1 and 2, when the motor 10 is energized the door 3c will move to the left. The actuating foot 17 associated with the cushioning means 13 on the door section 3c will be in fully extended position (corresponding to the

position shown for the corresponding member on the section 3b in Fig. 3), and when the left hand bearing surface of member 17 contacts the bracket 12 of the door section 3b the movable cylinder member 16 will be moved toward the right relative to the fixed support 14 attached to the door section 3c, causing the volume of hydraulic fluid in the cylinder space 24A at the left-hand side of the piston member 18 to be reduced. This causes the fluid to pass toward the right through passage 24 into the cylinder space 24B, the rate of flow of the hydraulic fluid being controlled by the setting of the metering screw 26. This results in movement of the movable cylinder member 16 relative to the door section to which it is attached, and the force exerted by the actuating foot 17 upon the adjacent bracket 12 with which it is in engagement will be less than the full impact force of the section 3c; this force may be adjusted by properly adjusting the metering screw 26 so as to impose upon the adjacent door section 3b an accelerating force sufficient to bring it up to the speed of the more rapidly traveling section 3c at about the time the foot 17 reaches its fully inward position as shown in Fig. 3. It will be appreciated that the flow of fluid through the passages 24 and 24' may be established by a fixed, predetermined orifice or flow-limiting structure, rather than an adjustable structure as specifically illustrated, without departing from the spirit of my invention. In any case, when the fully inward position of the movable cylinder member 18 is reached with respect to the fixed piston member 18, section 3b is carried to the left along with section 3c until the foot 17 associated with the cushioning means on the section 3b is brought into engagement with bracket 12 associated with section 3a, whereupon the accelerating operation on the section 3a is accomplished in the same manner as described above in connection with 3b. When the three door sections 3a, 3b and 3c are brought near to the position shown in dot-dash lines at the lower left-hand corner of Fig. 2, i. e., when the doors are nearly fully removed from covering relation with respect to the door opening 2, the motor 10 may be de-energized or caused to operate at a reduced speed so as to complete the movement of the doors at the proper position, as will be apparent to those skilled in the art. Where a reduced speed operation of the door section 3c is effected, it is preferable to establish a governed rate of deceleration of the driven door section which is somewhat less than the free deceleration rate of the door sections 3b and 3a, so that the sections 3a and 3b will not over-run section 3c, and during the final movement toward full door-open position the section 3c will exert a reduced driving action upon sections 3b and 3a.

It will be appreciated that a given relative movement of the door sections after interengagement of the actuating foot member 17 of the cushioning means with the opening bracket 12 is established by the allowable stroke of the cylinder 16 with respect to the fixed piston member 18. The acceleration of a "picked-up" door section will ordinarily (dependent upon the setting of the metering screw 26) have been completed by the time the full stroke (the given limited movement of the adjacent door sections) of the cylinder 16 has been effected. If the acceleration has been effected before the stroke is completed, the force upon the foot member 17 will be reduced to that required to keep the picked-up door in motion, but any force sufficient to overcome the frictional drag of the member 16 will

result in further movement of the member 16 relative to the member 18, until the full stroke is effected, inasmuch as fluid displacement will take place through the passage 24 under any pressure differential existing between spaces 24A and 24B. The cushioning means 13 thus serves to establish a controlled relative movement of adjacent door sections after operative interengagement, under any operating load or stress existing between the interengaging bearing surfaces, as defined by the foot member 17 and the adjacent bracket 12. Furthermore, after this given relative movement has been effected, and the door sections thus brought into the desired alinement with each other (as defined by the position of the brackets) there is no tendency for the door sections to be displaced from this desired condition of alinement as a result of the action of the cushioning means. This latter result is inherent in the operation of the cushioning means, which is adapted to produce the desired force opposing the force produced by engagement of the adjacent door sections, without producing a restoring force sufficient to effect a reverse relative motion of the door sections upon completion of the above-mentioned given relative movement.

When the doors have been moved to door-open position, the cylinders 16 will be fully retracted within the fixed support sleeve 14, corresponding to the position of the cushioning means shown in the section 3c in Fig. 3, and when the desired closing operation is instituted the section 3c will be moved to the right relative to section 3b until the right-hand edge or bearing surface of the actuating foot member 17 is brought into engagement with the left-hand edge of the closing bracket 11 on the adjacent section 3b, following which the cylinder member will be withdrawn from the fixed support sleeve 14 of the cushioning means attached to the section 3c after the manner indicated in Fig. 5 until the cylinder member 16 is completely withdrawn to its maximum left-hand position with respect to the support sleeve. At this time the section 3b will be fully accelerated to the speed of the moving door section 3c and will be carried toward the right until the actuating foot member 17 of the cushioning means associated with the section 3b is brought into engagement with the closing bracket 11 provided for the door section 3a. It will be appreciated that a suitable cross member or reinforcing means may be provided at the position of the bracket 11, as indicated at 11a in Fig. 4, to suitably reinforce the bracket 11 to withstand the accelerating forces imposed by the cushioning means.

When the power driven section 3c has been extended near its proper right-hand position at the extreme right of the door opening 2, the power drive provided by the motor 10 will be discontinued, as described in connection with the opening movement of the doors above.

The form of the invention illustrated in Figs. 10 through 13 is adapted to impose a frictional drag type of cushioning between adjacent door sections instead of the hydraulic displacement type of cushioning provided by the form of the invention shown in Figs. 3 through 9, and may comprise an actuating foot member 33 mounted on a slidable drag bar 34 having a forward portion 34a, a flat intermediate portion 34b adapted to be engaged by a pair of opposed friction shoe members 35 each provided with a friction layer 36 and pressed against the flat 34b through the agency of springs 37 backed up by an adjusting

screw construction as shown at 38 mounted on a cross-bar 39 connected to the supporting frame 40 which is mounted on the door section. The member 34 is provided with a rearward extension 41 journaled as at 42 on the rearward wall of the supporting frame 40, and the supporting frame may further be provided with a mounting flange 43 adapted to be attached to the upright 44 of the door frame in any suitable manner, as through the agency of bolts or the like. A removable journal member 45 is provided for the forward extended portion 34a of the member 34, together with a lock nut 46, mounted in a suitable threaded opening in the mounting flange 43 and serving to guide the forwardly extending portion 34a of the drag bar. In order to provide for removal of the drag bar from the supporting frame 40, I may provide a rectangular opening 48 at right angles to the normal position of the intermediate flat portion 34b of the drag bar 34, of sufficient size to permit withdrawal of the drag bar from the door assembly upon removal of the friction shoe members, springs, et cetera, and rotation of the drag bar through 90°. In Fig. 11 I have shown in dot-dash lines the position of the drag bar portion 34b in operation. A bracket member 47 corresponding in function to the bracket member 12 above may be provided for the intermediate door section upon which the actuating foot member 33 of a cushioning means on the next adjacent section will impinge in operation. The operation of this type of apparatus is entirely comparable to that shown at 13 in the first described form of invention, having in mind that the resistance movement results from the frictional drag of the member 34b upon the friction shoes 35 instead of the hydraulic flow or fluid displacement as provided in the first form of the invention.

Referring to Fig. 14, I have illustrated a form of fluid-displacement cushioning means which is adapted to provide a resilient resistance to impact upon interengagement of two adjacent door sections. This form of device may correspond generally to the form shown at 13, above, including a fixed support sleeve 14' mounted upon an upright 15' of a door frame, and carrying a movable cylinder member 16' provided with an actuating foot member 17, all as corresponding to parts 14—17 of the first-described form of cushioning means. Within the cylinder member 16' I may provide a fixed piston assembly corresponding to that shown at 18 above, complete with an axial passage 24 and metering means 26—27. The piston member 18 is fixed against movement with respect to the door frame portion 15' as through cross arms 19' inter-secured through bolts 23', as above.

The desired resilient action is secured through the agency of a pair of pressure surge chambers 51 and 52, mounted on the rearwardly projecting portion 53 of the cylinder member 16', for example, and respectively connected to the position of the compression spaces 24A and 24B through external passages 54 and 55. Suitable filling plugs 56 and 57 may be provided for the chambers 51 and 52.

The operation of this form of device is such that when the door section carrying the portion 15' is moved to the left, and the actuating foot member 17 is brought into engagement with a bracket 12' on an adjacent door section, the pressure built up in the compression space at the forward end of the cylinder 16' (24A) will cause fluid flow through the axial passage 24

in the piston member 18 as in the prior case, but in addition will force fluid upwardly in the surge chamber 51, building up the pressure in the air space 51' in the chamber 51. The air space serves as a resilient cushion, permitting displacement of the cylinder member 16' independent of the fluid displacement through the passage 24. When the actuating force upon the cylinder 16' is reduced, the pressure in space 51' will tend to equalize by forcing liquid back into the space 24A, thence into space 24B through passage 24, thus allowing the full relative movement of the door sections to take place, as limited by the stroke of member 16'. Operation of the device in the opposite direction, causing compression in the air space 52' of the chamber 52 should readily be apparent.

It will be seen that the form of Fig. 14 provides for displacement of a relatively incompressible fluid such as a hydraulic oil or other liquid, and a compressible fluid such as air or other gas within the surge chambers 51 and 52. Adjustment or variation of the resilient forces in the system may be accomplished by filling the chambers 51 and 52 to varied heights, thus altering the volume of the air spaces 51' and 52'. It will further be appreciated that a type of operation comparable to that provided by the form of Fig. 14 may be had with the form of device shown at 13 in Figs. 3—9, by incompletely filling the device with incompressible fluid, providing a partial air space for compression to establish a resilient resistance to the cylinder movement.

The several forms of device shown in Figs. 3 through 14 are adapted to be placed in position for providing a yielding resistance to relative movement of adjacent door sections in one direction, after completion of the yielding resistance in the opposite direction, wherefore the device is ready to operate in the opposite direction to which it has just operated, at all times.

In the fluid-displacement forms of cushioning means shown in Figs. 3—9 and 14, it will be appreciated that the respective piston ends of the piston member 18 operating in the compression spaces 24A and 24B actually constitute two separate fluid-displacement members which are mechanically interconnected through the piston member and hydraulically interconnected through the passage 24. These separate fluid-displacement members are so mounted for convenience only, and the functional equivalence of separate units mounted upon a single door section, or separate units mounted on adjacent door sections will be apparent to one familiar with mechanical principles.

As an example, I may provide a cushioning means of the fluid displacement type which is adapted for operation in one direction only, the return motion of the device into operative position ready for a fresh cushioning action being obtained within the device itself instead of through fluid displacement from a co-related cushioning member. Such a structure is illustrated in Fig. 15, comprising a cylinder member 60 rigidly mounted on one door section and provided with a piston 61, a piston rod 62 and an actuating foot member 63 adapted to engage a properly positioned opening or closing bracket on an adjacent door section. A spring 64 is provided within the compression space 62' within the cylinder 60, of such strength as to bias the piston 61 to an outward position upon removal of force upon the member 63. A surge chamber 65 is provided, mounted upon the cylinder 60,

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if desired, in fluid communication with the cylinder space 60'. The chamber 65 may be open to the atmosphere as at 66. A line 67 from the space 60' is connected through passage 68 to a flow control valve 69 and thence through passage 70 to the bottom of chamber 65, and for more rapid return circulation of the fluid I may provide a by-pass line 71 having a check valve 72 and connecting between passages 70 and 67.

The device of Fig. 15, as so far described, will operate to provide a yielding resistance to movement of the member 63 in a right-hand direction, under a metering action comparable to that obtained by the member 13, and upon removal of the moving force, the spring 64 will return the piston 61 to normal operating position. If desired, the resilient feature of the form shown in Fig. 14 may be incorporated in the device of Fig. 15, by providing a branch line 74 provided with a valve 75 and communicating from the passage 67 to a pressure surge chamber 76 corresponding to one of the chambers 51 or 52 above.

It will further be appreciated that the arrangement of the cushioning means through which interengagement of adjacent door sections is provided is subject to considerable variation. In Figs. 3 through 9, and 14, a single, double-acting cushioning means is provided, which obviously may be established upon either one of a pair of door sections. In Fig. 16 I have illustrated two door sections 80 and 81, the section 81 being provided with a cushioning means 82 which may be of the type shown in Fig. 15, i. e., adapted to function in but one direction. In Fig. 17 I have shown two door sections 83 and 84, the section 84 being provided with two cushioning means 85 and 86, each of which may be of the type of Fig. 15. The cushioning means 85 and 86 may be disposed one upon each door section, if desired. Where operation after the manner of the form shown in Figs. 3-9, 10 through 13, or 14 is desired, i. e., where the completion of the stroke of the cushioning means in one direction serves to place the device in position to operate upon relative movement of the door sections in the reverse direction, it is desirable to place both cushioning members 85 and 86 on the same door section, so that a convenient interconnection (either mechanical or fluid, or both) may be established.

Other modifications will occur to those skilled in the art, and I therefore do not consider my invention to be limited to the specific details of construction herein set forth and shown in the accompanying drawings, but rather to the scope of the subjoined claims.

I claim:

1. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association; and interengaging means including cushioning means associated with said door sections and adapted to establish a yielding interengagement between said door sections upon movement of one of said door sections in one direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section.

2. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths be-

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tween a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association, each of said door sections being provided with a bearing member, said bearing members being engageable with each other upon movement of one of said door sections in one direction; and cushioning means associated with one of said bearing members and yieldingly supporting the same, whereby said one bearing member is caused to undergo limited movement with respect to the associated door section upon such engagement, said cushioning means being adapted to resist said limited movement whereby such engagement results in a gradual acceleration of a door section by a moving door section.

3. A construction set forth in claim 2, said cushioning means comprising fluid displacement means.

4. A construction as set forth in claim 2, said cushioning means comprising friction means.

5. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association; and interengaging means including cushioning means associated with said door sections and adapted to establish a yielding interengagement between said door sections upon movement of one of said door sections in either direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section.

6. A construction as set forth in claim 5, said cushioning means comprising fluid displacement means.

7. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association; means defining two bearing surfaces on each of said door sections; one of the bearing surfaces of one of said door sections being adapted to engage with one of the bearing surfaces of the other door section upon movement of one of said door sections in one direction and thereby define a pair of interengaging surfaces, and the other bearing surface of said one door section being adapted to engage the other bearing surface of said other door section upon movement of said one door section in the reverse direction and thereby define a second pair of interengaging surfaces, one bearing surface of each of said pairs being mounted for movement relative to its associated door section; and cushioning means operatively associated with the movable bearing surfaces of each of said pairs and adapted to establish a yielding interengagement between said door sections upon movement of said one door section in either direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section.

8. A construction as set forth in claim 7, said cushioning means comprising fluid displacement means.

9. A construction as set forth in claim 7, said

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cushioning means comprising two separate cushioning means adapted to operate independently of one another.

10. A construction as set forth in claim 7, said cushioning means comprising separate fluid displacement members in fluid communication with one another, and including metering means for controlling the rate of fluid displacement from one fluid displacement member to the other in each direction of operation, to thereby establish a given yielding condition.

11. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association; and interengaging means including cushioning means associated with said door sections and adapted to establish a yielding interengagement between said door sections upon movement of one of said door sections in one direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section, said cushioning means having a fixed portion mounted on one of said door sections and a movable portion positioned for engagement by the other door section upon such movement of one of said door sections, and movable relative to said fixed portion a limited amount in response to force produced by said engagement, whereby a given relative movement of said door sections is produced following initial engagement thereof.

12. A structure as set forth in claim 11, said cushioning means being adapted to produce a force in opposition to said first-named force and thereby resist such relative movement, in the absence of the production of a restoring force sufficient to effect relative motion of said door sections opposite said given relative movement upon completion of said given relative movement.

13. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively ex-

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tended association; and interengaging means including fluid-displacement type cushioning means associated with said door sections and adapted to establish a yielding interengagement between said door sections upon movement of one of said door sections in either direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section, said fluid displacement type cushioning means being provided with a substantially incompressible fluid, and being adapted to cause a limited flow of such fluid during such yielding interengagement.

14. A plural door construction for a door opening, which comprises: two door sections adapted for movement in substantially parallel paths between a door-open position in which the door sections are disposed in an overlapping nested association and a door-closed position in which the door sections are disposed in a relatively extended association; and interengaging means including fluid-displacement type cushioning means associated with said door sections and adapted to establish a yielding interengagement between said door sections upon movement of one of said door sections in either direction, and operable upon such interengagement to gradually accelerate and move the other door section in the direction of movement of said one door section, said fluid displacement type cushioning means being provided with a substantially incompressible fluid, and being adapted to cause a metered flow of such fluid during such yielding interengagement, together with a compressible fluid adapted to establish a resilient opposition to the impact resulting from such interengagement, said cushioning means being provided with means dissipating such resilient opposition upon completion of such metered flow.

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